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Agricultural Technology
Development Society (ATDS)
Ghaziabad, UP



SUBHARTI
UNIVERSITY
UGC Approved



2nd International Conference on

Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)

20 - 22 October 2018

Theme-I : Recent Trends in Agricultural Sciences & Technology

Vol - 1

SOUVENIR & CONFERENCE BOOK



VENUE

Sardar Patel Auditorium, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.

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Agricultural Technology Development Society (ATDS), Ghaziabad, UP

2nd International Conference on Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)

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त्रिलोचन महापात्र, पीएच.डी.

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सचिव एवं महानिदेशक

TRILOCHAN MOHAPATRA, Ph.D.
FNA, FNASc, FNAAS
SECRETARY & DIRECTOR, GENERAL

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद्
कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली 110001

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MESSAGE

It is a matter of great pleasure that National Conference on 'Wildlife Health Management vis-à-vis Prospect of Mitigation of Extrinsic Influences Impinging their Conservation' is being organised at College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture & Technology, Pantnagar, U.S. Nagar, Uttarakhand on 29-30 September, 2018 in collaboration with Association of Indian Zoo and Wildlife Veterinarians.

Expansion of human needs as well as greeds resulting in encroachments of forest lands and wildlife territories in various states of the country is frequently leading to conflicts between human and wild animals. The unprecedented impetus to urbanization is posing further threats to wild flora and fauna culminating into severe damage to the delicate ecosystem and overall biodiversity.

It is expected that scientific deliberations amongst academicians, wildlife experts, business organizations and other delegates would result in sound recommendations that will help in deceleration of extinction of various wildlife species in the country and strengthen preservation of our rich biodiversity.

I extend my warm greetings to all the participants and wish the conference a grand success.

(T. MOHAPATRA)

Dated the 18th September, 2018
New Delhi



**CHAUDHARY CHARAN SINGH, UNIVERSITY
MEERUT (U.P.) INDIA**

PROFESSOR N.K. TANEJA

Ph.D.(Economics)
Vice-Chancellor



Ref. No. SVC/20/ 764
Dated : 03.10.2017

MESSAGE

It gives me pleasure to know that 2nd International Conference on “**Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)**” is going to be organised by Agriculture Technology Development Society (ATDS), Muradnagar, Ghaziabad (U.P.) during October 20-22, 2018.

Advance innovations in Agricultural, Biological and Applied Science help the policy matters address the problems more effectively relating to Food Security, Medicine and Environmental Sustainability. I hope the deliberations in the conference shall dwell on various dimensions in these important areas so as to open up new vistas of research for the guidance of policy planners.

I convey my good wishes to the organisers for the grand success of the Conference.

(N. K. Taneja)

Dr. Joginder Singh

Managing Chairman of Conference,
Secretary, Agricultural Technology Development Society (ATDS)
Muradnagar,
Ghaziabad.



सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिक विश्वविद्यालय, मेरठ 250 110

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प्रोफेसर गया प्रसाद

कुलपति

Professor Gaya Prasad

Vice Chancellor



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MESSAGE

I am happy to know that Agriculture Technology Development Society (ATDS) Ghaziabad, in collaboration with Swami Vivekanand Subharti University, Meerut (U.P.) India and faculty of Agriculture, Cairo University, Egypt is going to organize 2nd International Conference on “**Advances in Agriculture, Biological and Applied Sciences for Sustainable Future**” (ABAS 2018) on October 20-22 at Sardar Patel Auditorium Swami Vivekanand Subharti University, Meerut (U.P.) India.

As we know that food is basic need for survival of human being and it became vital once its availability is adequate to quench the world population. Toward achieving the goal of livelihood security it is important to conserve the agriculture. I hope that this conference will create an opportunity for the researchers, academicians to gain new ideas and understand the recent advances in agriculture, biological, applied science and conservation of biodiversity for sustainable future. I am sure that scientific/ technical deliberation and discussion will be greatly benefited to the delegates, participants and policy makers. Moreover it will also help in solving different problem and issues.

I convey my blessing and good wishes for the success of this 2nd International Conference and compliment to the organizers.

(Gaya Prasad)

BIHAR AGRICULTURAL UNIVERSITY, SABOUR

BHAGALPUR - 813210 (BIHAR)

Dr. Ajoy Kumar Singh
Vice Chancellor



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MESSAGE

With rapidly increasing population, achieving the sustainable food and nutritional security and overcoming regional imbalances across the globe is major challenge of the human society in 21st century. The shrinking natural resources, whether uncertainties due to climate change are the major threats to achieve a sustainable food security in the world especially in developing and underdeveloped countries. According some estimates agricultural production need to be increased by 70 percent from 2005-2050 to feed an estimated population of 9.1 billion.

It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. The scientific and technological advancements and their application in the field of agriculture is the key to address the emerging challenges.

I perceive that Advances in Agricultural, Biological and applied sciences for sustainable future (ABAS-2018) organized by Agricultural technology development Society (ATDS) Ghaziabad, Uttar Pradesh will provide a timely and relevant discussion forum for scientists, developmental agencies and policy makers and agricultural practitioners to share their innovations, experiences and expertise to better understand the challenges posed by emerging global issues and design strategies for sustainable development. I convey my best wishes to the organizers and wish them a grand success.

(Ajoy Kumar Singh)

Dr. S.K. Malhotra
Agriculture Commissioner

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सत्यमेव जयते

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कृषि भवन, नई दिल्ली-110001

Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation
& Farmers Welfare

Krishi Bhawan, New Delhi-110001

Dated: 6th September, 2018



MESSAGE

I am happy to know that International Conference on “Advances in Agricultural, Biological and Applied Sciences for Sustainable Future” is being organized from October 20th-22nd, 2018 at Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.

A focus on increasing food production without due concern for the environment is causing severe land and water degradation. What we need is to be able to produce wide variety of nutritious foods while having minimal impact on the environment - a sustainable food system. The sustainable development goals, signed by 193 world leaders in 2015, recognize that these challenges are interconnected and multidimensional. Technological innovations relating to agricultural science, biological science and applied science are vital to address the challenges to ensure production of enough food for increasing population in the sustainable manner.

The international conference is therefore very pertinent and timely. It is hoped that deliberations during the conference will generate road map.

I wish the conference a great success.

(S.K. Malhotra)

काशी हिन्दू
विश्वविद्यालय



BANARAS HINDU
UNIVERSITY

AN INSTITUTION OF NATIONAL IMPORTANCE ESTABLISHED BY AN ACT OF PARLIAMENT



Professor Saket Kushwaha
Former V C, LNM University, Darbhanga (Bihar)
Department of Agricultural Economics
Institute of Agricultural Sciences

MESSAGE

I strongly feel that updating information and sensitizing the young thinkers to focus their minds towards current trends is the call of the day. The best way forward is organizing and participating in vibrant conference which is the key character of the Agricultural Technology Development Society (ATDS) Ghaziabad, Uttar Pradesh, India, Swami Vivekanand Subharti University (SVSU), Meerut, Uttar Pradesh, India and Faculty of Agriculture, Cairo University (CU), Egypt who is jointly organizing three days 2nd International conference on 'Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)' scheduled to be held on October 20-22, 2018 at Sardar Patel Auditorium, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India in collaboration with Bulletin of Environment, Pharmacology and Life Sciences (BPELS), Agra, Uttar Pradesh, India, National Gladiolus Trust (NGT), Jammu, Jammu & Kashmir, India and International Journal of Pure and Applied Bioscience (IJPAB), Kota, Rajasthan, India. The conference is aimed to provide a common platform to scientists, researchers, academicians, professionals, social workers, policy makers as well as farmers and expertise corporate to exchange their new ideas and recent research findings with colleagues from within and outside India, which will boost their knowledge and experience. In this global event scientists across the world are participating from the foreign countries like Malaysia, Philippines, Egypt, UK, Eritrea, Sudan, Nepal etc. The current conference will be perceived as a place where learner can develop according to their unique needs and potential and means of achieving greater social equality. Under present circumstances we are passing through a period of value crisis in fundamental research. Values determine human behavior in a significant way.

The current International Conference under the flagship of Dr. Joginder Singh is well articulated and timely efforts to achieve the sustainability.

I wish this conference a grand success with a hope to see a policy document after the conference.

Sincerely yours,

(Saket Kushwaha)
Former Vice Chancellor,
Lalit Narayan Mithila University, Darbhanga (Bihar)

Varanasi 221005, UP, INDIA

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ICAR-Indian Institute of Farming Systems Research

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Dr A.S. Panwar
Director



MESSAGE

I am happy to know that Agriculture Technology Development Society (ATDS) Ghaziabad, (U.P.) India in collaboration with Swami Vivekanand Subharti University, Meerut (U.P.) India and faculty of Agriculture, Cairo University, Egypt is going to organize an 2nd International Conference on “Advances in Agriculture, Biological and Applied Sciences for Sustainable Future”(ABAS 2018) on October 20-22 at Sardar Patel Auditorium Swami Vivekanand Subharti University, Meerut (U.P.) India.

As we know that food is basic need for survival of human being and it became vital once its availability is adequate to quench the world population. Toward achieving the goal of livelihood security it is important to conserve the agriculture. I hope that this conference will create an opportunity for the researches, academicians to gain new ideas and understand the recent advances in agriculture, biological, applied science and conservation of biodiversity for sustainable future. I am sure that scientific/ technical deliberation and discussion will be greatly benefited to the delegates, participants and policy makers. Moreover it will also help in solving different problem and issues.

I convey my blessing and good wishes for the success of this 2nd International Conference and compliment to the organizers.



(A.S. Panwar)



MESSAGE

Demands for food, feed, water and shelter is increasing in quantity and quality day by day to meet the requirement of burgeoning population of the globe. Present global population of 7.6 billion expected to breach/reach 10 billion mark by 2050. India is home about 17% of world human being. The country is witnessing population growth at much faster rate than other part of the world and from present level of 1.37 billion, it is expected to reach 1.53 and 1.68 billion in years 2030, 2050, respectively. Besides, growing population, which puts excessive pressure on our natural resources, climate change is a major threat to the sustainability of global biosphere in coming future. In this challenging environment, we need to be vibrant, dynamic and innovative in developing and adopting scientific knowledge and technology into our production system. In this background, the present International Conference on "Advance in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018) is very contemporary and expected to come out with fruitful, implementable recommendations.

Participation of large number of delegates with widely divergent background in this International Conference will provide and excellent common platform for the academicians, scientists, policy maker NGOs, students and farmers to interact and come up with practical recommendations for development of policies, researchable and developmental and biodiversity conservation.

I wish grand success of this International Conference to the organiser particularly to Agricultural Technology Development Society, Ghaziabad.



(Manoj Kumar)



OFFICE OF THE VICE CHANCELLOR

SWAMI VIVEKANAND SUBHARTI UNIVERSITY

(Establish under UP Govt. Act No. 29 of 2008 and approved under section 2(f) of UGC Act, 1956)

Dr N.K. Ahuja

MDS (ORTHO), PGDHHM, FICD, FWFO, FPFA, FICDE

Vice Chancellor

Army Dental Corps (1970 – 1993)

Past President Indian Orthodontic Society

Former Director PG Studies & Principal

Subharti Dental College

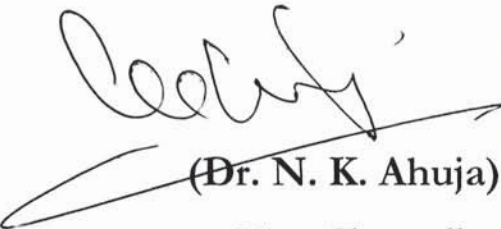


MESSAGE

It is my proud privilege to be a part & parcel of International conference on “Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)”, more so since the conference is being held in the campus of Swami Vivekanand Subharti University, Meerut.

This conference will be perfect platform for all delegates attending the conference and enrich their existing knowledge for sustainable future.

I welcome all delegates to Subharti Campus & convey my best wishes for fruitful interactions.


(Dr. N. K. Ahuja)
Vice-Chancellor



NEPAL AGRICULTURAL RESEARCH COUNCIL MOUNTAIN AGRICULTURE RESEARCH INSTITUTE, JUMLA, NEPAL



Dr. Shree Prasad Vista,
Director, MARI, Jumla, NARC
Email: prasadvista@rediffmail.com

MESSAGE

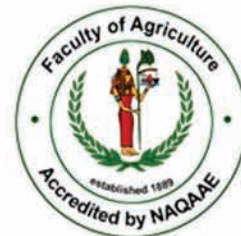
Most Asian countries are Agriculture dependent; hence, development and prosperity of such countries rely on agricultural innovations and technologies. Attaining sustainable future or meeting global challenges of zero hunger to all people will be possible if and only if the profession of farming is honored or respected by the society and the nation. There is always scarcity of agricultural labors during peak season, youths today are more attracted to the world of IT and are always reluctant to opt farming profession. Unless significant investment and incentive to agrarian community backed by political will is guaranteed, farming will never be any choice of today's younger generation.

I am glad to know that Agricultural Technology Development Society, Ghaziabad , UP, India is organizing a three days “Second International Conference on Advances in Agricultural, Biological and Applied Science for Sustainable Future (ABAS-2018)” from 20 to 22 October, 2018 at Swami Vivekanand Subharti University, Meerut, UP, India to discuss issues related to various thematic areas for uplifting agrarian community through agricultural innovations and emerging technologies, which ultimately will boost morale of farming professions attracting young mind, heart and hands in agriculture for sustainable future. I am optimistic that this upcoming conference will be helpful in achieving its goal vis-a-vis in motivating agricultural professionals, investors, development workers, researchers and policy makers for bringing rapid agricultural transformation. The deliberation and resultant outcome of the conference will be of immense help to all those professionals related to agriculture.

I am really excited to be the part of the Conference and I convey my greetings and best wishes to organizers, sponsors, delegates, presenters and participants for the grand success of this mega event.

(Shree Prasad Vista)

Faculty of Agriculture, Cairo University, Egypt



MESSAGE

It is very pleased that the College of Agriculture, Cairo University, is among the sponsors and participants with 2nd International Conference Advances in Agriculture, Biological and Applied Sciences for Sustainable Future (ABAS-2018) on October 20th-22nd, 2018. I would like to extend my thanks and appreciation to everyone who suggested and agreed to this.

Monitoring, monitoring and analysing food security developments is one of the most important issues in the Developing countries because it is a food deficit zone in some major food commodities such as cereals, sugar and vegetable oils, and as one of the most geographically affected areas in the world. To address these and other variables, more serious efforts are required at the national national levels to achieve food security in its comprehensive sense. It is to provide material, social and economic opportunities for all people at all times to obtain adequate, safe and nutritious food that meets their nutritional needs and nutritional tastes and ensures that they live a better life, health and activity. It is therefore important that the Developing countries food security situation be monitored periodically by monitoring and analysing key areas related to food availability, access, stability and nutritional dimensions.

The international Conference enjoys the participation of outstanding experts in the field of plant production from all over the world. We believe that this Conference will be of multiple and invaluable significance as participate will have the opportunity the exchange experiences and to establish a possible collaboration between individuals and institutions.

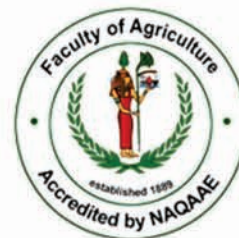
The Faculty of Agriculture, University of Cairo, will represent two crop professors, Dr. El-Sayed Gheith and Dr. Ola El-Badry and we hope that our College will contribute to the next conferences with more efforts related to climate changes and desert cultivation.

We wish you very useful and fretful disruptions and recommended out of this conference. We would like to express our deep appreciation.

To all members of the Organising scientific committees for their effort and hard work the excreted to make this Conference successful.

Prof. Dr. Amr Mostafa
Dean
Faculty of Agriculture
Cairo University, Egypt

Faculty of Agriculture, Cairo University, Egypt



MESSAGE

It is a great honor and pleasure the College of Agriculture, Cairo University, is among the sponsors and participants with 2nd International Conference Advances in Agriculture, Biological and Applied Sciences for Sustainable Future (ABAS-2018) on October 20th-22nd, 2018. I would like to express my thanks and appreciation to all members who suggested and agreed to this.

Analysing and monitoring food security developments is one of the most important issues in the developing countries because it is a food deficit zone in some major food commodities such as cereals, vegetable oils and sugar and as one of the most geographically affected areas in the world. It is to provide material, economic opportunities and social for all people at all times to obtain adequate, safe and nutritious food that meets their nutritional needs and nutritional tastes and ensures that they live a better life, health and activity. It is therefore important that the Developing countries food security situation be monitored periodically by monitoring and analysing key areas related to food availability, access, stability and nutritional dimensions.

We believe that this Conference will be of multiple and invaluable significance as participate will have the opportunity the exchange experiences and to establish a possible collaboration between individuals and institutions.

Dr. Ola El Badry and I, we are coming to attend the conference to represent The Faculty of Agriculture, University of Cairo, Egypt. I hope that our faculty will contribute to the next conferences with more efforts in future also.

I would like to express my greetings and warm welcome to everyone and sincere thanks to the members of the Organizing Committee and to all who are contributing with their participation, help and interest in the success of this conference.

Prof. El-Sayed M. Gheith

Faculty of Agriculture

Cairo University, Egypt



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Ref. No. 409/J.V.C

Dr. Narendra Singh
Principal
Janta Vedic College, Baraut, Baghpat, UP



Dated 11/0/8

MESSAGE

I am glad to know that an International Conference on “**Advances in Agriculture, Biological and Applied Sciences for Sustainable Future**” (ABAS 2018) is being jointly organized by Agriculture Technology Development Society (ATDS) Ghaziabad, (U.P.) India in collaboration with Swami Vivekanand Subharti University, Meerut (U.P.) India and faculty of Agriculture, Cairo University, Egypt on October 20-22 at Sardar Patel Auditorium Swami Vivekanand Subharti University, Meerut (U.P.) India. I hope and believe that issue pertaining to various aspects of agriculture and biological innovations and their dissemination to the end users will be deliberated and discussed by the delegates during the conference for the benefit of mankind at global level. I am sure that this International Conference would succeed in getting its main objectives. The theme chosen for this conference is of utmost importance in today’s context as concerned for sustainable development. The themes of the conference are very relevant for the contemporary world. I am sure that this 2nd International Conference will deliberate on latest development in the field of Agriculture, Biological and Applied Science.

I am sure that the deliberations/discussions to be held in this conference on above themes will definitely pave way for the researchers, policymakers and stakeholders to address the future challenges for growth and development of agriculture sector and insure food security.

I express my sincere appreciation to all the organizers who are working day and night to make this conference success and also thanks and welcome all the delegates

I extend my best wishes for all round success of this conference.

(Narendra Singh)



OFFICE OF THE CHAIRMAN (URC-NON MEDICAL) 'A'
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Ref.: No. SVSU/2018/

Date: 10.10.2018



MESSAGE

I am extremely delighted to know that 2nd International Conference on “Advances in Agriculture, Biological and Applied Sciences for Sustainable Future”(ABAS 2018) is being jointly organised by Agriculture Technology Development Society (ATDS) Ghaziabad, U.P. India in collaboration with Swami Vivekanand Subharti University, Meerut (U.P.) India and faculty of Agriculture, Cairo University, Egypt on October 20-22, 2018.

The theme chosen for this conference is of utmost importance in today's context as concerned for sustainable development. I am confident that the proposed conference will provide an International platform to researchers, academicians and other stake holders to discuss and interact with each other in the area of Agriculture, Biological and Applied Sciences.

I extend my best wishes and greetings to the organizers for great success in their endeavour. I also convey my best wishes to the participants to formulate a well synthesized plan of work that can be implemented in coming years.

With best wishes!

(Dr. Heero Hito)

Chairman



भारतीय गन्ना अनुसंधान संस्थान
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Lucknow - 226 002, Uttar Pradesh, India



Dr Ram Ji Lal
Ph.D., ARS
Ex HOD
Division of Crop Protection



MESSAGE

I am delighted to learn that the Agriculture Technology Development Society (ATDS), Ghaziabad, Swami Vivekananda Subharti University (SVSU), Meerut and Faculty of Agriculture, Cairo University, Egypt are jointly organizing 2nd International Conference on “Advances in Agricultural, Biological and Applied Sciences for Sustainable Future” at Moot Court Conference Hall, SVSU, Meerut from October 20-22, 2018 to share the knowledge and expertise in the concerned areas based on the theme of the International Conference. Our Honorable Prime Minister Sri. Modi's dream is that in the year 2022 when our country will be celebrating its 75th Independence Day, the farmer's income of our country must become double to feed the ever growing population without any damage to the ecological foundation of agriculture such as land, water, forest, biodiversity and environment.

I am sure this International Conference will provide a unique platform for researchers, policy makers, stakeholders, NGO's, farmers and students to discuss and interact with each other on various issues for the growth and development of agriculture sector and ensure food and income security.

I would like to take this opportunity to congratulate the organizers and also extend my best wishes for the grand success of the conference.

(RAM JI LAL)



सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिक विश्वविद्यालय, मेरठ 250 110 SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRI. & TECH. MEERUT - 250 110



MESSAGE

It is a pleasure to learn that a 2nd International conference 'Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)' is going to be jointly organized by the Agricultural Technology Development Society (ATDS) Ghaziabad, Uttar Pradesh, India, Swami Vivekanand Subharti University (SVSU), Meerut, Uttar Pradesh, India and Faculty of Agriculture, Cairo University (CU), Egypt in collaboration with Bulletin of Environment, Pharmacology and Life Sciences (BPELS), Agra, Uttar Pradesh, India, National Gladiolus Trust (NGT), Jammu, Jammu & Kashmir, India and International Journal of Pure and Applied Bioscience (IJPAB), Kota, Rajasthan, India, on scheduled to be held on October 20-22, 2018 for three days.

The application of latest technologies such as biotechnology, Post harvest technology, Plant Protection Technology etc, and renewable energy sources have emerged as central to strategies for enhancing the profitability, of crops.

It is that the hope that International conference among the technology generation and end users to work in a team work in agriculture.

I wish the International conference a great success.

(Rajendra Singh)



Agricultural Technology Development Society (ATDS)

(Registration No. 1024/61550- M/2015-16, under the societies registration Act No. 21,1860)

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Date ...10/10/2018.....



MESSAGE

It is great pleasure to know that an International Conference on “Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)” is being organized by the Society for Agricultural Technology Development Society, Ghaziabad and Co-organized by Swami Vivekanand Shubharti University, Meerut and Faculty of Agriculture, Cairo University, Egypt on 20-22 October 2018 at Sardar Patel Auditorium, Swami Vivekanand Shubharti University, Meerut, Uttar Pradesh, India. On this auspicious occasion, I warmly welcome all scientists, teachers, research scholars, students, farmers, NGOs, social workers, policy makers and others are involved in research areas of different institutions, colleges and university from India and abroad. Where all delegates the practices pertaining to advances agriculture, biological and applied sciences India and abroad will exchange their views.

I hope that the conference would provide a platform for participating delegates to interact and share their field/ lab experiences, significant recent research findings and exchange new ideas for formulating suitable future strategies for advancement of agriculture, biological and applied sciences for sustainable future.

I extend my best wishes for the successful organization of International Conference.

(Anant Kumar)

President



Agricultural Technology Development Society (ATDS)

(Registration No. 1024/61550- M/2015-16, under the societies registration Act No. 21,1860)

Muradnagar, Ghaziabad, Uttar Pradesh, India

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Ref. ATDA/434/2018

Date ...11/10/2018.....



MESSAGE

It is a matter of great privilege for me to organize 2nd International Conference on “Advances in Agriculture, Biological and Applied Sciences for Sustainable Future” (ABAS 2018) on October 20-22 at Sardar Patel Auditorium Swami Vivekanand Subharti University, Meerut (U.P.) India. On behalf of the organizing committee, I warmly welcome all the guests, participants, delegates, researchers and scientist in the conference. I am thankful to all honored guest and eminent scientist from in and outside India for sparing their valuable time to our International Conference. The main motive of the Conference is to bring together interdisciplinary ideas in the areas of Agricultural, Biological and Applied Sciences for Sustainable Development. This conference will create an opportunity for researches, academicians to gain new ideas and understand the recent advances in Agricultural, Biological and Applied Sciences. I am sure that this International Conference would succeed in getting its main objectives. The theme chosen for this conference is of utmost importance in today's context as concerned for sustainable development.

I am sure that scientific/ technical deliberation and discussion will be greatly benefited to the delegates, participants and policy makers. Moreover it will also help in solving different problem and issues.

I am also grateful to the members of various committees, my colleagues in the college and the department and supporting staff who worked day and night for the successful organization of the conference.

I am again delighted to welcome you all to this meeting and pray almighty to bless us for making this International Conference a grand success.

(Joginder Singh)

Secretary



Agricultural Technology Development Society (ATDS)

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Ref. ATDA/435/2018

Date 11/10/2018



FROM THE DESK OF CHIEF ORGANIZING SECRETARY

This is a matter of great honor that Agricultural Technology Development Society (ATDS) Ghaziabad, Uttar Pradesh, India, Swami Vivekanand Subharti University (SVSU), Meerut, Uttar Pradesh, India and Faculty of Agriculture, Cairo University (CU), Egypt in collaboration with Bulletin of Environment, Pharmacology and Life Sciences (BPELS), Agra, Uttar Pradesh, India, National Gladiolus Trust (NGT), Jammu, Jammu & Kashmir, India and International Journal of Pure and Applied Bioscience (IJPAB), Kota, Rajasthan, India is jointly organizing an 2nd International Conference "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)' on October 20-22, 2018 at Sardar Patel Auditorium, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh. On this auspicious occasion, I warmly welcome all participants, delegates, Researchers and Scientist of different institutions, colleges and university from India and abroad. The organization of such a mega event will provide us an opportunity to assemble the learned delegates coming from different parts of the world like Egypt, Sudan, Nepal, Malaysia, Finland, USA and China.

The 2nd International Conference on 'Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)' has been design to focus on various scientific tracks covering major areas of research agriculture, biological and applied sciences. ABAS 2018 aim to accelerate scientific discoveries and major milestone in the current situation and innovation relating to agriculture, biological and applied sciences and also its relevant areas. The main motive of the conference is to bring together interdisciplinary idea and approaches in the area of agriculture, biological, chemical, physical and industrial process. I hope that this conference will create an opportunity for the researches, academicians to gain new ideas and understand the recent advances in agriculture, biological and applied sciences for sustainable development. I am sure that scientific/ technical deliberation and discussion will be greatly benefited to the delegates, participants and policy makers. Moreover it will also help in solving different problem and issues.

Organization of such mega event is impossible without team work. I like to express my sincere thanks to our Honourable Patrons and Directors of Swami Vivekanand Subharti University for providing us with the support and encouragement in organizing the conference. I express my sincere thanks to the members of the organizing committee, advisory committee, faculty members and staff for true labor, invaluable support and suggestions to make this conference a grand success.

I am again delighted to welcome you all to this meeting and pray almighty God to bless us for making this International Conference a grand success.

(Rashmi Nigam)

Chief Organizing Secretary



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Ref. ATDA/436/2018

Date 12/10/2018



MESSAGE

I on behalf of organizing committee welcome you all to 2nd International Conference on “Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS -2018)” on October 20–22, 2018 at Sardar Patel Auditorium, Swami Vevakanand Subharti University, Meerut, Uttar Pradesh, India, organized by Agricultural Technology Development Society (ATDS), Ghaziabad, U.P., India. During the past fifty years, agricultural development policies have been remarkably successful at emphasizing external inputs as the means to increase food production. The global plant productivity is badly hit by unpredictable change in climate over the past few decades resulting in inadequate supply of plant products. Conversely, the worldwide population is predicted to surpass 9 billion by 2050 which will create scarcity of plant derived resources. The conservation of biodiversity to manage healthy agro-ecosystems via integrated approach of plant biology research might be one of the potential solutions to deal with food security in changing environment. The slow growth of farm income and new global trade regulations demand a paradigm shift has resulted in formulating the National Agricultural Research Programmes (NARP) to conserve natural resources in changing environment. Therefore, there is a need to introduce all these aspects of various strategies of crop improvement under environmental stress conditions with special emphasis to advanced biological-biotechnological perspectives in the field of agriculture. In the context of the foregoing, the first step in the right direction would come from educating and motivating young minds on the possibilities that this area entails for scientific exploration.

It will be an opportunity of sharing our expertise and experience with the renowned speakers from all over the world. It will also be a platform to strengthen the friendship and collaboration among the scientists, academia and the institutes.

The local organizing committee, under the valuable guidance of our Managing Chairman Dr. Joginder Singh, Executive Chairman's, Director's and Advisor's, has been very active and arrangements are well under way to ensure that the 2nd International Conference ABAS 2018 is a resounding success.

I appeal to the research community to extend their continued support and cooperation to the future activities of ATDS.

I look forward to welcoming you all in the Sardar Patel Auditorium, Swami Vevakanand Subharti University, Meerut, Uttar Pradesh, India.

(Dr. Wajid Hasan)

Organizing Secretary

2nd International Conference
Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS - 2018)
(20 – 22 October, 2018)



CONFERENCE PROGRAM SCHEDULE

Day-1 (Saturday) Date: 20.10.2018

8:00 am to 9:30 am: Registration

09:30-10:00 am: Breakfast

INAUGURAL SESSION

Time	Events	Felicitor
10.00-10.05	Lightening of Lamp	Dignitaries
10.05-10.10	Saraswati Vandana/Welcoming Song	Students
10.10-10.20	Felicitation of the guests	Organizing committee
10.20-10.35	Welcome Address & About the Conference	Dr. Rashmi Nigam, Chief Organizing Secretary
10.35-10.40	Release of Souvenir	Dignitaries
10.40-10.50	Welcome address of Dignitaries & About ATDS Society	Dr. Joginder Singh, Secretary, ATDS, Ghaziabad
10.50-11.00	Welcome address	Representative, Swami Vevakanand Subharti University, Meerut
11.00-11.10	Special Guest address	Dr. Shree Prasad Vista, Director, MARI, Jumla, Nepal
11.10-11.40	Special Guest address & Keynote Lecture	Prof. Mushahid Husain, Former-Vice Chancellor, M.J.P. Rohilkhand University, Bareilly, U.P
11.40-12.10	Special Guest address & Keynote Lecture	Dr. A. S. Panwar, Director, ICAR- IIFSR, Meerut, UP
12.10-12.20	Special Guest address	Representative, Cairo University, Egypt
12.20-12.50	Chief Guest Address	Prof. Gaya Prasad, Hon'ble VC, SVPUAT, Meerut, UP
12.50-1.00	Vote of thanks	Dr. Anant Kumar, President ATDS

01:00 - 02:00 pm: Lunch Break

TECHNICAL SESSION – I

2.00- 5.00 PM: Technical Session -1: Oral Presentation & Poster Session

THEME 1: Recent trends in Agricultural Sciences and Technology

Session Events: Invited Lectures, Oral Presentation

5.00- 5.15 PM: Evening Tea

TECHNICAL SESSION – II

Day-2 (SUNDAY) Date: 21.10.2018

08:30-9:00 am: High Tea

9.00- 11.15 AM: Technical Session -2: Oral Presentation & Poster Session

THEME 2: Environmental and livelihood security for sustainable Development

Session Events: Invited Lectures, Oral Presentation

11.15- 11.30 am: Breakfast

TECHNICAL SESSION – III

11.30- 2.00 PM: Technical Session -3: Oral Presentation & Poster Session

THEME 3: Advances in Biological Sciences and Biodiversity Conservation

Session Events: Invited Lectures, Oral Presentation

02:00 - 3:00 pm: Lunch Break

TECHNICAL SESSION – IV

03.00- 5.30 PM: Technical Session -5: Oral Presentation & Poster Session

THEME 4: Innovative Approaches in Applied Sciences and Socio-economic Development

Session Events: Invited Lectures, Oral Presentation

5.30- 5.45 PM: Evening Tea

TECHNICAL SESSION – V

Day-3 (Monday) Date: 22.10.2018

08:30-9:00 am: Breakfast

9.00- 12.00 AM: Technical Session -5: Oral Presentation & Poster Session

THEME 1: Recent trends in Agricultural Sciences and Technology

Session Events: Invited Lectures, Oral Presentation

VALEDICTORY SESSION

Time	Events	Facilitator
12.00-12.10	Felicitation of the Dignitaries	Organizing committee
12.10-12.20	Welcome Address of the Dignitaries	Dr.Rashmi Nigam, Chief Organizing Secretary
12.20-12.30	Welcome Address of the Dignitaries	Dr.Anant Kumar, President ATDS
12.30-12.40	Welcome address	Representative, Swami VevakanandSubharti University, Meerut
12.40-12.50	Felicitation of ATDS-2018 Awardees	Dignitaries
12.50-1.00	Conference Reports	Dr.Neelesh Kapoor, Organizing Convener
1.00-1.10	Special Guest address	Prof.SaketKushwaha, VC, Rajiv Gandhi University, Itanagar, Arunachal Pradesh
1.10-1.20	Special Guest address	Dr. Manoj Kumar, Joint Director, ICAR-CPRI, Meerut, UP
1.20-1.30	Special Guest address	Representative, Cairo University, Egypt
1.30-1.40	Special Guest address	Mr.Bishnu Prasad Bhattarai, Head, Agricultural Programme, HICAST, Kathmandu, Nepal
1.40-1.50	Chief Guest Address	Dr. S. K. Malhotra, Agriculture Commissioner, KrishiBhawan New Delhi
1.50-1.55	Special Announcement	Dr.WajidHasan, Organizing Secretary
1.55-2.00	Vote of Thanks	Prof. Ram JiLal, Retd. Prin. Scientist, ICAR-IISR, Lucknow, UP

2:00 pm - 3:00 pm: Lunch Break

Important Instructions:

- 1). Duration for Keynote Address (15 mins); Invited Lectures (10 mins); Oral Presentations (05 mins).
- 2). Poster Sessions will be organizing on 20, 21 & 22 October, 2018 with the following schedule:
Day-1, 20 October: 02:00-05:00 PM- Theme 1: Recent trends in Agricultural Sciences and Technology
Day-2, 21 October: 9.00- 11.15 AM - Theme 2: Environmental and Livelihood Security for Sustainable Development
11.30- 2.00 PM Theme 3: Advances in Biological Sciences and Biodiversity Conservation
03.00- 5.30 PM -Theme 4: Innovative Approaches in Applied Sciences and Socio-economic Development
Day 3, 22 October: 9.00- 12.00 AM:Theme 1: Recent trends in Agricultural Sciences and Technology
(Venue: Auditorium Lobby).
- 3). Dimensions for Posters (clearly visible flex print/digital print/other good quality print): 25 x 38 inches or 34 x 46 inches.
- 4). All participants are requested to upload their Power Point presentations/deposit their posters at Registration Counters.
- 5). For any amendments/rectifications related to Oral/Poster presentations, please contact at Registration counters.
- 6). Registration counters will be closed during Inaugural Function (10:00-12:00 PM).
- 7). ATDS-2018 Awardees must report one hour before the prescribed time.

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LEAD PAPERS

THEME-I, VOLUME-I

**RECENT TRENDS IN AGRICULTURAL
SCIENCES AND TECHNOLOGY**

HORTICULTURE BASED INTEGRATED FARMING SYSTEMS FOR DOUBLING FARMERS' INCOME**A.S. PANWAR, POONAM KASHYAP, N. RAVISANKAR, A. K. PRUSTY, SUNIL KUMAR, AMRIT LAL MEENA AND JAIRAM CHOUDHARY***ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, U P, 250110*

With the ever increasing population coupled with degrading land resources, a larger part of the population is already having difficulty in securing quality food. It is necessary to think of innovative and creative ways to feed and nourish everyone. A paradigm shift in farming systems research is the utmost need to accomplish the mission by integrating the modern tools and techniques of agriculture. Horticulture crops such as vegetables, fruits, plantation, spices, floriculture, medicinal and aromatic plants have greater role in farming systems in meeting the objectives of better soil, family nutrition, round the year production and income besides environmental improvement. Through Horticulture based farming systems, the resources are effectively utilized, resources are conserved well and environment is improved. In all the Integrated farming system models being developed through AICRP-IFS, two components viz., boundary plantation and kitchen garden are integrated with an aim to supply the fresh quality fruits and vegetables for the family especially to children who are the future human resource of this country. Among the 38 On-station farming system models developed through AICRP on Integrated Farming Systems network, eight horticulture-based farming system models have been developed for the country. Farming system has the in-built mechanism of sustainability due to presence of many inter-linked complementary and supplementary enterprises. In the event of aberrant weather and market price, integrated farming system ensures the farmers, thereby increases the sustainability. Further, wastes from one components are recycled as input for other components and thereby it also contributes positively to the soil health, crop growth and environment. Our results clearly indicate that IFS models are more sustainable than the practices of cropping system or dairy alone. (Gangwar *et al.*, 2015) The prevailing farming situation in India calls for an integrated effort to address the emerging issues / problems. The integrated farming systems approach is considered to be the most powerful tool for enhancing profitability of farming systems, especially for small and marginal farm-holders to make them bountiful. In fact, our past experience has clearly evinced that the income from cropping alone is hardly sufficient to sustain the farmers' needs. With enhanced consumerism in rural areas, farmers' requirements for cash have also increased to improve their standard of living. This is especially true in case of small and marginal farmers. Therefore, farmers' income and food requirements would have to be augmented and supplemented by adoption of efficient secondary/ tertiary enterprises like horticulture (vegetables/ fruits/ flowers/ medicinal and aromatic plants), apiary, mushroom cultivation, fisheries etc. However, these integrated farming systems will be required to be tailor-made and designed in such a manner that they lead to substantial improvement in energy efficiencies at the farm and help in maximum exploitation of synergies through adoption of close cycles. These systems also need to be socially acceptable, environment friendly and economically viable (DARE, 2015)

The ever increasing population of our country is causing a threat to Indian agriculture by creating diverse challenges and problems. The demand for food, feed, fodder and natural resources is creating a constant pressure to develop efficient agricultural systems which can suffice a farmer's need. Marginal and small farmers, representing more than 86% of Indian farm families with land holding below 1.2 ha, live in risk-prone diverse production conditions. Due to ever increasing population and decline in per capita availability of land, there is less or no scope for horizontal expansion of land for agriculture. Crop and livestock cannot be separated for small holder agriculture in India as crop + livestock is the pre-dominant farming system existing in the country and livelihood of 117 million marginal and small farm holdings revolves around this system. Small categories of farms are often subjected to weather vagaries like flood, drought and other natural calamities and farming remains risky. Vertical expansion in small farms is possible by integrating appropriate farming system components requiring less space and time and ensuring periodic income to the farmers. Integrated Farming System (IFS) is considered to be powerful tool and holds the key for ensuring income, employment, livelihood and nutritional security in a sustainable mode for small and marginal farmers who constitute 84.97 % of total operational holdings and operated 44.31 % of area. Integrated system meets the above goals through multiple uses of natural resources such as land, water, nutrients and energy in a complimentary way thus giving scope for round the year sustainable income from various enterprises.

Integrated farming system approach is not only a reliable way of obtaining fairly high productivity with considerable scope for resource recycling, but also covers concept of ecological soundness leading to sustainable agriculture. In the farming system approach, horticulture provides excellent opportunities in raising the income of the farmers even under abrasive conditions. The cultivation of fruit crops under horticulture based farming system (HBFS) plays an important role in the prosperity of a nation along with health, happiness, prosperity of the people and ensures sustainable farm income under abrasive climatic conditions. Integration of horticultural modules in farming systems aid in enhancing the productivity and profitability of the farming systems specially with cultivation of vegetables (Kashyap *et al.* 2015). The natural resources can be explored to its maximum potential in a complimentary way so as to harvest maximum returns from various enterprises of the systems through integrated farming systems.

INTEGRATED FARMING SYSTEM APPROACH AND ITS OBJECTIVES

IFS approach can be described as “A judicious mix of two or more components using cardinal principles of minimum competition and maximum complementarity with advanced agronomic management tools aiming for sustainable and environment friendly improvement of farm income, family nutrition and ecosystem services”. Preservation of bio-diversity, diversification of cropping/farming system and maximum recycling is the base for success of the farming systems approach (Singh and Ravisankar, 2015).

FARMING SYSTEMS AND ITS COMPOSITION IN INDIA

Characterization of existing farming systems throughout the country indicates existence of 19 pre-dominant farming systems with majority as crop + livestock (85%). Although crop + livestock system is dominating in the country, based on the percent contribution to net income, the systems are classified as crop, horticulture, livestock, fisheries dominant systems where in dominant component contributes more than 50 % of the total net returns. Accordingly, it has been found that horticulture based farming systems exists in the states of Goa, Kerala, Meghalaya, Rajasthan, Uttar Pradesh, Andaman and Nicobar islands, crop dominant farming systems are existing in the states of Andhra Pradesh, Bihar, Chhattisgarh, Goa, Haryana, Jammu and Kashmir, Jharkhand, Kerala, Karnataka, Madhya Pradesh, North-East, Maharashtra, Odisha, Punjab, Tamil Nadu, Uttar Pradesh and Uttaranchal while livestock dominant systems are observed in Rajasthan and Gujarat. West Bengal, parts of Odisha and Assam states have the fisheries as a major source of income to the existing farming systems. The scope for promotion of horticulture (fruit) based systems exists in Jammu and Kashmir, Himachal Pradesh, Maharashtra, parts of Uttar Pradesh and in Sikkim while plantation crops dominant systems are found in Andaman and Nicobar Islands and Kerala.

In selected states and locations, highly diversified systems also exists where in none of the component contributes for 50 % or more to the returns. Though the various farming systems are existing naturally in the country, integration of output as input to other components within the system is either completely lacking or at partial.(Manjunatha *et al.*, 2014) Competition exists within and outside the farm for various byproducts generated. Sustainable farming systems should aim for long term productivity, profitability, recycling of resources and employment generation.

MAJOR HORTICULTURE BASED FARMING SYSTEM MODELS DEVELOPED IN DIFFERENT STATES OF INDIA

Region specific horticulture based farming systems with special emphasis on most suitable horticultural crop of the region viz., plantation crops, fruit crops, exotic vegetables etc. can address essential requirements of productivity, profitability and sustainability besides employment generation. Here are 8 different horticulture based farming systems developed for different states as listed as under.

i) Orchard-based IFS model for Uttar Pradesh (1.5 ha)

Orchard based IFS model has been developed for Uttar Pradesh. The major components of the models are 1) Horticulture + intercrop systems (0.8 ha.), 2) Crops (0.6ha) and 3) Pond Dyke system (0.10 ha.). The production achieved through the model is 41t/yr (rice eq. yield) with annual net income of 4.29 lakhs/yr, generating employment of 742 mandays/yr.

ii) Coconut-based Farming System for Andaman & Nicobar island (1 ha)

A coconut based farming system model (1.0 ha) has been established for Andaman and Nicobar island. The major components of the models are 1) Coconut based multi-tier systems 0.8 ha. 2) Livestock – 4 pigs 3) Fish cum poultry 0.06 ha. 4) V.C. – 0.01 ha. The total production achieved from the model is 36t/year (REY) with a total cost of 1.70 lakhs/year. The annual income obtained through this model is Rs. 2.23 lakhs/year, besides generating employment of 198 mandays/year.

iii) Coconut-based multi-tier cropping model for Kerala (0.2 ha)

Coconut based multi-tier cropping model has been developed for Kerala. The major components of the models are 1) Coconut based multi-tier cropping systems (0.19 ha.) 2) livestock – .01ha. 2 cows, 3) Fish culture between coconut bunds and Azolla. The production of the model is 11t/year (REY) with annual net income of Rs. 0.57 lakh/year, generating employment of 127 mandays/year.

iv) Homestead based IFS model for Kerala (0.2 ha)

Homestead based cropping model has been developed for Kerala. The major components of the models are 1) Homestead based cropping systems (0.16 ha.) 2) Livestock – 0.01ha, 2 cows 3) Terrace garden + water harvesting, 0.15 ha.) 4) Vermi compost (0.006ha.) and poultry unit (0.01ha). The production of the model is 1,9,800 numbers/year (coconut eq. yield) with an annual net income of Rs. 0.35 lakh /year generating employment of 82 mandays/year.

v) Banana-based IFS model for Kerala (0.2 ha)

Banana based IFS model has been developed for Kerala. The major components of the models are ; 1) Horticulture + intercrop systems (0.18 ha.) 2) livestock's – .01ha. 2 cows 3) Vermi compost (0.01ha). The production of the model is 4t/year (banana eq. yield) with annual net income of Rs. 4.29 lakh/year generating employment of 742 mandays/year.

vi) Exotic vegetables-based IFS model for Uttar Pradesh (0.4 ha)

Exotic Vegetables based IFS model has been developed for Uttar Pradesh. The major components of the models are ; 1) Exotic Vegetables (0.34 ha.) 2) Livestock (0.06ha.) with 1 buffalo +1 cow. The production of the model is 19.6t/year

(REY) with annual net income of Rs. 2.03 lakh/year generating employment of 367 mandays/year share obtained from coconut based multi-tier systems.

vii) Plantation crop based IFS model for Goa (0.80ha)

Plantation based IFS model has been developed for Goa. The major components of the models are ; 1) Plantation crop based (0.70 ha.) 2) Livestock–. 8 pigs & 25 birds 3) Vermi compost (0.10ha.). The production of the model is 23t/year (REY) with annual net income of Rs. 0.89 lakh/year generating employment of 508 mandays/year.

viii) Fruit tree based IFS model for Rajasthan (1.0ha)

Fruit tress based IFS model has been developed for Rajasthan. The major components of the models are; 1) Fruit tress + crop based (0.87 ha.) 2) Livestock –1cow 3) Others Vermi compost (0.13ha.). The production of the model is 7.8t/year (cluster bean eq. yield) with annual net income of Rs 0.97 lakh /year generating employment of 225 mandays/year.

Comparative performance of these 8 horticulture based farming systems models (HBFS) in terms of production and economics has been presented in Table 2 which suggests important role of horticulture based farming systems in enhancing productivity, profitability and employment generation.

Table 1: Performance of horticulture based farming systems models in terms of production and economics

Location	IFS Model	Area	Production (Equivalent yield of base crop of region) (t/year)	Annual Net profit (lakh/year)	Empower (Man- days/year)
Andaman & Nicobar island	CBFS + Pig based IFS model	1.0	36 (rice eq. yield)	2.23	198
Goa	Plantation + Pig + Poultry	0.8	23 (rice eq. yield)	0.89	508
Kerala	Coconut based IFS model	0.2	11 (rice eq. yield)	0.57	127
Kerala	Homestead based IFS model	0.2	19800 nos /year (Coconut eq. yield)	0.35	82
Kerala	Banana based IFS model	1.58	4 (Banana eq. Yield)	0.16	96
Rajasthan	Agroforestry based IFS model	2.0	5.9 (pearl millet eq. yield)	0.50	192
Rajasthan	Agri-horti based IFS model	2.0	15.1 (pearl millet eq. yield)	1.32	350
Rajasthan	Horti-pasture based IFS Model	2.0	6.5 (pearl millet eq. yield)	0.52	210
Rajasthan	Agri-silviculture based IFS model	2.0	5.0 (pearl millet eq. yield)	0.49	192
Rajasthan	Fruit tress + field crop + medicinal plant based IFS	1.0	7.8 t (cluster bean eq yield)	0.97	225
U.P.	Orchard based IFS model	1.5	41 t (rice eq. yield)	4.29	742
U.P.	Exotic vegetable based IFS model	0.4	19.6 (rice eq. yield)	2.03	367

CONCLUSION

It can be concluded that diversification of existing farming systems with change in crops, cropping systems, addition and improvement of livestock components, inclusion of horticulture, kitchen garden, primary and secondary processing, boundary plantations are essential to improve the on-farm income of small holders in India. This also paves way for meeting the household demand of balanced food, improved recycling of nutrients and water besides increasing the on-farm employment for family. Diversification of existing farming systems clearly demonstrated the advantages. It has been observed that productivity gain of 2 to 3 times and increase in net return of 3 to 5 times is possible with improved systems. Further, resource saving of 40 to 50 % can also be ensured besides enhancing the income of household to the level of atleast Rs 400 to 500/day. Additional employment generation of 70 to 80 % is also possible. Improved diversified horticulture based farming systems also ensure household nutritional security apart from providing the livelihood and smile security.

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EVALUATION OF SOME WHEAT GENOTYPES UNDER SOWING DATES AND NITROGEN LEVELS: 1. GROWTH AND STRAW YIELD**EL-SAYED M. GHEITH, AHAMAD ABDEL SHAHEED, OLA Z. EL-BADRYANDSAFAA A WAHID***Agronomy Department, Faculty of Agriculture, Cairo University, Egypt*

A study on the response of five wheat genotypes (Sids 1 and Gemmiza 9 from Egypt, L.R.-52 from Sudan, L.R.-62 and L.R.-67 from Yemen) to three sowing dates (25th November, 10th and 25th December) and two nitrogen levels (120 and 240 kg N/ha.) was conducted at the Agricultural Experimental and Research Station, Faculty of Agriculture, Cairo University, Egypt during 2011/2012 and 2012/2013. The experiment was laid out in RCBD in a split plot design, placing sowing dates in the main plots, nitrogen levels in the sub plots and genotypes in the sub sub-plots with three replications. Sowing dates had significant effect on the number of days to 50% heading, flag leaf area, plant height and straw yield in both seasons. The highest values of the previous traits were obtained at early sowing on 25th November in both seasons. All the studied traits significantly increased by increasing nitrogen levels up to 240 kg N/ha. The genotype L.R.-67 emerged 50% of its heads earlier, Gemmiza 9 and L.R.-67 gave taller plants, L.R.-62 produced the highest number of tillers, whereas Gemmiza 9 and L.R.-62 produced the highest straw yield in both seasons. The earliest heading and the largest flag leaf area were obtained from sowing on 25th December at 240 kg N/ha. in both seasons. Late sowing (December) and low nitrogen applications significantly declined the yielding capacity of the wheat genotypes. Gemmiza 9 and L.R.-62 performed better in term of straw yield as compared to the other genotypes.

Key words: *Wheat, sowing dates, N levels, genotypes.*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is considered the most strategic crop for Egypt and some other developing countries. Increasing wheat production is a national target in Egypt to fill the gap between consumption and production. Great attention and efforts have been paid by the Egyptian government and scientists to narrow wheat security gap. Man is dependent on wheat crop for food and for feed for his domestic animals because wheat straw is very important for livestock feed. Planting date is one of the most critical considerations and agronomic factors involved in producing high yield of small grain cereal crops like wheat. Several studies documented the effect of planting dates on wheat performance. Early or late sowing increases the risk of yield losses (Ali et al., 2010; Madani et al., 2010; Mostafa et al., 2010; HasinaGul et al., 2012). Similarly, plant height (Abdel-Hadi and El-Naggar, 2010; HasinaGul et al., 2012;), number of tillers/m² (RakeshKumar Sharma, 2003), straw and biological yields (Ali et al., 2010; Alisial et al., 2010; Mostafa et al., 2010) were increased with early sowing (early November) over late sowing (December). Nitrogen fertilization is the most important factor in front of wheat agronomist for achieving yield targets. Several investigators found positive response of wheat to nitrogen fertilization (El- Gizawy, 2009; Madani et al., 2010; Abedi et al., 2011; Ooro et al., 2011; Qi Wang et al., 2012), as well as to genotypes (Giambalov et al., 2010; Iqbal et al., 2012). The present project was therefore designed to investigate the effect of sowing dates and nitrogen levels on growth and straw yield of some wheat genotypes

MATERIALS AND METHODS

Study on the response of five wheat genotypes, (Sids 1 and Gemmiza 9 from Egypt, L.R.-52 from Sudan and L.R.-62 and L.R.-67 from Yemen) to three sowing dates (25th November, 10th December and 25th December) and two nitrogen fertilizer levels (120 and 240 kg N/ha.) was conducted at the Agricultural Experimental and Research Station, Faculty of Agriculture, Cairo University, Egypt during 2011/2012 and 2012/2013. The experiment was laid out in Randomized Complete Block Design (RCBD) in a split plot design placing sowing dates in the main plots, nitrogen fertilizer levels in the sub plots and genotypes in the sub sub plots with three replications. The net of sub sub plot area was 8 m² (twenty rows, two meters long and 20 cm apart). Seed bed was prepared by ploughing the field for 3 times with cultivator followed by planking. Wheat grains (144 kg/ha.) were sown manually with single row hand drilling by maintaining row to row distance of 20 cm. The soil was clay loam in texture, chemical and mechanical analyses are presented in Table (1). The amount of nitrogen in the form of urea (46%N) was added as per treatment in two portions, being applied immediately at sowing and the rest was applied at the time of first irrigation. All plots received uniform cultural practices. Data about the number of days to 50% heading, flag leaf area at 100 days from planting, plant height, number of tillers/m² and straw yield/ha. were recorded as recommended procure. The recorded data were analyzed statistically by using statistical software package MSTAT-C (Michigan State University, 1990). Least Significant Differences (L.S.D.) at 0.05 probability was employed to test the significant differences among mean values of each treatment (Steel and Torrie, 1997).

Table 1: Mechanical and chemical analysis of upper 30 cm of soil in both seasons.

Mechanical analysis	1 st season	2 nd season	Chemical analysis	1 st season	2 nd season
Clay %	38.2	37.2	Available N (ppm) ¹	46.5	49.8
Silt %	23.4	24.6	Available P (ppm) ²	13.7	15.3
Sand %	38.4	38.2	Available K (ppm) ³	366.0	369.0
Organic matter	1.6	1.9	pH	7.7	7.6

Calcium carbonate %	3.0	3.2	Ecmmhos/c 25C ⁰	2.4	2.4
Texture	C. loam	C. loam			

1, 2 and 3 = N, P and K according to Jackson (1958), Olsien et al. (1945) and Pipper (1960), respectively..

RESULTS AND DISCUSSION

Effect of sowing dates

Results presented in Table (2) show that number of days to 50% heading, flag leaf area, plant height and straw yield were statistically affected by sowing dates in both seasons. Tallest plants (115.17 and 112.43 cm) were observed at early planting (25 November), while smallest plants (96.57 and 94.37 cm) were recorded at later planting (25 December) in both seasons. Plants sown on November 25 came very late to heading (106.07 and 98.63 days) compared with the late planting in 25 December (89.63 and 83.03 days) in both seasons, respectively. Likewise, Number of tiller/m² and flag leaf area were decreased with delaying sowing date from 25 November to 25 December in both seasons, respectively. Therefore, early sowing in 25 November increased straw yield by 102.6% and 129.9% in the first season and by 88.0% and 102.3% in the second one compared with sowing in 10 and 25 December, respectively. Similar results were given by RakeshKumar Sharma (2003), Hamam and Khaled(2009) Abdel-Hadi and El-Naggar (2010) and Mostafa et al. (2010) who found that delay in sowing from 15 November to 15 December decreased these traits.

Table 2: Effect of sowing dates on studied traits in both seasons.

Sowing dates	Plant height (cm)		No. of days to 50% heading		No. of tillers/m ²		Flag leaf area(cm ²)		Straw yield (t/ha.)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
	season	season	season	season	season	season	season	season	season	season
25 Nov.	115.17	112.43	106.07	98.63	556.33	473.08	54.25	52.65	5.45	2.67
10 Dec.	107.13	104.97	69.17	89.43	527.33	439.33	51.88	50.73	2.69	1.42
25 Dec.	96.57	94.37	89.63	83.03	505.67	419.00	51.61	50.00	2.37	1.32
F 0.05	*	*	*	*	ns	ns	*	*	*	*
LSD0.05	3.07	3.34	0.41	1.17	-	-	1.37	2.15	0.73	0.31

*= Significant and ns= not significant.

Effect of nitrogen levels

All studied characters except number of tillers/m² were significantly affected by nitrogen levels in both seasons Table (3). Tallest plants (108.66 and 106.02 cm) were observed at 240 kg N/ha., while smallest plants (103.98 and 108.82 cm) were recorded at 120 kg N/ha. in both seasons, respectively. These results may be due to the stimulation effect on internodes elongation. Iqbal et al. (2012) and HasinaGul et al. (2012) reported similar results.

It is evident from these results that heading was delayed from 96.75 to 97.75 days in the first season and 89.64 to 91.09 days in the second one by increasing nitrogen application from 120 to 240 kg N/ha. This increment in heading period may be due to nitrogen addition that favored vegetative growth which in turn delayed time of heading. These results are in harmony with those obtained by Hamamand Khaled (2009). The highest flag leaf area (55.11 and 53.63) was obtained at 240 kg N/ha., while the lowest values (50.05 and 48.58) were produced at 120 kg N/ha. in both seasons, respectively. Nitrogen fertilization also has prominent effect on straw yield in both seasons. The application of 240 kg N/ha. increased straw yield by 17.0% and 10.9% over the lowest nitrogen level (120 kg/ha.) in both seasons, respectively. This might be due to the well utilization of nitrogen fertilizer in metabolism and meristic activity which improved growth characters such as plant height and number of tillers/m². These results are in agreement with those obtained by AnureetKaurPannu and Buttar (2010) and Qi Wang et al. (2012) who found that the largest straw yield per unit area was obtained by application of 240 – 360 kg N/ha.

Table 3: Effect of nitrogen levels on studied traits in both seasons.

N level (kg/ha.)	Plant height (cm)		No. of days to 50% heading		No. of tillers/m ²		Flag leaf area(cm ²)		Straw yield (t/ha.)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
	season	season	season	season	season	season	season	season	season	season
120	103.98	108.82	96.75	89.64	520.89	440.00	50.05	48.58	3.23	1.74
240	108.66	106.02	97.75	91.09	938.67	446.11	55.11	53.63	3.78	1.93
F 0.05	*	*	*	*	ns	ns	*	*	*	*

*= Significant and ns= not significant.

Effect of genotype

Genotypes had significant effect on plant height, number of days to 50% heading, flag leaf area, number of tiller/m² and straw yield in both seasons (Table 4). As regarding to plant height, Gemmiza 9 was the tallest one (109.00 and 106.06 cm) followed by L.R.-62 (106.06 and 103.50 cm), while the shortest plants were recorded either by Sids 1 (105.17 and 103.17 cm) or L.R.-67 (105.17 and 103.17 cm) in both seasons, respectively. AS regarding to 50% heading, results indicated that L.R.-62 ranked first (95.17 and 88.33 days) followed by L.R.-62 (96.00 and 88.89 days) and Sids 1 (96.61 and 90.00 days), while Gemmiza 9 (98.33 and 91.89 days) ranked fourth and L.R.-67 (100.33 and 92.50 days) came 5th in both seasons, respectively. Concerning number of tillers/m², the highest number of tillers/m² (612.78) was observed from L.R.-62, while the lowest value (478.89). was recorded by Gemmiza 9 in the first season. Whereas, L.R.-67 (520.38) ranked 1th and Sids 1 (402.22) ranked 5th in the second season. These results are in agreement with those obtained by Menshawy (2007) and Njuguna et al. (2010) who found that genotypes showed a different effect on this trait. Mean straw yield comparison indicated that the highest yield (3.91 and 2.03 t/ha.) was belonged of Gemmiza 9, while the lowest yield (3.09 and 1.62 t/ha.) was recorded by Sids 1 in both seasons, respectively. These results are in harmony with obtained by Menshawy (2007), Njuguna et al. (2010) and Iqbal et al.(2012).

Table 4: Effect of genotypes on studied traits in both seasons.

Genotype s	Plant height (cm)		No. of days to 50% heading		No. of tillers/m ²		Flag leaf area(cm ²)		Straw yield (t/ha.)	
	1 ^s season	2 nd seas on	1 st season	2 nd sea son	1 ^s season	2 nd seas on	1 st seas on	2 nd sea son	1 st se ason	2 nd se ason
Gemmiza 9	109.00	106.06	98.33	91.89	478.89	482.22	54.32	53.02	3.91	2.03
Sids 1	105.17	103.17	96.61	90.00	483.89	402.22	51.86	49.97	3.09	1.62
L.R.-52	105.72	103.50	96.00	88.89	574.44	402.50	52.30	51.28	3.60	1.90
L.R.-62	106.06	103.50	95.17	88.33	612.78	407.50	55.25	53.26	3.72	1.92
L.R.-67	105.17	103.17	100.33	92.50	498.89	520.38	49.15	48.13	3.20	1.71
F 0.05	*	*	*	*	*	*	*	*	*	*
LSD 0.05	1.03	1.42	0.70	1.21	53.90	45.62	3.62	2.98	0.34	0.18

*= Significant.

Effect of interactions

Planting early in 25 November and application of 120 kg N/ha. increased number of days to 50% heading by 15.80 and 26.07 days compared with planting on 25 December in both seasons, respectively (Table 5). Moreover, planting L.R.-67 at 25 November and L.R.-62 at 25 December gave the maximum (108.67 days) and minimum (88.50 days) period to heading in both seasons, respectively (Table 6).

Table 5: Effect of sowing dates × N levels interaction on number of days to 50% heading in both seasons.

Treatments	N levels (kg/ha.)			
	120	240	120	240
	1 st season		2 nd season	
25 Nov.	105.13	97.06	107.00	100.20
10 Dec.	95.20	88.40	97.13	90.47
25 Dec.	89.33	82.60	80.93	83.47
F 0.05	*		*	
LSD 0.05	0.77		1.32	

*= Significant

Table 6: Effect of sowing dates × genotypes interaction on number of days to 50% heading in first season.

Sowing dates	Genotypes				
	Gemmiza 9	Sids 1	L.R.-52	L.R.-62	L.R.-67
25 Nov.	108.00	104.33	104.67	104.67	108.67
10 Dec.	97.33	96.17	94.67	92.33	100.33
25 Dec.	89.67	89.33	88.67	88.50	92.00
F 0.05	*				
LSD 0.05	1.21				

*= Significant.

CONCLUSION

From the obtained results it can be concluded that number of days to 50% heading, flag leaf area, plant height, number of tillers/m² and straw yield per unit area were significantly increased with increasing N levels up to 240 kg N/ha. and at sowing on 25th November. Moreover, Gemmiza-9 performed better in turn of straw yield as compared with other genotypes.

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MARKER ASSISTED BREEDING IN IMPROVING WHEAT FOR CLIMATE RESILIENCE

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Ever increasing threats of climate change to crop production and food security are being currently discussed globally. Wheat (*Triticum aestivum* L.) is one of the most important food crops worldwide, occupying largest cultivated area, and supplying 40% of food globally and 25% of calories for the developing world. Hence increase in its production and productivity is very much desired to meet the demand of ever increasing population. Five new pathotypes, namely, 110S119, 238S119, 110S84, 110S247 and 46S117 of stripe rust (*Puccinia striiformis*) reported in 2014 demands serious attention towards preparedness to fight against potential threat of this devastating pathogen. Due to change in climate, the severity of spot blotch (*Bipolaris sorokiniana*) incidence is increasing in North Western Plains Zone (NWPZ) of India where leaf and stripe rust, and powdery mildew were major diseases. Hence exotic germplasm obtained from CIMMYT, Mexico were screened under epiphytotic conditions and resistance lines were identified using gene linked markers. Considering the importance of yellow rust in Northern Hills Zone (NHZ) and yellow as well as brown rusts in North Western Plains Zone (NWPZ), two major yellow rust resistance genes, *Yr10* and *Yr15* and brown resistance genes *Lr19/Sr25*, *Lr24/Sr24* and *Lr34/Yr18* from the donor genotypes were mobilized in popular cultivars and elite genotypes. It is envisaged that marker-assisted deployment of major genes along with APR genes will confer durable rust resistance in wheat.

Key words : Germplasm, wheat leaf rust, stripe rust, spot blotch, microsatellite marker, marker-assisted backcrossing (MABC), Gene pyramiding

INTRODUCTION

Wheat is a source of food and livelihoods for over 1 billion people in developing countries. India with 98.61 million ton wheat production in 29.72 million hectare in 2017-18 is second largest producer of wheat in the world (ICAR-IIWBR, 2018). Wheat crop faces a variety of biotic and abiotic stresses during its life cycle. Particularly among biotic stresses, rusts (*Puccinia* spp) are destructive foliar disease of wheat (*Triticum aestivum* L.) and poses a substantial threat to food security worldwide. Rusts can cause yield losses from 10 to 70%, further reducing the quality of grain and forage (Chen, 2005). Where favourable conditions occur and susceptible varieties are grown, significant yield losses may incur.

It is anticipated that climate change will lead to enhanced problem of biotic as well as abiotic stresses. The three rusts, stripe (yellow), leaf (brown) and stem (black) of wheat can only survive on living plant material, with the dominant host being wheat. During the past decade a number of virulent strains of wheat rusts have emerged, causing global concerns to wheat production. In 2010 and 2013, a new, virulent strain of stripe rust on *Yr27* has caused severe outbreaks and losses in many countries in North and East Africa, the Near East and South Asia. Breakdown of *Yr9* resistance in mega wheat variety PBW 343 has become a matter of concern. There has been frequent breakdown of rust resistance in other popular wheat varieties in India in recent years. Earlier two races, 78S84 and 46S119 of stripe rust (*Puccinia striiformis*) were prevalent in hills and north western plains zone (NWPZ) of India, however five new pathotypes namely, 110S119, 238S119, 110S84, 110S247 and 46S117 were reported in 2014, which demands serious attention towards preparedness to fight against potential threat of this devastating pathogen.

Because rust fungi evolve rapidly, the main focus of our breeding is to emphasize resistance based on slow rusting, adult-plant resistance (APR) genes that individually have small to intermediate effects but high resistance level approaching near immunity, achieved by combining 4-5 of these genes (Singh et al., 2014). Apart from resistance durability, the main advantage of selecting additive, minor genes combinations is that selection can be done simultaneously with other traits in field conditions under high disease pressures.

Spot blotch, caused by fungus *Cochlibolus sativus* (anamorph *Bipolaris sorokiniana*), is currently the most important disease of wheat in eastern India (Gupta et al., 2017). The disease is particularly severe when high humidity stage and high temperatures occurs together at the late post-anthesis growth stages. As the wheat rusts remain under control, spot blotch has continued to dominate on nearly 9 m ha since Green Revolution (Joshi et al., 2007 and Singh et al., 2015). Being warm and humid, the eastern India is the hot spot for this disease where significant losses in wheat production are recurring features and estimated to be 15% on the average (Dubin and van Ginkel, 1991) affecting millions of resource-poor farmer. Several lines and varieties with moderate to adequate resistance have been developed and released, and diversity for resistance has increased in the improved CIMMYT germplasm (Singh et al., 2015). Severe infection may also reach to the spikes, resulting in less weight due to shriveled grains. therefore, analyzing spot blotch resistance along with its correlation with yield traits would help in identification of better donors for spot blotch resistance with higher yield to be used in breeding programme (Tiwari et al., 2016).

MARKER ASSISTED SELECTION: CHOICE OF MARKERS

Molecular tags- a prerequisite for marker assisted selection (MAS)- have been developed for many agronomic traits in several crop plants using different kinds of molecular markers. The essential requirements for molecular marker-aided selection in a plant breeding programme are: (1) marker(s) should cosegregate or be closely linked (1cM or less) with the desired trait; (2) an efficient means of screening large populations for the molecular markers should be available; and (3) the screening technique should have high reproducibility across laboratories, be economical to use and should be user friendly. Molecular markers are specially advantageous for agronomic traits that are otherwise difficult to score (Gupta et al., 1999). The choice of marker system to be used for the detection of DNA polymorphism, depends first on the objective of study and the needs dictated by its specific application, and second on the facilities and skills available in a laboratory. Therefore, a comparative study of different technologies may be helpful in making a choice of suitable marker.

Gupta et al. (1999) compared the advantages and disadvantages associated with the use of different marker systems so that one may choose a suitable marker technology, for a specific purpose, such as plant breeding, DNA fingerprinting, genetic diversity analysis and comparative mapping. It should be recognized that different marker systems may be suitable for different purposes. For example, it has been shown that microsatellite markers are codominant and, relative to all other marker types, have high information content (estimated as either the polymorphic information content or genetic diversity index or expected heterozygosity). However, the very high cost of their development restricts their uses in many laboratories. However, the availability of large number of microsatellite primer pairs in bread wheat and the extensive molecular genetic maps based on these microsatellites overcame this barrier has accelerated their use even in small laboratories. In addition, the locus specificity and high level of polymorphism associated with microsatellites make them the marker system of choice for molecular marker-aided selection in practical plant breeding.

Use of molecular markers has emerged as a powerful and efficient approach to complement traditional plant breeding for improving crops. An array of molecular markers are now available that include RFLP that is based on Southern blot hybridization and, RAPD, ISSR, SSR and STS are based on polymerase chain reaction. The AFLP and CAPS markers are the other PCR based markers involving pre and post amplification restriction digestion, respectively. The most recent marker system is single nucleotide polymorphism (SNP) that utilizes the vast DNA sequence resources available in different crop species. Each of these markers has its own strengths and limitations. Markers are being used in several different aspects of crop improvement including estimation of genetic diversity, construction of high density genome maps, mapping and tagging of genes, map-based isolation of genes and marker assisted selection (MAS). MAS is carried out for transferring target gene(s) from one genetic background to another using tightly linked markers (foreground selection). MAS is also carried out to quickly recover recurrent parent genome in backcross breeding using a large number of either random or mapped markers having whole genome coverage (background selection). Hence, MAS requires markers tightly linked to the genes for the target traits as well as high-density genome maps in crops of interest. This condition is not fulfilled in all crops and traits. MAS has been effectively employed in pyramiding identified genes involving short breeding cycles through background and foreground selection thereby adding resistance to established cultivars of each crop (Prabhu et al., 2009).

MARKER VALIDATION

Before using the molecular markers in actual plant breeding, it is necessary to undertake studies on marker validation, a process of examining the behaviour of markers and the associated polymorphism in different genetic backgrounds. The validity of a molecular marker linked with any trait should be examined in other crosses, since, for a marker to be useful in breeding programmes, it needs to detect the polymorphism in different crosses. For example, markers identified in one cross as being linked to protein content need to be tested in other crosses to determine if the alleles associated with high and low protein contents in two genotypes involved in the original single cross used for marker development, are also associated with similar phenotypes involved in other crosses.

Marker validation involves: (1) identification of potential markers from available research; (2) identification of the genetic material for the appropriate breeding programmes; (3) examination of the effectiveness of the marker/trait linkage in the breeding material identified; (4) critical discussion of results, and suggestions from the plant breeders to decide on the validation of the particular marker-trait combination. However, it may be more difficult to conduct marker validation for quantitative traits where there is major genotype-environment interaction, so that the effect of a QTL in a specific environment is impossible to predict, since different loci may interact differently with different environments. The difficulty may be overcome by identification of more and more QTL linked with independent molecular markers followed by mapping of the QTL identified and subjecting them to interval mapping (Gupta et al. 1999).

Gene pyramiding for durable resistance: Role of molecular markers

The term gene pyramiding in plant breeding is used to signify the activity of building into one variety more than one gene for a character so that the expression of the character is enhanced. Conventionally, breeding plants with resistance against a specific disease requires the identification of resistant parents, which are then crossed with agronomically acceptable but susceptible parents. A program of backcrossing to the susceptible parent and selection of resistant phenotypes leads to the production of plants that are similar to the susceptible parent but have the required resistance. Typically, this process takes 10 or

more years, and by this time, the pathogen has evolved a variant that is not recognized by the improved cultivar, leading to susceptibility. To overcome this, molecular markers play an important role to improve the efficiency and precision of conventional plant breeding via marker-assisted selection (MAS). In majority of the MAS programmes, marker assisted back crossing (MABC) has been deployed which includes marker assisted foreground selection along with phenotypic selection to identify plants possessing desirable genes in segregating populations and background selection, utilizing the polymorphic markers to ensure the sufficient recurrent parent genome (RPG) recovery. Breeding of resistant varieties is an effective approach to eliminate the use of fungicides and minimize crop losses due to rust diseases. Therefore, breeding varieties with multiple diseases resistance is essential and also most economical way to manage them. Molecular markers have emerged as a powerful tool for the precise transfer of genes from donor to recipients and it is becoming integral part of classical plant breeding. Molecular markers help precise introgression of gene of interest on one hand and screening of sources of resistance on the other hand (Gupta et al., 2010, Tomar et al., 2014, Prabhu et al. 2009).

MATERIALS AND METHODS

Resistance evaluation in field conditions and confirming the resistance with gene linked markers

The investigations were carried out at the Department of Genetics & Plant Breeding, G. B. Pant University of Agriculture and Technology, Pantnagar, India. Five stripe rust pathotypes were selected for screening for race-specific resistance namely 46S119, 78S84, 47S102, 46S102, and 47S103. Out of them, 46S119, 78S84 were highly prevalent stripe rust pathotypes with in the Indo-gangatic region and within Indian subcontinent.

Germplasm screening for rust resistance

A total of 440 germplasm obtained from National Bureau of Plant Genetic Resources (NBPGR), New Delhi, were used to evaluate the accessions for resistance towards the stripe rust in season 2013-14 and 2014-15. Resistant checks including Avocet/Yr5, Avocet/Yr10, and Avocet/Yr15 were used in the field trial. The plots were surrounded by susceptible spring wheat Agra local as a spreader of rust inoculum naturally. In addition, to increase the inoculums load, artificial inoculation was performed with the virulent races 78S84 and 46S119 of stripe rust. Inoculation and evaluation of rust disease were performed at the seedling stage as well as the adult plant stage. The recommended scoring method was followed to undertake the pathological analysis. In order to test the adult-plant stage, field tests were considered having adult plant resistance (APR); those that had a high infection type (moderately resistant (MR)-moderately susceptible (MS) type reaction) but possessed low disease severity (<30%) in the field tests at the adult-plant stage were measured showing durable/slow-rusting (SR). Genotypes were selected on the basis of two consecutive years (2013-14 and 2014-15) and pathological studies were further subjected to molecular marker analysis (Table 1) to evaluate the source of resistance present by following narrow down methodology (Fig. 1).

MARKER ASSISTED GENE TRANSFER FOR RUST RESISTANCE

The high yielding wheat varieties, UP 2338, UP 2382 and 7UP 2572 were taken as recipient parents to improve the rust resistance using the donors Avocet/Yr10 and Avocet/Yr15 for Yr10 and Yr15, respectively, and the APR gene Lr34/Yr18 with UP 2425. Gene and marker information is given in Table 1.

Table 1. Targeted genes and linked markers

Gene/ trait	Gene linked marker	Primer sequence	Size of fragment (bp)	Reference
Yr5	Wgwm501	5' GGCTATCTCTGGCGCTAAAA 3' 5' TCCACAAACAAGTAGCGCC 3'	160	Sun <i>et al.</i> , (2002)
Yr10	Xpsp3000	5' GCAGACCTGTGTCTATTGGTC3' 5' GATATAGTGGCAGCAGGATACG3'	240	Bariana <i>et al.</i> (2002)
Yr15	Xgwm273	5' ATTGGACGGACAGATGCTTT 3' 5' AGCAGTGAGGAAGGGGATC 3'	156	Peng <i>et al.</i> (2000)
Lr34/ Yr18	csLV34	5' GTTGGTTAAGACTGGTGATGG 3' 5' TGCTTGCTATTGCTGAATAGT 3'	160	Lagudah <i>et al.</i> (2006)
Spot blotch	Xgwm148	5'GTGAGGCAGCAAGAGAGAAAA 3' 5' CAAAGCTTGACTCAGACCAAA 3'	165	Roder <i>et al.</i> (1998)

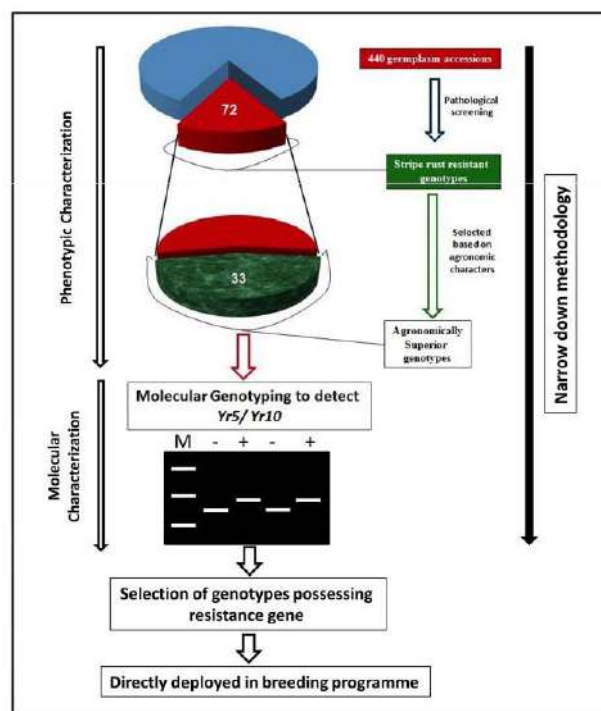


Fig. 1. Schematic diagram of narrow down methodology followed to unveil the source of stripe rust resistance in 440 diverse germplasm set. These screened genotypes were ultimately subjected to molecular genotyping for race-specific major genes viz. Yr5, Yr10, Yr15, and non-race specific durable resistance gene Lr23/Yr18 using tightly linked markers (Badoni et al., 2017).

GERMPLASM SCREENING FOR SPOT BLOTCH RESISTANCE

Simultaneously to identify resistance sources for spot blotch from a set of exotic germplasm received from International Centre for Maize and Wheat Improvement (CIMMYT), Mexico, accessions were screened under epiphytotic conditions [Chaurasia et al., (1999)]. Disease assessment was done by recording disease severity (%) displayed by all the leaves of each row was recorded at three different growth stages (GS), viz., GS 63 (beginning of anthesis to half complete), GS 69 (anthesis complete) and GS 77 (late milking). The area under disease progress curve (AUDPC) based on disease severity (GS63, GS69 and GS77) over time was calculated (Shaner and Finney, 1977).

The resistance was confirmed using the gene linked SSR markers. *Xgwm148* (Kumar et al., 2010) and STS marker, *csLV34* (Lagudah et al., 2006) linked to spot blotch resistance QTL were used to confirm the resistance shown by germplasm accessions at molecular level. Twenty two out of 200 accessions showing high resistance under epiphytotic conditions were subjected to molecular marker analysis. One each resistant check (Chirya 3) and susceptible check (Ciano T 79) was also used along with the resistant accessions for comparison.

MARKER VALIDATION AND EVALUATION UNDER ARTIFICIAL EPIPHYTIC CONDITION

First of all markers were validated in the background of selected donor genotypes. Marker assisted foreground selection was employed to identify plants possessing desirable genes in segregating populations. The segregating generation progenies were artificially inoculated with prevalent pathotypes of yellow rust. The inoculum of rust pathotypes was provided by ICAR-Indian Institute of Wheat & Barley Research Institute, Regional Research Station, Flowerdale, Shimla. Stringent phenotypic selection for faster recovery of the recurrent parent genome was exercised.

RESULTS

Marker assisted breeding for rust resistance

Validation of genes in the background of respective donors

Validation of resistance genes, Yr10, Yr15, Lr19/S25, Lr24/Sr24 and Lr34/Yr18 in the background of respective donors, Avocet/Yr10, Avocet/Yr15, FLW 8, FLW 21 and UP 2425 was done using different microsatellite markers. The amplification using the marker *Xpsp 3000* has shown the desired allele for Yr10 with product size of 260bp in the donor, and in the recipient parent presence of two bands of ~210bp and 290bp was observed. For Yr15 the marker *Xgwm 273* shows the presence of desired allele with product size of 165bp in the donor and in the recipient no band was observed.

Foreground selection for the presence of genes in F_1 and backcross populations

Foreground selection was attempted using the gene linked markers *Xpsp 3000*, *Xgwm273* and *csLV34* for the genes, Yr10, Yr15 and Lr34/Yr18, respectively. The lines showing positive for the genes were tagged before flowering and

backcross was attempted to generate BC₁F₁, BC₂F₂ and BC₃F₃ generations. In each generation sufficient disease pressure was created using virulent races of brown and yellow rusts. A representative gel showing the presence of Yr15 in BC₁F₁ has been shown in Fig. 2.

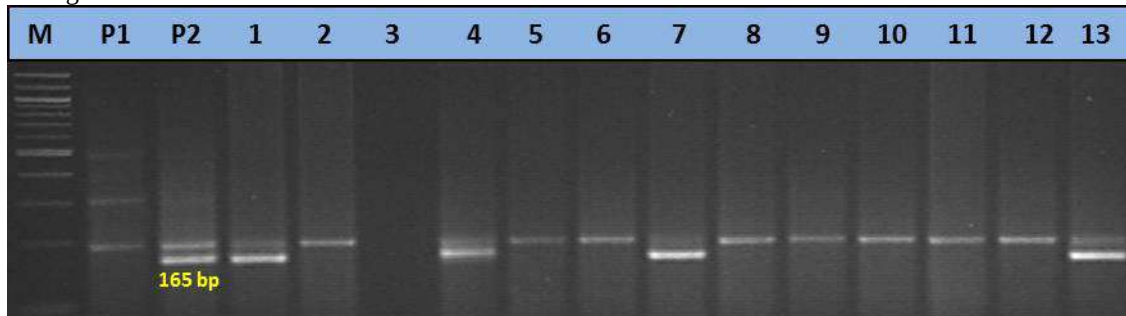


Fig. 2: Representative gel image of foreground selection for Yr15 in BC₁F₁ generation

M- 100 bp step up ladder, P₁- UP 2338, P₂- Avocet-Yr15, 1-13: progeny of BC₁F₁ generation, genotype no. 1, 4, 7 and 13 shows the presence of donor allele of 165 bp

Evaluation of selected homozygous breeding lines for agronomic performance

On the basis of resistance to stripe rust at phenotypic as well as at molecular level, eleven lines were selected from 56 IPS. These all selected lines showed variable expression for all the agronomic traits as well as for disease severity. All the traits viz., plant height, spike length, number of spikelets per spike, length of flag leaf and width of flag leaf was comparable with recurrent parent UP 2338, while disease severity was comparable with the donor parent Avocet-Yr15. Data on thousand grain weight of ten lines, out of eleven selected lines showed better expression than that of recurrent parent (with disease pressure). Data on disease severity and response of these ten selected lines is given in Table 2.

Table 2: Disease severity and disease response of selected improved lines in the background of UP 2338 (Singh et al., 2018)

Cross combination	Disease severity (%)	Disease response
UP 2338 x Avocet-Yr15		
1	Trace	Resistant (tR)
2	Trace	Resistant (tR)
3	Trace	Resistant (tR)
4	10	Moderately resistant (10MR)
5	5	Resistant (5R)
6	Trace	Resistant (tR)
7	Trace	Resistant (tR)
8	5	Resistant (5R)
9	5	Moderately resistant (5MR)
10	Trace	Resistant (tR)
UP 2338 x FLW 8		
1	Trace	Resistant (tR)
2	Trace	Resistant (tR)
3	Trace	Resistant (tR)
4	5	Moderately resistant (5MR)
5	5	Resistant (5R)
UP 2338 x FLW 21		
1	5	Resistant (5R)
2	5	Moderately resistant (5MR)
3	Trace	Resistant (tR)
4	Trace	Resistant (tR)
5	Trace	Resistant (tR)
6	Trace	Resistant (tR)
UP 2338 (Recipient)	80	Susceptible (S)
Avocet-Yr15 (Donor)	0	No sporulation
FLW 8 (Donor)	0	No sporulation
FLW 21 (Donor)	0	No sporulation

Background selection

Background selection was performed using 57 polymorphic SSR markers for progenies of *Lr19/Sr25* gene and 48 SSR markers for progenies of *Lr24/Sr24* gene which were distributed over all the 21 chromosomes. The recovery of the genome of recipient parent was evaluated in all foreground positive plants available in backcrossed generation namely, BC₂F₁, BC₃F₂ and BC₃F₃ except for BC₃F₁ generation. Background selections for recipient parent UP 2338 provided the RPG recovery with the average of 94.30% in a range of 85.25% to 96.45% for *Lr19/Sr25* and for *Lr24/Sr24* RPG recovery was found with the average of 94.65% in a range of 84.25 % to 96.45%.

Phenotypic evaluation for spot blotch resistance

The spot blotch epidemics developed well in field trials. Germplasm accessions were highly variable for disease severity (Fig.3) as AUDPC value was calculated to screen the 200 germplasm accessions against spot blotch (*Bipolaris sorokiniana*) severity in the field under epiphytotic conditions. Out of 200 accessions, 17 accessions were observed highly resistant, 7 resistant, 87 moderately resistant, 3 highly susceptible and 86 accessions were observed moderately susceptible (Table 3).

Molecular evaluation for spot blotch resistance

Both the markers *Xgwm148* and *csLV34* have shown polymorphism between the resistant (Chirya 3) and susceptible checks (Ciano T79) and the marker *Xgwm148* with a product size of 165bp differentiated 9 out of 22 accessions (Fig.4). Similarly, the marker *csLV34* with a product size of 160bp differentiated 10 out of 22 accessions (Fig.5). Three accessions shown in lane number 11, 17 and 19 namely, accessions no. SKAUZ/KS91WGRC11//SKAUZ,CH/TH.CU

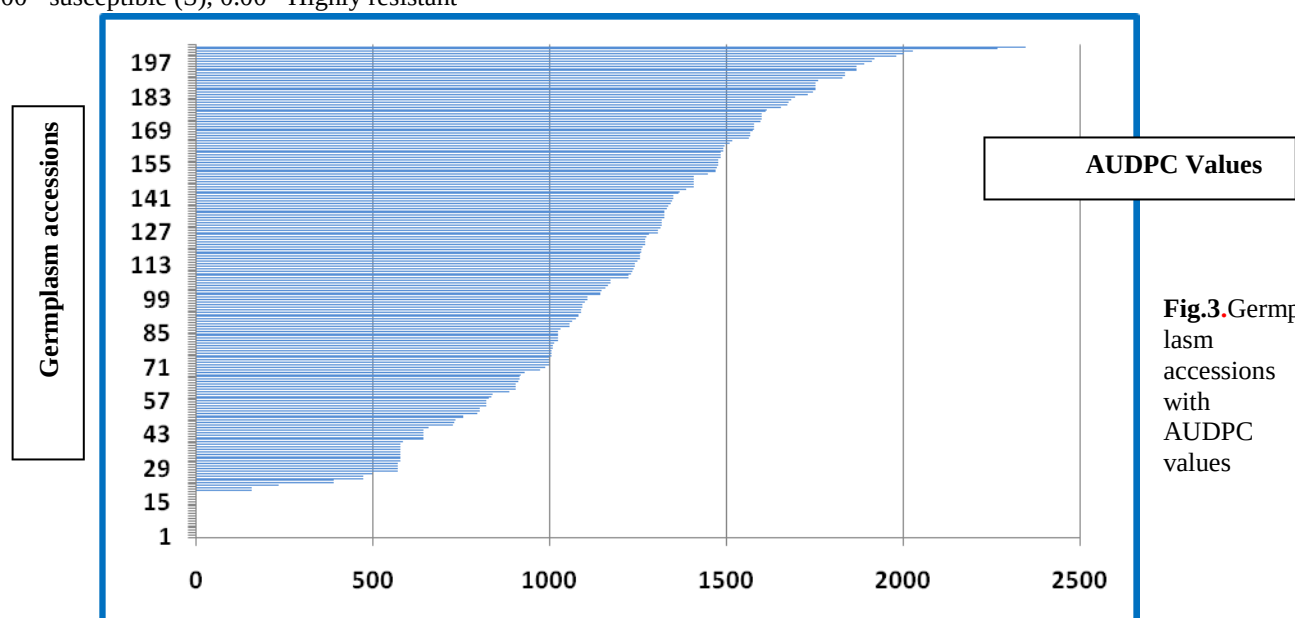
//GLEN/3/ALD/PVN/4/CS/LE.RA//2*CS/3/CNO79 and BCN//YUK/AE.SQARROSA (434) respectively were, found positive for both the markers.

Table 3: AUDPC values of 200 germplasm accessions

Spot blotch resistant/ susceptible	Total no. of accessions	AUDPC range
Highly resistant	17	0
Moderately resistant	87	568.5-1248
Resistant	7	157.5-496
Moderately susceptible	86	1256.5-1912.5
susceptible	3	2029.5-2346

AUDPC value of checks: Chirya 3 - 454.5 (R), Francolin- 914.5 (MR), Sonalika- 2267 (S), Ciano T 79- 1891.5 (MS)

AUDPC value: < 500= resistant (R), 500-1250= moderately resistant (MR), 1250-2000= moderately susceptible (MS), >2000= susceptible (S), 0.00= Highly resistant

**Fig.3.** Germplasm accessions with AUDPC values

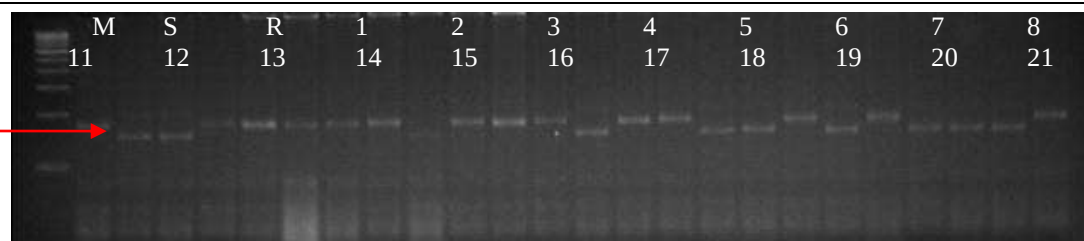


Fig.4: Molecular characterization of spot blotch resistance by *Xgwm148*
Accession No. 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 16, 18 and 22 are positive for *Xgwm148*



Fig.5. Molecular characterization of spot blotch resistance by *csLV34*
M: 100bp ladder, S (susceptible check): Ciano T 79, R (resistant check): Chirya 3
Accession No. 6, 8, 9, 10, 11, 15, 16, 17, 18, 19 and 22 showing the presence of Lr34/Yr18.

DISCUSSION

Rusts are the most devastating fungal diseases in wheat worldwide, which can primarily be managed through resistance breeding as chemical control is costly and not eco-friendly. However, cyclic breakdown of the resistance genes due to evolution of new pathogenic races, demands for constant identification of new genes for resistance. Pyramiding of two or more genes can help to improve the durability of rust resistance but it is possible only if closely linked DNA markers are available (Vinod et al., 2010). With the advent of DNA markers it has now become possible to precisely transfer the desirable genes from unadapted germplasm to elite lines with minimum or no linkage drag.

In the present study, we successfully introgressed three rust resistance genes viz., *Yr15*, *Lr19/Sr25* and *Lr24/Sr24* into a popular wheat variety UP 2338 through marker assisted backcross breeding. Crosses were attempted in the lines of BC₂F₂ generations for the pyramiding of stripe rust (*Yr15*) and leaf rust (*Lr19* and *Lr24*) resistance genes in the background of the recurrent parent UP 2338. The cross seeds (F₁s) were raised and positive plants for both the genes were selected, harvested and forwarded for further evaluation. MAS also has been successfully implemented to introgress the gene through marker assisted backcrossing (MAB) and pyramid major genes/QTL through marker assisted pyramiding (MAP) for different traits in wheat (Sivasamy et al., 2009; Chhuneja et al., 2011; Kumar et al., 2011; Singh et al., 2018). Agronomic performance of selected introgressed plants was comparable to recipient parent which shows that phenotypic selection along with markers assisted background selection led to maximum genome recovery of recipient parent in the present study. Background analysis exercised through phenotypic evaluation is reported to be useful in efficient recovery of the RPG (Singh et al., 2013; Singh et al., 2018).

Spot blotch is a significant production constraint in the Northern Eastern Plain Zone of India, and hence, it was considered to be worthwhile to screen the CIMMYT germplasm to identify resistance accessions, which could be of help in developing spot blotch resistance wheat varieties. Lr34 conditions resistance to leaf rust, but it has been established that, via either pleiotropy or through linkage to a spot blotch resistance gene, its presence simultaneously gives a significant level of protection against the spot blotch pathogen (Lillemo et al., 2013). Because the Lr34 is tightly linked with LTN, this phenotypic marker can be used to identify plants with Lr34.

Vasistha et al. (2017) reported that the mean AUDPC for spot blotch in eleven BC₃F₅ homozygous lines carrying Lr34 gene was substantially lower than that of recurrent HUW510 (susceptible to spot blotch). Grain yield was also higher in the Lr34 lines. This study demonstrated that the leaf rust resistance gene Lr34 can be successfully introgressed into popular wheat cultivar using MAS for enhancing resistance against spot blotch. Exploration of germplasm resources for the identification of genes conferring resistance to different diseases using the molecular markers should be a continuous effort (Badoni et al., 2017; Devi et al., 2016; Jaiswal et al., 2015; Jaiswal et al., 2016; Talha et al., 2016).

CONCLUSION

The methodology adopted in the study successfully demonstrated as proof of concept of the efficient, and precise methodology involved in screening of a large set germplasm. Exploration of germplasm resources for the identification of genes conferring resistance to different diseases using the molecular markers should be a continuous effort so that elite germplasm could be properly tagged and eventually serve as a valuable genetic resource. Similarly transfer and pyramiding of multiple genes for resistance through marker assisted back crossing (MAB) has been successfully resulted in the

improvement of popular varieties. The outcome may be potentially helpful for breeders by assisting them to rapidly incorporate the combination of race-specific and non-specific genes into widely adapted wheat cultivars through marker-assisted pyramiding approaches for minimizing the loss caused due to rust epidemics and other diseases of importance in wheat.

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POTATO FOR FOOD AND NUTRITIONAL SECURITY: INDIAN PERSPECTIVE**MANOJ KUMAR, BANDANA AND ANUJ BHATNAGAR***ICAR-Central Potato Research Institute Campus, Modipuram, Meerut-250110*

Potato (*Solanum tuberosum* L.) is one of the most important non-cereal food crop worldwide and is prominently called as king of vegetables in India. High photosynthetic efficiency with high harvest index and flexible growth period make this crop amongst top producer of edible dry matter per unit area and time. Potato, besides being high in starch/ carbohydrate, biologically superior protein, rich in minerals and also some vitamins has very important role in ensuring food and nutritional security for ever growing world population and rightly been identified as food for future by the FAO. World population is likely to touch 9.7 billion by 2050 with its 17% share in India (1.65 billion) this crop has to play key role in global sustainable food system producing more energy and dry matter from less land as compared to rice, wheat and maize. Additional virtue of potato is it has negligible fat with substantial amount of vitamins. Potato is one of the food crops of the world that alone combines the desirable characteristics of high yield, low cost and a nutritious and palatable food. Potato has multiple uses as staple food, vegetable and delicious processed items throughout the world.

India stands second in potato, producing about 48.6 m tonnes from 2.01 m h after China. True potential of this crop was realized only in post-independence India with increase in area by 9 times, production by 30 times and productivity by 3.3 times. Potato from its meagre area has great potential to play a very significant role in rural poverty alleviation and food and nutritional security in Indian economy. This crop traditionally a temperate crop has been sub-tropicalized by the great collective efforts of researchers and farmers of the country in the leadership of ICAR-Central Potato Research Institute (CPRI), Shimla. The country has about 60 potato varieties as national and Institute release with its suitability in various regions and purpose. These varieties may be grouped as short, medium, long durations, processing purpose, red skinned, nutritionally superior potatoes, etc. About 4000 (and increasing) germplasm repository provides strong source base for creation of large variability for strong breeding programme. Region specific potato production sound agro-technique including nutrient and water management developed and cropping systems identified has played great role in increasing productivity as well as horizontal expansion of this crop. Digital soil maps of potato growing area, validated models, decision support systems and expert systems are in place and being improved further to progress towards precision cultivation of crop. Late blight the most dreaded disease has almost been mastered with well validated prediction model and efficient management schedule in place. Integrated management for all major pests and diseases has already been included in recommendations in all major potato growing regions. Viral diseases are main culprit of vegetatively cultivated potato for degeneration of seed. Hence, it is important to use healthy seed for sustainable and economic production of potato. Since last five decades strong potato seed production programme of the country based on elimination of viruses using advanced serological and diagnostic technique, rouging, and growing crop in vector free window as well as, conventional seed production technology based on "seed plot technique" has contributed immensely in bringing potato revolution and saving huge foreign exchequer. CPRI has developed state of art high-tech seed multiplication system based on tissue culture and aeroponic. Adoption of seed production systems developed by the institute has led to opening of more than 20 tissue culture production units throughout the country. Several Government/Private seed producing organizations procure virus-free in vitro mother cultures of important notified and released potato varieties every year from ICAR-CPRI, Shimla for further multiplication in their high-tech seed production programmes. The latest hi-tech seed production system standardized by the institute is based on the concept of soil-less, aeroponic technology. The aeroponic system of seed production has the potential

to revolutionize potato seed sector has been commercialized to 14 firms of the country. Each firm is licensed to produce 10 lakh mini tubers by aeroponic system. Even if each firm is operating at half of its potential, about 6.5 million mini tubers are currently being produced by those firms.

With the development of potato processing varieties (namely Kufri Chipsona-1, Kufri Chipsona-2 Kufri Chipsona-3, Kufri Chipsona-4, Kufri Frysona and Kufri Himsona) along with its production, post-harvest and processing technologies, now about 7 % of our national production is going for processing. It can be of great of help in solving the issue of glut and increase the diversified use of potato. The availability of quality raw material of these varieties and standardization of storage techniques for processing potatoes at 10-12°C with sprout suppressant CIPC [Isopropyl N-3-chlorophenyl carbamate] has also changed the entire scenario of potato utilization in India within a short span of last 10 years. Since last many years it has been observed that the economic growth of the country has too accelerated potato consumption, which is expected to continue for processed, ready to eat convenience food, which has led to diversification in potato consumption and utilization.

Despite such an impressive achievements, there are still many challenges and emerging problems which need to be addressed in coming decades. CPRI Vision 2050, after accounting for rapid growth of potato processing due to fast economic development of the country, lower proportionate growth rate of seed demand, rise in per capita consumption of fresh potato (future role of potato in food security and fast economic development) and as a result of ongoing efforts to lower post-harvest losses, envisage, the estimated demand of potatoes in 2050 about 122 million t. In addition demand of another 3 million t during 2050 is assigned to potato starch industry, animal feed, export of seed potato and processed potato products. Hence, we would require potato production of about 125 million t in 2050 in our country at an ACGRs of 3.2%. To achieve this production target it is envisaged that area under this crop has to be increased from present 2 m h to 3.62m h with increasing productivity level 23 to 34.51t/ha. These production and yield targets has to be achieved against odds of changing climate, increase occurrences of weather extremities, reducing availability of good quality water, increasing demands and awareness of healthy food, with the additional goals of increasing environmental sustainability and economic viability. There are challenges to meet international standard to increase export share of our production following good agricultural practices (GAP). Our research system is well tuned to develop need based technology working in collaboration with farmers and other sectors, however, favourable policy support and infrastructure growth is must to sustain the momentum.

CONSTRAINS AND STRATEGIES FOR DOUBLING THE INDIAN FARMERS INCOMES BY 2022-AN OVERVIEW**RAM JI LAL, RASHMI NIGAM AND JOGINDER SINGH***Ex. Principal Scientist & HOD, Division of Crop Protection**ICAR-Indian Institute of Sugarcane Research Lucknow-226 002**Department of Plant Pathology, J. V. College, Baraut, Baghpat, UP**Department of Horticulture, J. V. College, Baraut, Baghpat, UP*

In India, agriculture is the largest private enterprise (>10 crore farm holdings), has been and will continue to be the lifeline of the Indian economy at least in the foreseeable future. It contributes nearly 17% to National GDP, sustains livelihood of about two third of the population, accounts for 52% of the National workforce and forms the backbone of the agro-based industry. In global terms, India today has: 16 % of human population, 15% of farm animal population, 2% of geographical area, 1% of rainfall, 0.5 % of forests, and 0.5 % of grazing land.

India through modern agricultural technologies has moved from an era of chronic food shortage and “begging bowl” to a level of food self-sufficiency, buffer stocks and even food exports. At present the productivity gains are nearly 3.5 times in food grains, 1.6 times in fruits, 2.1 times in vegetables, 5 times in fish, 1.8 times in milk, and 4.8 times in egg production., respectively. Besides, agriculture is a social sector where non-trading concerns like food and nutritional security, employment and income generation, poverty elevation, gender equality, ecology and environment play a significant role. India’s population is expected to be around 1.5 billion by 2030 AD at the present compound growth rate of 1.6 per cent per annum. The country will required to produce an additional 5-6 million tonnes of food grains annually to meet the food requirements. Therefore, the country must continue to produce more food and other agricultural commodities per unit of land, water, energy and time to feed the increasing population. In this process, it has to be ensured that there is no damage to the ecological foundation of agriculture, such as land, water, forest, biodiversity and the atmosphere.

However, the diverse changes and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, appearance of new threatening insect-pests and diseases, slow growth of farm income and new global trade regulations demand a paradigm shift in formulating the National Agricultural Research Programmes (NARP) to conserve natural resources and bio-diversity for achieving food security besides maintaining the ecological balance for sustainable agriculture.

Keeping above in mind, one of the major policy initiatives of the National Democratic Alliance (NDA) government is that of doubling farmers incomes by 2022 to feed the ever growing population. There has been agrarian distress in the sector for the last two decades. Therefore, there is need to focus on farmers income instead of production or the growth rate in agriculture. Official recognition of the distress and the agrarian crises came in the form of NSSO (National Sample Survey Office) survey in 2003, which reported that 40% of Indian farmers disliked the farming as a profession due to its low profits, high risk, and the lack of social status and, therefore, would like to leave it at the first opportunity (Agarwal and Agarwal, 2017).

They are continuing farming in the absence of opportunities outside agriculture. Furthermore, there are cast-wise differences among farmers in terms of their interest in farming; the higher casts seem to be more reluctant with farming than Scheduled Caste (SC) and Scheduled Tribe (ST) farmers. Among the SC and STs, the disliking for farming diminishes with increase in landholding size and increases in the case of other casts (Bithal *et al.*, 2015). The need to focus on farmers income also indicates from the fact that a very large population of the farming households in most of the central and eastern states (23.0% -45.0%) live below the poverty line (BPL), higher than the national average (22.5%). The proportion of BPL farming households (17.5%-22.5%) even in some of the so called agriculturally progressive states such as Gujarat, Karnataka, Maharashtra, and Tamil Nadu, is close to the National average. Further, the gap between farm and non-farm incomes has grown over the decades, from a ratio of 1:30 in the mid-1980s to 1:4.08 in the middle of last decade, and 1:3.12 in 2011-2012 (Chand, 2017).

There has been much debate for the last one year about the definition of the farmer’s income and the time frame for doubling it. If it is doubling of the real incomes of farmers then it is an important and challenging goal to achieve it in five to seven years because of the following reasons. (i) low and non-remunerative Maximum Support Prices (MSPs) (ii) non-remunerative price in the market (iii) the low share of farmers in the consumer rupee (iv) poor penetration of crop insurance (v) high and increasing input costs, and (vi) the absence of market infrastructure. They also cite modest growth in the past compared to the 12% annual figure needed for doubling the farmer’s income in nominal terms, which works out to be an annual growth of 20-30% to double the farmers income in real terms.

It is estimated that doubling incomes in nominal terms requires six years, and in real terms 13 years, and it is going to take longer time frames in both respects for marginal and small farmers. Further, it would need varied time frames across different state-level growth rates of farmers household incomes—which vary from 6.7% in West Bengal to 17.5% in Haryana in nominal terms, with the average for India being 11.8% - and on the absolute levels of farmer household income (Satyasai

and Mehrotra, 2016). It is estimated that farmer's incomes can be increased by 75% in seven years, and that it would take 10 years to double the same (Chand, 2017).

Annual income per farmer has increased from Rs. 12365/- in 1993-94 to Rs. 1,20,193/- by 2015-16, at current prices. However, at real prices, the increase has been from Rs.21,110/- to Rs. 44,027/- during this period. This shows that farmers average real incomes doubled only after a period of 22 years. Even the total farm income of all farmers at real prices just about doubled during this period, from Rs. 3.0 lakh crore (Rs. 3 trillion) to Rs. 6.0 lakh crore (Rs. 6 trillion). This works out to a growth rate of 3.4% a year per farmer and 3.13 for total farmer income over the period (Chand, 2017).

The recent survey conducted by the NABARD in the country indicate that the annual income of the farmers is increasing at the rate of 12% per annum whereas, there is requirement of only 10.4% growth rate per annum to double the farmers income. About 48% farmer's family resides in the village. During 2015-16 the, per family income was 1.07 lakh which they obtained from farming, animal husbandry and other agricultural activities while, there income was Rs. 77,110/- per family during 2012-13. Out of 34 States and Union Territories, in 19 the growth rate of income was 15% and it was 10.5% in the remaining states. At country level, overall growth rate was 12.0%. The report also indicated that about 52% farmers of the country are in debt. The committee further indicated that in growth rate of income, the southern states are much ahead than Punjab, Haryana and Western Uttar Pradesh. It also includes West Bengal, Odessa, Bihar, Jharkhand and Eastern Uttar Pradesh. Therefore, there is more probability for increasing the growth rates in these states.

Dr Mahapatra, Director General, Indian Council of Agriculture (ICAR) and Secretary Department of Agricultural Research and Education (DARE) in a 2 days conference held in New Delhi said that in the country only 5.0% youths adopt agriculture as a profession due to absence of any other source of income. He further emphasized that this is a very serious issue in the field of agriculture. Therefore, the Government of India is immediately launching a scheme "Abhyas" to attract the science graduates to takeup agriculture. The science graduates will be given six months training free of cost under said scheme and after that they can start their own agricultural clinics, soil testing labs or any other related types of business for the benefit of the farmers. The banks will also provide loans free of cost on subsidised rates to such youths (*Danik Jagaran* dated 31st August, 2018).

The central government has tremendously increased the Maximum Support Price (MSP) of various crops against previous year as mentioned in Table-1.

Table-1: Maximum Support Price (MSP) of various crops fixed by the central government

Crop	Production Cost/ quintal (Rs.)	MSP */Q (Rs.)	Increase as against previous year (Rs.)	Percent benefit in comparison to cost of cultivation
Rice (Ordinary)	1166.00	1750.00	200.00	50.-09
Rice (Grade-A)	-	1770.00	180.00	-
Jowar (Hybrid)	1619.00	2430.00	730.00	50.09
Bajra	990.00	1950.00	525.00	96.97
Maize	1131.00	1700.00	275.00	50.31
Arhar (Tur)	3432.00	5675.00	225.00	65.36
Moong	4650.00	6975.00	1400.00	50.00
Urd	3438.00	5600.00	200.00	62.89
Groundnut	3260.00	4890.00	440.00	50.00
Sunflower	3598.00	5388.00	1288.00	50.01
Soyabean	2266.00	3399.00	349.00	50.01
Til	4166.00	6249.00	949.00	50.01
Cotton (medium fiber)	3433.00	5150.00	1130.00	50.01

*: MSP (Maximum Support Price); Source: *Danik Jagaran* dated 25th August, 2018

Road maps prepared by different states for doubling the farmers incomes:

Some of the states, like Madhya Pradesh, Chhattisgarh and Uttar Pradesh have already prepared their road maps for doubling farmers incomes.

The Government of Madhya Pradesh in 2016 has estimated the contribution of various sources of increase in incomes: increase in yield would contribute 30%, agricultural diversification 20%, reduction in input costs and better prices 15% each, with rest coming from an expansion in area under cultivation (14%) and a reduction in the post harvest losses (6%). Regarding increases in yields, the gap between present and attainable yields was found to be as high as 43%-131% across different crops i.e. coarse grains, pulses and oil seeds.

The state government has set up a task force on the issue of doubling farmers incomes and has appointed an advisory committee of 51 progressive farmers under the chairmanship of the Ministry of Agriculture. Fifty one districts have prepared their own road maps for this purpose and 55,000 villages are also working toward preparing such road maps, which would be presented at *panchayats* specially set up for agriculture at the time of the *Pradhan Mantri Krishi Mahotsav*. District

irrigation plans have been prepared under the Pradhan Mantri Krishi Sicahayee Yojna (PMKSY). Half a million temporary agricultural pumps are made permanent with an allocation of Rs. 5,000/- crore.

It has also identified 19 constraints in order to double farmers incomes. These include: increased irrigation from public recourses, additional electricity supply for agriculture, interest-free crop-loans, expansion of agricultural area, encouraging mechanization, agricultural diversification, expansion of modern seeds, soil health management, new channels of agricultural technology, extension, farmer-producer company organization, expansion of the food processing sector, encouragement to organic farming, management of natural risk in agriculture, expansion of agricultural storage capacity, better organization of agricultural markets, animal husbandry, fisheries, silk, bamboo and agro-forestry production, and institutional structures for achieving the objective. So far 142 farmer-producer companies have been set up and 300 more such companies are planned by 2021. The institutional structures include an agriculture cabinet, a separate agriculture budget, a task force for the agricultural sector, a farmers commission for agricultural development and farmer well being, and micro irrigation and agro-forestry missions. It is estimated that yield and production-related efforts would lead to 70% additional farmer income with the remaining 30% coming equally from cost reduction, higher prices and reduced economic losses (Government of M.P.).

The Government of Chhattisgarh has decided to focus on 7 areas to increase farmers income: agricultural development of Adivasi farmers, reducing the cost of cultivation, increase in yields, improving the market infrastructure, storage and processing facilities, development of irrigation, agricultural diversification, and better agricultural extension system. It estimates that the Union Governments soil health scheme would lead to a saving of 10% on fertilizers and contribute to a 5% increase in yields. It also plans to use Mahatma Gandhi National Rural Employment Scheme (MANREGA) to recharge 4,50,000 irrigation wells and raise the yield of rice, maize, pulses and other oil seeds. It proposes to set up at least 20 farmer-producer companies in each district and bring half the number of farmer's under a crop insurance scheme. The expected reduction in cost of production through various means is estimated to be 5-15%. Production would increase 15-30%, price realization 10-20%, cropping intensity 15-30% and off-farm resources 5-30%, with extension contributing 5-20%. Thus income can increase between 55% and 155% over the next 7 year

It further details crop-specific increases in income, which vary from 5-35% across crops due to seed replacement, 10% due to bio-fertilizers, and 5-15% through mechanical sowing. It is also expected that a 15% increase in incomes will come from the use of check dams and small irrigation ponds each. The area under horticulture has been targeted to increase by more than 60%, and the number of onion storage structures to rise to 100% from 12 at present. The area under protected cultivation is expected to be more than double during this period. Similarly increases in income from animal husbandry are estimated, with 30% due to rise in yields, and 10% each from reduced cost of production, price increase, better risk management, and the expansion of the government schemes. The major activities for achieving the higher income targets include: an increase in seed replacement rate of maize, and lentils, expansion in issuing soil health cards, the promotion of the system of rice intensification, drip and sprinkler irrigation, and replacement of short term loans. The other major steps include linking up of markets with the National Agricultural Market, e-NAM, expanding cold storage capacity, building green/shed net houses, organizing new dairy cooperative societies, expanding bulk milk cooler and milk-chilling centre capacities, cage culture in fisheries, and agri-clinics and agricultural business centres, and doubling the production of lac (Dept. of Agriculture and Food Processing, 2017).

The Government of Uttar Pradesh is also taking solid steps for doubling the farmers income by 2022. For this, apart from farming it is also concentrating their efforts in horticulture, animal husbandry besides agriculture, management of natural resources through agricultural diversification by encouraging the farmers for the balance use of fertilizers on the basis of soil health card and increasing the irrigation facilities in low rainfall areas. In addition, the government is also taking steps for food processing with the help of private entrepreneurs, providing higher price of farmer's produce through simple and quick disposal scheme and bringing maximum farmers under crop insurance scheme.

It has set up the target for the production of 86.38 lakh Mt. ton food by 2022. Therefore, the government is forcing farmers to adopt soil health scheme for the judicious and balance use of fertilizers to achieve this target. The government has also set up a "Krasak Sambridhi Ayog" to double the farmer's income by 2022. The Hon'ble Chief Minister is its President, State Agriculture Minister, Prof. Ramesh Chandra (Member of NITI Ayog), are its Vice Presidents, Agriculture Production Commissioner (APC) and Chief Secretary are its members. It has also nominated Agricultural Scientists, Special Secretaries of various departments besides representatives from co-operative sectors to advise the government for doubling the farmer's incomes by 2022. The "Krasak Sambridhi Ayog" has set up to consider and recommend the government on the following five points for doubling the farmers incomes in the said period (Danik Jagaran dated 25th August, 2018).

1. To find out the ways and means for higher production in less cost of inputs.
2. To advise the ayog for the proper storage of farm produce.
3. To identify the gaps for low production and advice for doubling the farmer's incomes.
4. To find out appropriate suggestions for the development of agricultural technologies, animal husbandry, fisheries, poultry, silk production, agriculture, agro-forestry and milk production, and
5. To develop policies for an overall agricultural development based on different agro-climate.

The Govt. has credited Rs. 456.16/- crores directly in the account of about 23.29 lakh farmers under all the schemes through Direct Benefit Transfer (DBT). It has become the first state in the country regarding the payment to the farmers through DBT. In addition, the state is also giving subsidy to the farmers for the procurement of seeds and fertilizers through DBT scheme.

Constraints and strategies for enhancing farmers incomes: There could be various strategies to achieve growth in farmers incomes within as well as outside the farm sector. Within the farm sector, the increase in incomes come from greater production per unit area as a result of higher yields, as there are yield gaps of between 25% -100% across various crops especially in dry land regions and in some high-value crops even in irrigated areas. India's average yields in most crops are only half that of China's. The increase can also come from higher cropping intensity, lower cost of production, higher prices or a combination thereof. But, yields are not amenable to sudden change as they depend on the type of technology deployed, which cannot be altered in a short span of time. Also, high-yielding varieties need irrigation facilities, which cannot be expanded quickly.

The other strategy to achieving higher volumes of production, with increase in yield, is higher cropping system, which can be taken up only if there is an increase area under irrigation or a greater access to water. This again is not achievable in the short-term despite the fact that there is plenty of focus on the expansion of irrigation through various schemes such as the PMKSY, and the promotion of micro-irrigation. It is also important to consider that higher production from either from better yields or increases in cropping intensity would not only by themselves lead to higher income in the absence of price support mechanism or well-linked up markets for the produce, as witnessed recently in case of pulses.

Reducing the cost of production (of which 11% comprises machinery costs) is most doable, as this requires extension education to the farmers and providing access to low-cost mechanical services to small and marginal farmers, who cannot afford to buy and own costly machines and agricultural equipment. This is happening across states with the opening of custom hiring service centres by cooperatives, producer companies, self-help groups, and private individual operators, as well as large agri-machinery companies, and agricultural start-ups, with and without state support. Similarly, despite the fact that public extension services are more or less dysfunctional due to various reasons, there are many organizations like agricultural set-ups working closely with farmers to provide extension services as part of a package.

The other strategy of increasing farmers incomes through higher and stable prices because of the inability of the states to implement the Minimum Support Prices (MSP) mechanism for two dozen crops. The government has also showed its inability to implement the Swaminathan Committee recommendations of the MSP which is 50% above the cost of production.

Diversification of high-value crops can help to raise incomes, and are also required for social and environmental reasons, as these crops account for a large proportion of the value of output but covers relatively low area. Cereal crops cover 77% of the gross cropped area (GCA), but account for only 41% of the value of output. The fruits and vegetable contribute 26% the value of output; all high-value crops cover 19% of the GCA and account for 41% of the value of output. But there are many policy distortions that undermine diversification, although markets encourage it. The success in this sector depends highly on reforming agricultural markets and improving their performance from the farmers perspective. Further, new channels of procurements, like contract farming, direct purchase, and private wholesale markets in these crops.

The other important step that can help farmers to protect their incomes from production risk is crop insurance. This is also not being implemented properly despite the relevance of crop insurance schemes such as *Pradhan Mantri Fasal Bima Yojna*. This now also covers apart of the market risk as it also provides for compensation for the post harvest losses. However, the scheme covers only 30% of the GCA. There are many issues regarding claims settlement because of the lack of awareness about the schemes, and also the exclusion of the small and marginal farmers.

The strategies for enhancing farmers incomes outside the farm sector include access to off-farm and non-farm employment and occupations like dairy farming or handicrafts besides moving people outside the farming sector altogether. The former measure can help to provide additional and more regular incomes, and the later one can increase income of those left behind in farming. However, the moving people out of the farming sector is hardly unlikely to happen as there are hardly any opportunities for unskilled or semi skilled farm workers outside the sector.

Constraints and strategies for enhancing growth targets: The prospects of doubling farmers incomes by adding up various sources of income growth viz., yield, live stock income, resource use efficiency, cropping intensity, crop diversification, better price realisation, and shifting to non-farm occupations was analyzed by Chand (2017). He reported that it is mainly price realisation that can give the maximum push to income (growing at 13.0%). He also estimated that the required growth rate in different components of sources of income, in order to double the farm income, is as against those achieved in the past. The growth rates required are at least 1% higher than those achieved in most components in the past except in resource use efficiency, cropping intensity, and shift to non-farm occupations. The target for 2022-23 are more than double in case of quality seed supply, electricity supply, and are very high for fertilizers, irrigation, cropping intensity, and high yielding variety coverage. In fact, the area under fruits and vegetables is targeted to reach 26 million hectares from less than 17 million ha in 2013-14, which is a tall order, as is the higher target for cropping intensity, from 40% to 53% in 10 years. Some of the policy reforms suggested towards doubling farmer's incomes like the liberalization of leasing land, as

proposed by the *NITI Aayog* (2016), are likely to have certain adverse impacts on small and marginal farmers unless there are mechanisms to insure that they are not by-passed by various initiatives from the state and the corporate sectors.

Hence, it is evident from the example of Madhya Pradesh, Chhattisgarh and Uttar Pradesh States that different states require varied strategies because of different levels of agricultural development in growth rates and the level of farmers incomes. Therefore, it is concluded from the above discussion that there is an urgent need to focus on high-value crops and rain-fed areas, non-farm occupations, agro-industrialization, strengthening and innovating producer and worker institutions for doubling Indian farmers incomes.

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POSTER

GROWTH AND PRODUCTIVITY OF BARELY (*HURDIUMVULGAREL.*) AS AFFECTED BY SOWING METHODS AND NITROGEN FERTILIZER LEVELS**OLA Z. EL-BADRY AND EL-SAYED M. GHEITH***Faculty of Agriculture, Cairo University, Egypt Department of Agronomy, *Corresponding author: Ola Z. El-Badry*

Growth and productivity of barely (*HurdiumvulgareL.*) as affected by two sowing methods (drilling and broadcasting) and three nitrogen levels, i.e. 60, 80 and 100 kg N/fed. (one feddan = 4200m²) were studied at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt during two successive winter seasons 2015/2016 and 2016/2017. The experiments design was split-plot in randomize complete pluck design in four replications. Both of sowing methods and nitrogen levels significantly affected all growth characters, except leaf area index in the second season, as well as grain yield and its related favorable, except spike length and grain weight/spike, in both seasons. Increasing nitrogen levels up to 80 kg N/fed. caused an obvious increase in net assimilation rate, plant height, number of spikes/m², spike length, weight of grains/spike, grain yield, straw yield and harvest index. On the contrary, number of days to 50% heading, leaf area index and crop growth rate produced the maximum values at 100 kg N/fed. Drilling method exceeded broadcasting in all studied characters in both seasons. The interaction had significant effect on leaf area index and number of spikes/m² as well as grain yield which produced the highest values with using drilling method and application of 100 kg N/fed. as well as 80 kg N/fed., respectively in both seasons. It could be concluded that planting barley with drilling method and application of 80 kg N/fed. were the optimum for increasing barley production under the experimental site and the same conditions.

Key words: Barley, sowing method and nitrogen fertilizer.

INTRODUCTION

Barley (*HordiumvulgareL.*) is the forth grain crop both in area and production in the world after maize, wheat and rice. It has the potential to become one of the important cereal crop in Egypt. It grown for green forage or for feeding on its straw as well as its grain also as food by some Arabian trips who live the desert and in dry region for making bread either alone or mixed with wheat. It could also be used for malt industry especially the starch grain of the two–barley cultivars. Barley grown in Egypt in 60480 ha with total production of 102244 t/year (FAO, 2016). To increase barley production in Egypt more efforts should be directed to improve cultural practices, i.e. sowing time, rate and methods, nitrogen fertilization, weed control and using good cultivars. Several investigators found the positive effect of sowing method (Dihiman and Kalra, 1978;; Ghabour, 1995; Gheith et al., 2009) and Hagra, 1985 and nitrogen fertilizer levels (Andreasen et al. 2006; Hayob, 2007; Omar, 2008) on growth, yield and yield components. Therefore, the present study aimed to investigate the growth, yield and its related components of barley under modified microclimate conditions induced by changing in sowing method and nitrogen fertilizer levels.

MATERIALS AND METHODS

A split plot experiment based on randomized complete pluck design with four replications was conducted at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo university, Egypt during the successive winter seasons 2015/2016 and 2016/2017 to study the effect of three nitrogen levels, i.e. 60, 80 and 100 kg N/fed. (one feddan = 4200 m²) and two sowing methods (drilling and broadcasting) on growth, yield and yield components of barley (*HordeumvulgareL.*) cv. Giza 156. Sowing methods were arranged in main plots and nitrogen fertilizer levels were in sub plots. Barley grains (50 kg/fed.) were planted in the third and second week of November in the first and second season, respectively. The grains were handily drilled in rows 20 cm apart in the drilling method and broadcasted in the broadcasting method. Nitrogen fertilizer (urea 46% N) was applied in two equal splits, the first dose was applied before the first irrigation and the second one was added before the second irrigation. All other agronomic operations except those under study were kept normal and uniform for all treatments. Number of days from planting to 50% heading was recorded. Growth characters were determined at 60 and 80 days from planting on five plants basis randomly taken from each sub plot. Samples were carried out to the laboratory and were separated into leaves and stems. Plant materials were dried in a ventilated oven to the constant weight for 48 hours at 70 centigrade to determine the dry matter. Data collection procedure for the following parameters is as under: Leaf area/plant (LA/plant) = leaf length × leaf width × 0.75 × number of green leaves/plant (cm²), Leaf area index (LAI) = Leaf area / plant (cm²) / plant ground area (cm²), Crop growth rate (CGR) = $(W_2 - W_1) / (T_2 - T_1) \times 1 / GA$ (g/m² /day) and Net assimilation rate (NAR) = $(W_2 - W_1) (LnLA_2 - LnLA_1) / (T_2 - T_1) (LA_2 - LA_1)$, mg/dm² /day. Plant height was determined at 80 days from planting. Where: W₁, LA₁ and W₂, LA₂ refer to plant dry weight and leaf area per plant at T₁ and T₂ time of sampling, respectively. Whereas, GA= ground area and $Ln(X) = 2.303 \times \log(X)$. LA/plant was determined using method described by Pearce et al. 1975, while CGR and NAR were calculated according to Watson formula (Radford, 1967). At harvest, number of spike/m², spike length, grains weight/spike, grain yield, straw yield, harvest index were recorded. The recorded data were analyzed statistically by using statistical software package MSTAT-C (Michigan State University, 1990). Least significant Difference (L.S.D.) at 0.05 % probability was employed to test the significant differences among mean values of each treatment (Steet and Torie, 1997).

Results and Dissections

Effect of nitrogen fertilizer levels

Growth characters

Results presented in Table (1) indicate that the difference in all growth characters (time of heading, leaf area index (LAI), crop growth rate (CGR), net assimilation rate (NAR), and plant height) due to changing levels of nitrogen fertilizer were significant in both seasons. It is evident from these results that heading was delayed from 71.6 -75.6 days in the first season and from 72.6 – 74.6 days in the second one by increasing nitrogen levels from 60 to 100 kg N/fed. The increment in heading period may be due to nitrogen addition that favored vegetative growth which in turn delayed time of heading. These results are in harmony with those obtained by Gheith et al. (2013 and 2016). Leaf area index and crop growth rate were increased significantly with increasing nitrogen levels up to 100 kg N/fed. in both seasons. This increase in LAI occurred may be due to the increase in leaf expansion. This finding is in harmony with those recorded by Ali (2012), Alam (2013) and Gheith et al. (2016). Moreover, Either NAR or plant height were increased significantly with increasing nitrogen levels up to 80 kg N/fed and then decreased up to 100 kg N/fed. in both seasons. The highest NAR (11.6 and 12.9) and the tallest plants (64.1 and 74.2) were that fertilized with 80 kg N/fed. in both seasons, respectively. This effect of nitrogen application on plant height may be due to the stimulation effect on internodes elongation. The previous effect of nitrogen on the growth characters may be due to the vital role of nitrogen and its necessity for protoplasm formation, photosynthesis activity, cell division and meristematic activity in plant organs is illustrated. Iqbal et al. (2012) and

Gheith et al. (2016) reported similar results.

Table 1: Effect of nitrogen levels on growth characters in both seasons.

Characters	N levels (kg/ fed.)							
	60	80	100	LSD	60	80	100	LSD
	1 st Season				2 nd Season			
Days to 50% heading	71.6	72.7	75.6	1.1	72.6	73.5	74.5	1.9
LAI (80 days)	4.6	5.0	5.5	0.6	4.4	4.9	5.1	0.2
CGR (60-80 days)	200.1	212.3	225.6	11.5	199.2	210.3	220.4	9.5
NAR (60-80 days)	6.8	11.6	10.8	2.3	7.3	12.9	12.1	1.3
Plant height (80 days)	63.7	64.1	63.8	0.3	70.8	74.2	72.9	1.9

CGR (g/m²/day and NAR (mg/dm²/day.

Grain yield and its related characters

Results presented in Table (2) revealed that there was significant difference in grain yield and its components except spike length due to nitrogen fertilizer levels in both seasons. The application of 80 kg N/fed. caused significant and higher increases regarding number of spikes/m², grain weight /spike, grain yield, straw yield and harvest index. As an average of two seasons, increasing nitrogen levels up to 80 kg N/fed. caused an obvious increase in the previous traits by 30.4, 23.1, 46.4, 50.2 and 7.7% and by 128, 26.7, 8.6, 32.8 and 5.8% over each application of 60 and 100 kg N/fed, respectively. These results were expected that nitrogen is one of the most important components of cytoplasm, nucleic acid and chlorophyll. Therefore, as the level of N increased, rapid multiplication of cells occurs which in turn enhances the amount of metabolites necessary for building plant organs. These results are in harmony with those obtained by Khedr (2004), Woldeyesus et al. (2004), Andreassen et al. (2006), Hayob (2007), Omar (2008) and Gheith et al. (2009).

Table 2: Effect of N levels on grain yield and its components

Characters	N levels (kg/ fed.)							
	60	80	100	LSD	60	80	100	LSD
	1 st season				2 nd season			
Number of spikes/m ²	320.1	390.1	368.1	33.2	310.3	430.2	360.9	40.2
Spike length (cm)	4.2	4.3	4.6	-	4.0	4.5	4.2	-
Grain weight/spike(g)	1.3	1.4	1.3	0.1	1.2	1.8	1.7	0.3
Grain yield (t/fed.)	1.01	1.45	1.23	0.04	1.22	1.83	1.81	0.01
Straw yield (t/fed.)	2.45	3.90	2.37	1.31	2.29	3.21	2.99	1.01
Harvest index (%)	31.1	33.5	31.2	1.2	30.1	32.4	31.1	1.3

Effect of sowing methods

Growth characters

Results presented in Table (3) showed that sowing methods had significant effect on all studied growth characters in both seasons except LAI in the second season. These results indicated clearly that drilling method produced the highest values compared with broadcasting method. These results are in harmony with those abstained by Dihiman and Kalra (1978) and Gheith et al. (2009).

Table 3: Effect of sowing methods on growth characters in both seasons.

Characters	Sowing methods					
	Drilling	Broad casting	LSD	Drilling	Broad casting	LSD
	1 st season			2 nd season		
Days to 50% heading	74.1	72.2	1.8	75.6	72.3	2.1
LAI (80 days)	5.2	4.2	0.3	4.9	4.8	-
CGR (60-80 days)	220.2	206.1	10.2	326.2	212.1	13.1
NAR (60-80 days)	10.1	8.2	1.6	11.1	8.6	1.9
Plant height (80 days)	63.1	61.1	2.0	66.1	64.1	1.8

CGR (g/m²/day and NAR (mg/dm²/day.

Grain yield and its related characters

As regarding the effect of sowing methods on grain yield and its related components, significant effect were detected in both seasons with respect to number of spikes/m², grain yield, straw yield and harvest index. However, no significant effects on spike length and grain weight/spike were found in both seasons (Table 4). It is rather increasing to note that drilling method exceeded broadcasting method in all studied characters in the two studied seasons. A possible even distribution for this finding is that drilling method most likely ensures characters in such cause would be better than that of the uneven disruption of plants in case of broadcasting method. These results are in harmony with those recorded by Dihiman and Kalra (1975), Hagra (1985) Ghabour (1995) and Gheith et al (2009).

Effect of interaction

The interaction between the two studied factors had significant effect on LAI, number of spikes/m² and grain yield per unit area in both seasons (Table 5). Sowing barley with drilling method and application of 100 kg N/fed. produced the highest LAI (5.4 and 5.1) and number of spikes/m² (408.5 and 410.5), respectively. Whereas, grain yield per unit area recorded the highest values (1.54 and 1.85) under the same method and application of 80 kg M/fed.in both seasons, respectively.

Table 4: Effect of sowing methods on grain yield and its components in both seasons.

Characters	N levels (kg/ fed.)					
	Drilling	Broadcasting	LSD	Drilling	Broadcasting	LSD
	1 st season			2 nd season		
Number of spikes/m ²	380.2	341.4	30.5	382.0	352.3	28.9
Spike length (cm)	4.2	3.9	-	3.9	3.8	-
Grain weight/spike(g)	1.5	1.2	-	1.7	1.5	-
Grain yield (t/fed.)	1.53	1.23	0.21	1.77	1.58	0.66
Straw yield (t/fed.)	2.9	2.2	0.5	3.2	3.0	0.1
Harvest index (%)	30.0	29.9	0.1	32.0	29.2	2.7

Table 5: Effect of interaction between N levels and sowing methods

on LAI, number of spikes/m² and grain yield in both seasons.

Sowing methods	N levels (kg/fed.)	LAI		Number of spikes/m ²		Grain yield (t/fed.)	
		1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
		1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Drilling	60	5.0	4.9	440.1	410.3	1.50	1.82
	80	5.3	4.9	390.0	390.4	1.54	1.85
	100	5.4	5.1	408.5	410.5	1.51	1.83
Broadcasting	60	4.4	4.4	308.0	305.2	1.01	1.12
	80	4.9	4.9	370.0	400.2	1.36	1.81
	100	5.0	5.0	346.3	331.4	1.31	1.81
LSD		0.7	0.2	19.2	18.2	0.41	0.22

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ECO-FRIENDLY BEEKEEPING AND CROP PROTECTION IN UTTARAKHAND, INDIA**RUCHIRA TIWARI,***Assistant Professor, Department of Entomology, College of Agriculture, Govind G.B. Pant University of Agriculture and Technology, Pantnagar-263145, Distt. U. S. nagar, Uttarakhand, India*

Honey bees are known for their promising role as a pollinator and forager of plant flora, not only help in increasing the agri-productivity but also provide innumerable valuable products such as honey, beeswax, royal jelly etc. But the efficiency of bees are affected by many agents namely bacterial, viral, fungal diseases, pest, wax moth and predatory wasp. Diseases of bee are the serious problems which in turn cause economic losses to bee keepers and further hamper the expansion of beekeeping and the bee industry worldwide. The bacterial brood disease, European foulbrood (EFB) and diseases caused by ecto and endo parasitic mites, *Varroa destructor* and *Acarapis woodi*, respectively are the severe ones causing severe damage to honey bees (*Apis mellifera*) colonies in Uttarakhand. Whereas among the insect pests, greater wax moth, *Galleria mellonella* causes extensive damage to bee combs by feeding on wax by its larvae and making silken galleries rendering the bee frames unfit for further utilization. The predatory wasp, *Vespa orientalis* (L) attacks the beehives and kill the bees. The beekeepers used antibiotic, terramycin to control EFB and sulphur, formic acid, apistan strips, methyl salicylate, oxalic acid for mite and wax moth control but they found them ineffective. Due to the frequent use of these synthetic chemicals in bee hives the several beekeepers have lost their bee colonies and on the other hand, the development of resistance and contamination of honey due to antibiotic, terramycin has led to a ban on this drug.

Therefore, to combat all these diseases, pest and predators the authoress used cow urine, ajwain seed powder, neem leaf powder, cow dung powder, cow dung ash powder and smoke generated by burning of cow dung and neem leaves at various apiary sites of Uttarakhand during 2008-2017.

The effectiveness and feasibility of using an eco-friendly, non-chemical, animal originated product, cow urine have been explored for the first time in preventing and management of infection of bacterial disease, European Foulbrood (EFB), in the colonies of honey bee, *Apis mellifera* at apiary site pant Nagar, Uttarakhand in 2006 (Mall and Tiwari, 2007). The experiments were also conducted on efficacy of cow urine against EFB disease at various locations of Uttarakhand in the year 2008-2011. It has been observed that the cow urine spray reduced the disease infection to below detectable limit in 10 and 12 days, respectively, as against terramycin treated infected colonies where only 40-45% recovery in EFB infection was observed. Cow urine treated infected combs not only showed rapid and cent- percent recovery in disease infection but also promotion of growth of brood . (Akash and Tiwar,2012). The *in vitro* laboratory experiments were also conducted on the antibacterial activity of the cow urine collected from desi cow in comparison with terramycin on the EFB bacteria of honey bee in the growth of bacteria in different treatments of cow urine was calculated in (mm) and was compared with the growth of bacteria in standard antibiotic, terramycin treated media.(Akash and Ruchira, 2013).

The studies were conducted to manage the ecto-parasitic brood mite, *Varroa destructor* infestation in the bee colonies of *Apis mellifera* (L.) at different locations of Uttarakhand by applying eco-friendly animal origin and plant products. The complied average data of all three apiaries at Dineshpur, Haldwani and Halduchaur revealed that cow urine (desi breed) @ 100%, significantly reduced brood mite infestation (75.60%) with highest mean mite fall (38.00) and sealed worker brood area (SWBA) (1042.00 cm²) followed by cow urine (jersy breed) @ 100% with reduction brood mite infestation, mite fall and Sealed worker brood areas(SWBA) were (75.27%, 37.33 and 991.36 cm²), ajwain powder @ 5g (74.09%, 35.67 and 988.52 cm²) cow urine (Holstein breed) @ 100% (71.57%, 33.00 and 974.34 cm²) and neem leaf powder @ 5g (66.59%, 32.33, 892.32 cm²) in comparison to synthetic chemicals i.e. thymol @ 500mg (58.55%, 29.00 and 464.16 cm²) and formic acid @ 5ml (45.35%, 20.33 and 372.44 cm²) and untreated control.(Tiwari *et al*, 2014). No any adverse effects of these products were observed on bees and the brood and the worker bees worked efficiently and cleaned the infected/ infested brood area and bees in the colonies. It also showed some positive additional effects during the experiments were reducing wasp attack by repelling them away from the beehives and reducing the robbing amongst the bees. The quality analysis of honey samples collected from bee hives treated with these eco-friendly plant and animal origin products were found free from any contamination, with no problem of excess moisture and presence of heavy metals and microbial counts.

The success stories of Indian and German beekeeper, Michael Dryer adopted Cow urine for organic beekeeping s from India and Germany was published

Indian mustard (*Brassica juncea* (L.), is an excellent source of vegetable oil. Being cross pollinated crop attracts large number of pollinators, among them, honeybees being the most prominent. To analyse the foraging activity i.e, foraging rate and time of honeybee, *Apis mellifera* on mustard crop treated with eco-friendly formulations, a novel study was conducted at G.B.P.U.A & T Pantnagar, Uttarakhand during rabi crop season 2015-16. The eco-friendly formulations included animal urine collected from different cow breeds, buffalo and goat @ 20% along with cow urine based plant extracts i.e Neem leaf cow urine extract (NLCUE) and Ajwain seed cow urine extract (ASCUE) @ 1% and 2% were sprayed during peak bloom period of mustard crop. The results showed that there was no adverse effect of tested eco-friendly formulations on foraging behaviour of honeybees, and the maximum foraging rate was observed during the noon hours i.e. 12:00 to 01:00 PM with maximum foraging rate on mustard crop sprayed with desi cow urine @ 20% with (24.0 flowers/bee/min) in comparison to

foraging rate in untreated mustard crop ranged from (15.0-7.0 flowers/bee/min.). Thus, it may be concluded that in this novel research work which was conducted for the first time worldwide and can easily be incorporated to enhance the pollination services of honeybees in mustard crop. (Bisht and Tiwari, 2016)

Similarly, effect of animal and plant origin products were also found effective for growth and development of honey bees. The maximum larval weight of honey bee, *A. mellifera* (128.63mg) and (131.78mg) was observed in desi cow urine treated old bee frames and neem leaf powder treated new bee frames, respectively. The maximum weight of newly emerged adults (112.66 mg) and (118.77mg) was recorded from buffalo urine treated old bee frame and desi cow urine treated new bee frames, respectively. The maximum mean sealed worker brood areas were calculated in old bee frames (304.24cm²) and newly drawn combs (311.63cm²) treated with desi cow urine. (Bisht and Tiwari, 2017)

The commonest method mitigating the problem of major pest of honey bee i.e. wax moth, *Galleria mellonella* (L) is use of harmful chemicals such as Paradichlorobenzene, Naphthalene balls, Celphos (Aluminium phosphide) tablets and Acetic acid. These chemicals not only harm the bees but also create a problem of residue, often leading to problem such as absconding, or colony collapse disorder. Therefore, to overcome the problem of wax moth infestation in empty bee frames under storage conditions, a preliminary and novel approach involving the construction and use of wooden smoke unit to fill cow dung cake smoke generated by burning with neem (*Azadirachta indica*) and jatropha (*Jatropha curcas*) leaves to control the wax moth infestation under airtight and semi airtight storage conditions was conducted at Pantnagar, Uttarakhand during 2014. The study showed promising results as cent- per cent mortality of different stages of wax moth was found in airtight smoke units while under semi airtight conditions the mortalities of adults, larvae and pupae were found 83.33%, 86.66 % and 58.33%, respectively. (Bisht and Tiwari, 2017)

Eco-friendly crop protection :

The eco-friendly formulations were also evaluated against mustard aphid, *Lipaphis erysimi* and its natural enemies and pollinator, honeybees under field conditions whereas the laboratory experiments have been conducted to find out their efficacy against white mold of mustard, *Sclerotinia sclerotiorum* (Tiwari et al 2016). The cow urine at 25% and 100% and cow urine based formulations prepared with plant products i.e. neem and jatropha @2% were found significantly effective against mustard aphid with increase in population of natural enemies, parasitoid, *Diaeretiella rapae* and predator, *Coccinella septempunctata* and pollinator, honey bees. It has been clearly seen that after 3-5 days of spraying of cow urine based formulations, mummified aphids were found on the mustard crop due to attack of parasitoid. The crop yield was also calculated more in cow urine based formulations in comparison to water based formulations and untreated control. Under laboratory conditions, *in vitro* studies on the effect of eco friendly formulations against plant pathogenic fungus *Sclerotinia sclerotium* concluded that the cow urine and cow urine based plant extracts gave cent per cent fungal growth inhibition as observed in fungicide treatment (Carbendazim 50WP) and in comparison to 46.0% to 82.0% fungal growth inhibition in water based plant decoctions which is clearly revealed that eco friendly formulations could be used as an cheap and best alternatives in the management of *Sclerotinia sclerotium*. (Tiwari et al 2016)

A novel and preliminary field study was made on the efficacy of animal urine against gram pod borer, *Helicoverpa armigera* (Hubner) on chickpea (*Cicer arietinum* L.) at experimental farm NEBCRC, GBPUA&T Pantnagar, Uttarakhand during Rabi crop seasons of 2016-17 and 17-18. The pooled data for both the years clearly showed that all the treatments were found significantly superior over control. The data on mean larval population, pod damage and grain yield was obtained for Indoxacarb (14.5 SC) @ 0.9ml/l (3.34larvae/plant, 11.38% and 15.15q/ha) showed that the chemical was performed the best among the treatments followed by Desi cow urine (4.50larvae/plant, 13.00%, 12.92q/ha), Horse urine (4.33 larvae/plant), 13.97%, 12.55q/ha) and Goat urine (5.83larvae/plant, 15.65%, 12.25q/ha) in comparison to untreated control (19.34larvae/plant, 38.70%, 5.51q/ha). On the other hand, the mean population of pupae of parasitoid, *Camptoplex chloridae* was recorded the least (0.78/plant) in Indoxacarb and significantly more per plant (2.42, 2.42 and 2.00) in Desi cow urine, Horse urine and Goat urine, respectively. Thus, the present novel study clearly revealed that animal urine can safely and effectively be incorporated in integrated pest management schedule against *Helicoverpa armigera* on chickpea (Ajaykumara and Tiwari, 2018).

CONCLUSION

These innovative eco-friendly management practices were found as good alternatives to chemicals, to keep the incidence of diseases, pests and predators of honey bees at bay. This expertise technology developed for eco-friendly management of honey bees is a novel approach throughout the world and has been adopted by several beekeepers across India. The beekeepers from Nepal, Germany, Ecuador (South America) and Croatia have also adopted this eco-friendly technology for bee management and getting benefitted. The above mentioned technology has been developed by the financial help obtained from AICRP, Honey bees, Uttarakhand Council for Science and Technology, Dehradun, Uttarakhand and NABARD, Mumbai, Maharashtra.

Thus, it may be concluded that animal origin product, cow urine, botanicals and cow urine based formulations are safe for honey bees, eco-friendly, readily available, almost free of cost to farmers and have long term effect without having any adverse effect on natural enemies and pollinators under field conditions can easily be incorporated as one of the measure

under integrated pest management programme for crop protection. It shall open new avenues for the use of natural bio-resources for their commercial utilization and generation of revenue for farmers of rural areas of Uttarakhand.

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THRIPS TABACI: BIOLOGY AND ITS MANAGEMENT**M. SHAFIQ ANSARI¹, MAHER AHMED MORAIET², AND RABIYA BASRI¹**¹Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, India²Division of Entomology, Department of Plant Protection, Agriculture Research Station – Seiyun, Yemen

Onion is an important vegetable crop widely grown and consumed all over the world. It contributes significantly to the Indian economy by exporting 2.41 million tons of onion in 2016-17. India is the second largest producer of onion in the world but lacking behind in productivity (14.21 tons/ha) compared to China. It is cultivated in 1.19 million ha with production of 21.4 million tons in 2017-18. The major onion producing states in India are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Rajasthan, Bihar, Haryana, Andhra Pradesh, Tamil Nadu and West Bengal that contribute almost 90% of the total onion production. It is cultivated in three seasons; kharif, late kharif and rabi in different states of India.

Onion thrips, *Thrips tabaci* Lindemann (Thysanoptera: Thripidae) is a major insect pests throughout the world. It causes extensive damage to onion due to direct feeding as well as by transmitting economically important Iris yellow spot virus. It also transmits bacteria, *Pantoea ananatis* causing central rot in onion bulb. It damages the stored onion bulbs responsible for blemishing, shriveling and skin separation, and then allowing entry and establishment of black mould (*Aspergillus niger*) and also predispose to other secondary infection when stored at ambient temperature. Primary hosts of *T. tabaci* are onion, cotton, cucumber, tobacco, garlic, leek, cabbage, and black pepper. While, the secondary hosts are potato, melon, tomato, sugarbeet, pigeonpea and cassava. Annual yield loss is estimated to be about 10 to 15% up to 90% in Maharashtra, India and more than 50% in USA.

Adult are elongate, yellow and brown in color with two pairs of fringed (hairy) wings. Mouthparts are beak-like, right mandible is absent or rudimentary and left is functional with seven-segmented antennae. Longevity of adults and life spans are significantly affected by onion cultivars. It reproduces parthenogenetically. However, most species of thrips are reproducing by arrhenotoky. *Thrips tabaci* showed both reproduction modes: arrhenotoky and thelytoky with female biased sex ratios. Males of *T. tabaci* were not recorded on onion culture under laboratory conditions. Thrips hibernates in the winter under the base of plant in soil, debris of crop and other plant habitats.

They become active when temperature warm up in the spring season. Adults migrate to new onion fields with the velocity of wind. Adults also feed on inner leaves in center of onion neck and insert eggs individually into the leaves through their ovipositor.

Onion thrips lay eggs in soft tissues of leaves. Eggs are white-yellow, kidney shaped, microscopic in size. Biology of *T. tabaci* was studied on four cultivars: Onion White (OW), Nasik Red, Nasik Red Plus N-53, and Onion Dr-301 (Krishna). Significant ($P < 0.05$) differences were between thrips population on the cultivars in egg incubation (mean of 3.76 ± 0.10), I instar (mean of 2.01 ± 0.05), pre-pupa (mean of 1.50 ± 0.50), total immature (mean of 11.47 ± 0.17), pre-oviposition (mean of 1.63 ± 0.07), oviposition (mean of 14.66 ± 0.65), post-oviposition (mean of 1.07 ± 0.10), mean total eggs (mean of 61.14 ± 3.01), and fertility life table. However, no significant ($P > 0.05$) differences were found between the cultivars in II instar (mean of 2.41 ± 0.08), pupa (mean of 1.58 ± 0.49), morality of immature stages (mean of $33.71 \pm 3.83\%$), and mean daily eggs (mean of 3.82 ± 0.11). The results provide that onion cultivars are an important factor that affect the biological and life table parameters of *T. tabaci*. Onion White and Nasik Red are more susceptible than Nasik Red Plus N-53 and Onion Dr-301 (Krishna). It is also necessary to consider the cultivars when designing for *T. tabaci* management program.

Monitoring and detection of insect pests and their relative abundance are the foundation of an authentic IPM approach. We suggested that mass trapping of onion thrips is not suitable for the management purpose but can be used only for monitoring on onion crop under field condition. Economic Threshold Level, action threshold (AT) or economic injury level (EIL) may adequately be utilized as decision-making tool in the management of thrips if the density of the thrips reaches or exceeds the threshold level. Infestation of *T. tabaci* does not affect bulb yield under 1 TPD under favorable agro-climatic condition in Aligarh, India. Generally, management of thrips should be mandatory between February and April. The AT varied from 3.52 to 30 TP by different methods for estimation of ETL. However, the estimated AT with 10 TP could be recommended for onion farmers.

The temperature shows positive relationship while, relative humidity significantly negative relationship with the abundance, damage and egg laying of *T. tabaci* in agroeco-system of onion. The infestation of thrips starts from December, establishes in the field in the month of February, and have peaks when temperature $>18^{\circ}\text{C}$ with $< 55\%$ RH (14-22 weeks after transplanting (WAT)) in the month of March and April. Onion cultivars are an important factor that affect the biological and life table parameters of *T. tabaci*. It is also necessary to consider the cultivars when designing for *T. tabaci* management program. Onion White and Nasik Red are more susceptible than Nasik Red Plus N-53 and Onion Dr-301 (Krishna). White Marglobe (7.46-7.80 thrips/plant (TP), 38.92-20.37 t/ha) and Onion Dr-301 (Krishna) (7.68-5.18 TP, 27.44-18.74 t/ha) are suitable for growing in Aligarh, because they are tolerant to thrips with higher yield than other cultivars. Therefore, thrips-tolerant onion varieties could keep down the infestation at low level as well as could minimize the application of insecticides.

Specific potential natural enemies of onion thrips are not found but spiders and coccinellid beetles are the most common predators. More investigations are required to make long-term strategy to exploit the application of natural enemies

in the management of *T. tabaci* on onion crop. Date of transplanting is one of important tactics in the management of *T. tabaci* in the onion field. Onion thrips can be effectively managed by early transplanting (November) and give high yield. Spacing of 30×15 cm (row ×plant) is useful in reducing thrips infestation. The results showed that wider spacing is significantly superior to closer spacing in the management of thrips infestation with high weight of onion particularly with OK, which reduced the thrips population with higher yield. The highest weight of bulbs (2.24-1.84 kg/h 10 onion bulbs) and yield (24.47-29.82 t/ha) were obtained in flatting system. It can be recommended that planting onion in flatting system is the best and suitable method in the management of *T. tabaci* and increasing the production of onion. Carrot can also be utilized as an intercrop in the management of *T. tabaci* on onion, but further need of investigations on their optimal spatial arrangement in an intercropping system to avoid reduction in bulb yield. Application of fertilizers could help onion plant to resist the infestation of OT. Nitrogen dosage at 100 kg/ha (50 kg at basal and rest of 50 kg after one month) is effective for reducing the thrips population. It is recommended that 80 kg P₂O₅/ha (20.93-22.13 t/ha) and 100 kg N/ha (23.05-25.40 t/ha) could give greater production of onion. Lastraw and neemarin (azadirachtin 0.15%) are the economical bio-insecticides that could be use against onion thrips (Moraiet et al. 2015). Dimethoate and imidacloprid gave highest benefit cost ratio (8.22:1 and 6.59:1) on OK, respectively. Therefore, dimethoate 30% and imidacloprid 17.8% can be recommended to manage thrips on onion crops.

Integrated Pest Management:

Integrating practices are adopted for thrips management from transplantation to harvesting on onion crop; I module: - early sowing, flatting system, plant spacing 30×15 cm (row ×plant), nitrogen dosage at 100 kg/ha, 80 kg P₂O₅/ha and three applications of neemarin (azadirachtin 0.15%) at the time of action threshold (10 thrips/plant) was successful in escaping high thrips infestation and producing better yield in comparison to control treatment. Cost/benefit ratio is higher in integrated management than the farmer's ordinary practices.

II module:- late sowing, flatting system, plant spacing 30×15 cm (row ×plant), nitrogen dosage at 100 kg/ha, 80 kg P₂O₅/ha and two application of neemarin (azadirachtin 0.15%) at the time of action threshold (10 thrips/plant), two application of imidacloprid 17.5% SL @1.5ml/L.

III module: flatting system, plant spacing 30×15 cm (row ×plant), wheat as barrier crop, seedling root dip treatment with imidacloprid 17.5% SL @ 0.04% for 12h nitrogen dosage at 100 kg/ha, 80 kg P₂O₅/ha and two application of neemarin (azadirachtin 0.15%) at the time of action threshold (10 thrips/plant).

LEAD PAPER:**GLADIOLUS CULTIVATION FOR FARMERS PROSPERITY****DR. MANOJ NAZIR***Directorate of Agriculture, Talab Tillo Jammu (j and K)*

The word gladiolus was coined from the Latin word gladius meaning sword lily on account of its shape of its foliage. Corn flag is it's another name in Europe G. Illiricus was found wild as weed in corn fields. Water fall Lilly is another name given to it as G.primulinis was found growing near the Victoria Falls in the tropical forests of Africa. It was introduced into cultivation towards end of 16th century. In India cultivation dates back to 19th century, as Firmingers manual of gardening in India published in 1863 mentions that Charles Grey of coonoor grew some gladiolus from corms and seeds in his garden.

Gladiolus cultivation under northern Indian plains, coastal areas of TamilNadu and Pondicherry has a potential to change the economic scenario of farmers of these areas. For generating both money as well as employment in rural areas gladiolus is such a crop suitable for establishing floriculture industry by progressive farmers and entrepreneurs and undoubtedly the best bulbous flower in India. Its magnificent spikes in dazzling colours remain fresh for 10 to 22 days. Its cultivation in Jammu region has become an important sector as consumption of flowers is rising associated with economic development. Jammu division of J and K has a wide range of climates and micro climates different production system, socio economic diversity and consumer requirements. Mostly farmers belong to small and marginal category. Diversification to horticulture crops is now the major option to improve livelihood security of small farmers and improved employment opportunities. Jammu division of (J and K) and coastal plains of India is going to play a vital role in floriculture trade which will turn the economy of these states. Floriculture scenario in Jammu province of (J and K) has changed very rapidly since 2000. In 1998 – 1999, area under gladiolus cultivation in Jammu province was 0.5 hec and its reached to 2.0 hec. In 2002 and 5.0 hec in 2004 and 10.0 hec in 2007. Now every year 25 – 50 farmers take up its cultivation in Jammu region of J and K. In 1999 40,000 spikes of gladiolus were produced, from 1999 – 2002. 1, 00,000 spikes were produced. From 2002-2004. 1, 20,000 spikes were produced and from 2005-2007. 3, 00,000 spikes were produced from the plains of Jammu region (from October to April). Despite all this Jammu import 85% of gladiolus spikes and other cut flowers from rest of the country. Floriculture sector is experiencing a rapid change the world over the globalization and its effect on income generation. Consumption of gladiolus spikes in northern plains of India and coastal plains is rising day by day and this trend will continue to increase because of its demand in the market and improvement in purchasing power. A gladiolus spike has a potential to change economic scenario of poor farmers.

Recent trends:

Consumers are becoming more aware of what to buy. They are becoming professional buyers. They tend to ask for higher choices in product quality levels depending on purpose of purchase, as well for higher levels of service and a wider and deeper assortment. Now the trend has shifted from seasonal to year round production of flowers and the soil of Jammu has potential to make spikes of gladiolus available when they are most wanted (like mothers day, Valentines Day) besides marriages, birthdays and other occasions. FAO-sponsored project on green house technology for small scale farmers should be implemented in Jammu, western U.P, and Coastal plains of Tamil Nadu which will give a confidence to farmers for green house production of flowers. Government of Jammu and Kashmir, U.P and Tamil Nadu should be instrumental in setting up of floricultural units both for export and domestic markets. Cold storage facilities for flowers for export should be set up.

Why Gladiolus has become farmer's first choice

Farmers feel secure by cultivating gladiolus as the spikes fetch then a good return in comparison to other crops and can be also intercropped with vegetables like Knolkhol, radish and floricultural crop like French marigold and gerbera.

CROP	AREA (Hect.)	TOTAL INCOME (Rs.)
Wheat	1.6	72,000.00
Paddy	2.0	40,000.00
Radish	0.2	12,000.00
Cabbage	0.3	06,000.00
Spinach	0.1	500.00
Gladiolus	0.1	28,000.00
Knol kohl	0.5	2,000.00

Year	Area under Cultivation (Hects.)	Total No. of Spikes produced	Total No. of Farmers engaged	Profit (Rs.)
1998 – 99	0.2	12000	05	18000
1999 – 2000	0.3	18000	07	27000
2000 – 01	0.5	30,000	10	60000
2001 – 02	0.5	30,000	12	65000
2002 – 03	1.0	1,20000	14	245000
2003 – 04	2.0	240000	20	480000
2004 – 05	3.0	300000	25	860000
2005 – 06	3.5	4,20000	35	12,60000
2006 – 07	4.0	4,80000	40	14,44,000
2007 – 08	4.5	5,40000	46	16,00000
2008 – 09	6.0	6,60000	60	20,00000

Status of Gladiolus in Jammu (J&K)

Gladiolus cultivation has not only a potential to change economic status of a poor farmer but also a good mode of diversification

Floriculture has become one of the important high value agricultural industries, in many countries of the world. Due to globalization and its effect on income enhancement in different regions of the world, a growing percapita consumption of floricultural products is witnessed in most of the countries

The traditional flowers like Jasmine, marigold, chrysanthemum, and tuberose are the mainstay in India. With increase in importance of protected cultivation and green house technology combined with liberalized trade policies and many concessions given to entrepreneurs, many companies have ventured into growing flowers for exports

Major cut flowers grown in India are Rose, orchids, gladiolus, carnation, anthurium and gerbera. India is especially well placed to meet international demand for cut flowers which peak during winter months. Indian floriculture has recently witnessed commendable changes which have transformed it from hobbyist activity to a commercial enterprise. The value of import and export is increasing every year.

Objects of the mission

1. To make this crop popular in India (666 distt.)
2. To Identify promising and stable genotypes for All locations of India
3. To help and guide the farmers about its commercial importance and how it can improve the economic status

What is a Colour Revolution?

It is revolution through colorful spikes of gladiolus that will enhance the economic status of our majority of poor farmers

The Netherlands's also a big importer but re exports most of its imports. Indian cutflowers like gladiolus, roses, gerbera, carnation are liked by these countries and could import these flowers during winter months when these flowers could not be cultivated there during winter months and can also promote close diplomatic relations with these countries.

Europe and other countries are increasingly looking towards India for cut flowers. The climatic conditions in most of these countries don't favour year round cultivation of cut flowers.

Flowers like Roses, gladioli, carnation and orchids are enthusiastically received in Japan, Germany the Netherlands, U.K and Hongkong. The Indian floriculture industry occupies 1, 06,000 hectares. And produced 5, 35,000 million tones of loose flower and 2565 million numbers of cut flowers resulting in an export of Rs. 1150 million and out of the total area approximately 58, 000 hectares. Is under annual flowers.

Why gladiolus crop selected for this mission

For generating both money as well as employment in rural areas gladiolus is such a crop suitable for establishing floriculture industry by progressive farmers and entrepreneurs and undoubtedly the best bulbous flower in India. Its magnificent spikes in dazzling Colour remain fresh for 10 to 22 days. Gladiolus cultivation has a potential to change the economic scenario of farmers of this country

After extensive touring from length to breadth of India we could gather that mostly our farmers belong to small and marginal categories are struggling hard. They do not earn much from their traditional crops. And diversification to horticultural Crops is now the major option to improve livelihood security of small farmers increase employment opportunities through earning foreign exchange. We want to provide a security cover to our farmers and gladiolus as a cut flower has that potential

I select a few farmers with the help of extension officers of department of Agriculture or scientists of the Universities of that area brief them about its cultivation; lay down research trials directly at farmers fields. After successful trials we publish technical brouchers in regional languages and in English. And give live demonstration on spot.

A blooming spike of Pondicherry

The spike of gladiolus from plains of India is more colorful, attractive, more number of florets per spike in comparison to temperate regions of India. The results of coastal areas of Tamil Nadu and Pondicherry were beyond our expectations the spike of gladiolus from Indian soil is more fascinating and has export potential. The demand of its cut flowers is rising day by day and North America is the biggest market

COST BENEFIT RATIO

Cost of one corm ranges between Rs.2-3. If grown scientifically and only stable and promising varieties for that area a farmer can get 2-3 spikes per corm. Cost of cultivation per corm is 25 paisa. Market value of one spike is 3-4 rupees. Total min. amount earned is Rs. 6-9 per corm. Net profit from spikes is Rs. 6-9 minus 2.25-3 .25 = 3.75- 5.75. It means from one acre of land a farmer can earn a net profit of rupees 1, 20,000 – 1, 84,000. From 32000 corms planted in one acre of land.

Other surprise is that after 45 days of spike cut a farmer gets now 2-3 corms back from one planted corm which can be used for next sowing after dormancy break for three months. More so a farmer gets 5- 20 cormlets which grows into well developed corm in three – four months. That is why I have been telling that a single corm of gladiolus has a potential to change economy of our farmers. That is why I selected gladiolus crop for bringing Colour revolution in India. A colorful farmer means a colorful India.

Till April 2017, we had laid 10,000 trials and farmers cooperated with us. They were very enthusiastic. In Jammu, 0.05 ha. of land was under its cultivation before this mission .Today40 ha. of land is under its cultivation.

The farmers of coastal Tamil Nadu and Pondicherry were unaware about its cultivation despite being one of the “Flower growing belts” of India.

They grow gladiolus for the first time in their fields. More and more farmers are coming forward for its cultivation after seeing its rising demand in the national and international markets. This season twenty farmers in Chidambaram (Tamil Nadu) went for its cultivation

Yes a positive change was visible among the farming community. A milk seller turn to progressive gladiolus grower in Jammu. From 0.1 hecets of gladiolus crop he earned a net profit of Rs. 14,000 per crop more than what he earns from 0.2ha of. Radish. On seeing economic boost and visible change in his economy he converted his whole land into gladiolus crop. On seeing the achievements of this farmer other farmers of this vicinity had adopted the same practices. Nowadays, each and every farmer in Jammu region is going for this cultivation. This year up to April 09 four lakh spikes of gladiolus were produced from Jammu plains and still 80 % of spikes we have to import from other states.

Other progressive farmer at R.S Pura (Jammu) a teacher by profession not only sells spikes of gladiolus but now he develops corms from cormlets and exports them to those growers where from he used to import corms for cultivation. A farmer sh. Srinivas Perumal of village C Mutlur of Chidambaram on growing gladiolus for the first time in 2008 noticed a visible change in his economy and decided to go for it extensive cultivation. On noticing, SBI. C.Mutlur is ready to give crop loans. For the commercial cultivation of gladiolus.

We have made a documentary on scientific cultivation of gladiolus entitled “Exploring Gladiolus for Colour revolution in India” presently it is dubbed in Hindi and English now I will dub it in Telugu and Tamil for the farmers of these regions totally free of cost that will enable them to know more about its cultivation. we have also published technical brouchers about scientific cultivation of gladiolus in Hindi, Urdu, Dogri, Kashmiri, Tamil languages till date besides English.

Cost of one corm ranges between Rs.2-3. If grown scientifically and only stable and promising varieties for that area a farmer can get 2-3 spikes per corm. Cost of cultivation per corm is 25 paisa. Market value of one spike is 3-4 rupees. Total min. amount earned is Rs. 6-9 per corm. Net profit from spikes is Rs. 6-9 minus 2.25-3 .25 = 3.75- 5.75. It means from one acre of land a farmer can earn a net profit of rupees 1, 20,000 – 1, 84,000. From 32000 corms planted in one acre of land.

Other surprise is that after 45 days of spike cut a farmer gets now 2-3 corms back from one planted corm which can be used for next sowing after dormancy break for three months. More so a farmer gets 5- 20 cormlets which grows into well developed corm in three – four months. That is why I have been telling that a single corm of gladiolus has a potential to change economy of our farmers. That is why I selected gladiolus crop for bringing colour revolution in India. A colorful farmer means a colorful India.

BIOPESTICIDE: AN ECOFRIENDLY APPROACH FOR SUSTAINABLE FUTURE**RASHMI NIGAM, JOGINDER SINGH, RAM JILAL AND WAJID HASAN***Department of Plant Pathology, Janta Vedic College, Baraut, Baghpat (U.P.)**Department of Plant Pathology, Janta Vedic College, Baraut, Baghpat (U.P.)**Division of Crop Protection, ICAR- Indian Institute of Sugarcane Research, Lucknow 226002**¹Krishi Vigyan Kendra, Jahanabad-804432, Bihar, India (Bihar Agricultural University, sabour Bhagalpur)*

Agriculture is central to human survival it provides food and fuel and other ecosystem services, is an important source of livelihood, and plays a crucial role in economic development, it also plays a role in improving economy of the country. Emphasis of present day agriculture is to produce more with lesser land, water and man power. The Green Revolution technology adoption has increased wide varieties of agricultural crop yield per hectare which increased food supply in developing countries. Inputs like fertilizers, pesticides helped a lot in this regard. But in spite of this fact, food insecurity and poverty still prevails prominently in our country. Use of chemical pesticides and fertilizers have caused negative impact on environment by affecting soil fertility, water hardness, development of insect resistance, genetic variation in plants, increase in toxic residue through food chain and animal feed thus increasing health problems and many more which makes bio pesticides to come into picture. The present study deals with different type of biopesticide used in agriculture for the sustainable development.

Keywords: Biopesticide, Ecofriendly, Biofungicide, Sustainable.

INTRODUCTION

Agriculture plays a vital role in a developing country like India. Apart from fulfilling the food requirement of the growing Indian population, it also plays a role in improving economy of the country. The Green Revolution technology has increased wide varieties of agricultural crop yield per hectare which increased 12-13% food supply in developing countries. Inputs like fertilizers, pesticides helped a lot in this regard. But in spite of this fact, food insecurity and poverty still prevails prominently in our country. The indiscriminate use of chemical pesticides and fertilizer in modern agriculture resulted in the development of several problems such as pesticide resistance insects, resurgence of target and non-target pests, destruction of beneficial organisms like honey bees, pollinators, parasitoids and predators and pesticide residue in food, feed and fodder (Al-Zaidi *et al.*, 2011). Sustainable food security requires not only that all people at all times have access to sufficient and nutritious food, but also that this food be produced with minimal environmental impact. Sustainable agricultural development, instead, requires that agriculture meet the needs of the present without compromising the ability of future generations to meet their own needs.

Hence, the today's need is to produce maximum from the decreasing availability of natural resources without adversely affecting the environment. Therefore, alternative, environmentally safe methods are needed for pest management. The present study deals with different type of biopesticide used in agriculture

Bio-pesticides are ecofriendly pesticides which are obtained from naturally occurring substances (biochemicals), microbes and plants. They are also biochemical pesticides that are naturally occurring substances that control pests by nontoxic mechanisms. Biopesticides are living organisms (natural enemies) or their products (phytochemicals, microbial products) or by products (semiochemicals) which can be used for the management of pests that are injurious to plants. They pose less threat to the environment and to human health. Bio-pesticides for Insect-pest and Disease Management, Biological Pest Control and Biological Weed Control are some of the methods for minimizing the adverse effect of pesticides. Bio-pesticides are ecofriendly pesticides which are obtained from naturally occurring substances (biochemicals), microbes and plants (Dutta, 2015). They are also biochemical pesticides that are naturally occurring substances that control pests by nontoxic mechanisms. Biopesticides are living organisms (natural enemies) or their products (phytochemicals, microbial products) or by products (semiochemicals) which can be used for the management of pests that are injurious to plants. The most commonly used biopesticides are living organisms, which are pathogenic for the pest of interest. These include biofungicides (*Trichoderma*), bioherbicides (*Phytophthora*) and bioinsecticides (*Bacillus thuringiensis*). There are few plant products also which can now be used as a major biopesticide source (Salma *et al.*, 2011). Biopesticides are an important ingredient of Integrated Pest Management (IPM) packages due to their capability in maintaining the natural diversity without the use of any artificial or synthetic residues. The origin of Biopesticides can be microbial (bacteria, fungi or virus), herbal (plant extracts) or genetically modified plants (GM). *Beauveriaspp.*, *Trichodermaspp.*, and *Bacillus spp.*, are some of the microbial biopesticides. Biopesticides may be broadly categorized into three major groups: 1) Biochemical biopesticides 2) Microbial pesticides and 3) Plant-Incorporated Protectants (PIPs).

Biochemical pesticides are herbal-based substances that are naturally produced by a plant or an organism. They are non-toxic and biodegradable. Plant biochemicals are collectively called botanicals and the most important botanical is pyrethrum, followed by neem, rotenone and essential oils, typical used as insecticides (e.g. pyrethrum, rotenone, rape seed oil, quassia extract, neem oil, nicotine), repellents (e.g. citronella), fungicides (e.g. laminarine, fennel oil, lecithine), herbicides (e.g. pine oil), sprouting inhibitors (e.g. caraway seed oil) (Isman, 2006). They help the plant in counter-attacking its pests or producing chemicals that would prevent pest attack on the plant.

Microbial pesticides originate from micro-organisms such as bacteria, fungi or other protozoan groups. The widely used microbial pesticides are *Trichoderma viride*, *Bacillus thuringiensis*, *Bacillus sphaericus*, *Pseudomonas fluorescence* (Bacteria), *Beauveria bassiana* (Fungi), Baculo virus and Nucleopolyhedrosis Virus. These are mostly target-specific organisms that are aimed at killing one or a group of pests. Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient.

Plant-Incorporated-Protectants (PIPs) These are genetically modified materials produced by modifying a protein and introduced into the plant so that it produces its own pesticide. For example, the gene for Btpesticidal protein, was introduced into the genetic material of cotton plant and plant manufactures the substance that destroys the pest.

Applications of Biopesticide

Biopesticides are usually applied in a manner similar to chemical pesticides, but achieve pest management in an [environmentally friendly](#) way. With all pest management products, but especially microbial agents, effective control requires appropriate [formulation](#) (Burges, 1998) and [application](#) (Matthews *et al.*, 2014, Lacey and Kaya, 2007). Biopesticides for use against crop diseases have already established themselves on a variety of crops

Advantages of Biopesticide

Biopesticides are usually inherently less toxic than conventional pesticides. No harmful residues detected.

Biopesticides generally affect only the target pest and closely related organisms, in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects and mammals.

Biopesticides often are effective in very small quantities and often decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides. It can be cheaper than chemical pesticides when locally produced.

When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly reduce the use of conventional pesticides, while crop yields remain high. Biopesticides can be more effective than chemical pesticides in the long-term

CONCLUSION

To develop eco-friendly pest control technologies are the need of day and challenging tasks for developing countries to improve agricultural productivity in a sustainable manner. Biopesticides are considered as one of the eco-safe alternatives due to their biodegradation in nature, multiple mode of action on target pests and may not leave toxic residues, are used globally for controlling insect pests and diseases.

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MANAGEMENT OF DIAMOND BACK MOTH, *PLUTELLA XYLOSTELLA* L., IN BRASSICAS**WAJID HASAN¹, NIDA ASIF¹, RASHMI NIGAM AND JOGINDER SINGH**¹Krishi Vigyan Kendra, Jahanabad-804432, Bihar, India (Bihar Agricultural University, sabour Bhagalpur)

Agricultural intensification and greater production of Brassica vegetable and oilseed crops over the past two decades have increased the pest status of the diamondback moth (DBM), *Plutellaxylostella* L. (Lepidoptera: Plutellidae), and it is now estimated to cost the world economy US\$4-5 billion annually. Proven technologies for the sustainable management of DBM currently exist, but overcoming the barriers to their sustained adoption remains an enormous challenge (Furlong et al, 2013). Diamondback moth, *P.xylostella*) is a major pest of cruciferous plants around the world (Talekar & Shelton 1993). It is known to be resistant to main groups of insecticides (Perez et al. 1995), ranking among the twenty most resistant pest species reported up to now (Mota-Sanchez et al. 2002; Mohan & Gujar 2003; Shelton 2004). The *P.xylostella* has a cosmopolitan distribution and its occur where brassicas are grown (Talekar and Shelton, 1993). It is highly migratory with seasonal movement (Talekar and Shelton, 1993). It has 20 generation per year in tropics and due to its genetic elasticity, it leads to development of resistance insecticides (KahutiaGathu et al 2009, Shelton, 2004). The diamond-back moth, *P.xylostella*, appeared in the beginning of September and population steadily reached its peak by the end of November followed by a declined phase from the last week of December to the last week of January. The pest population abruptly increased from February and peaked in April. Overall study revealed temperature as key abiotic factor in regulating the field population of *P. xylostella*. Hot conditions favoured its multiplication while cold ones in November-February limited it (Shukla and Kumar, 2004). Diamondback moth, *Plutellaxylostella* (L.), became the major pest of Brassica vegetable production in Guangdong, a province in southeastern China, in the late 1980s and has continued to challenge growers, particularly during the spring and autumn. Local production breaks, and strict post harvest hygiene are associated with lower pest pressure on large-scale production units. As more and more insecticides become ineffective the need to implement an insecticide resistance management strategy, as well as basic integrated pest management practices, will become more pressing. The potential use and development of a better forecasting system for diamondback moth that will assist these developments is outlined (Zhenyu et al 2012). Since 1993, the annual worldwide cost of diamondback moth, *P.xylostella* (L.) control has been routinely quoted to be US\$1 billion. This estimate requires updating and incorporation of yield losses to reflect current total costs of the pest to the world economy.. The "length of the string" is somewhere between US\$1.3 billion and US\$2.3 billion based on management costs. However, if residual pest damage is included then the cost estimates will be even higher; a conservative estimate of 5% diamondback moth-induced yield loss to all crops adds another US\$2.7 billion to the total costs associated with the pest. A conservative estimate of total costs associated with diamondback moth management is thus US\$4 billion-US\$5 billion (Zalucki et al, 2012).

The preoviposition (1-5 days) and oviposition period (6-14 days) decreased with increase in temperature. Lifetime fecundity was highest at 20 degrees C, followed by 15 degrees C. An increase in egg hatching was also observed with the increase of temperature up to 25 degrees C. Growth period of individual life stages, and hence, the total life cycle duration, decreased with the increase of temperature. Growth index was higher at 25 degrees C than at 30 degrees C. Similarly, larval survival and adult emergence were highest at 25 degrees C. Larval size in instars were maximum at 25 degrees C and minimum at 30 degrees C (Gupta et al, 2013). The mean incubation period ranged from 3.25 to 4.24 days at 24.73 to 28.07 degrees C. The larval and pupal period lasted for 9.83 to 14.25 and 5.72 to 5.99 days, respectively at 24.74 to 31.55 degrees C and 39.50 to 58.76 per cent relative humidity. With the rise in temperature, adult emergence decreased from 100 to 75 per cent. Maximum adult longevity (5.62 days) was observed at temperature range of 26.47 to 29.34 degrees C. The temperature and humidity also affected the fecundity. The maximum number of eggs (168.50) were laid at 24.74 to 27.50 degrees C and 51.93 to 58.76 per cent humidity. The mean time taken to complete the life cycle was 27.43 days with a range of 19 to 40 days (Kaur et al, 2012).. Significant fewer males were captured in pheromone-treated and conventional-practice fields than in the blank control field, but the difference was not significant between the pheromone-treated and conventional-practice fields. In addition, fewer eggs and larvae were observed in pheromone-treated fields. Our results suggest mating disruption coupled with minimal insecticidal supplements is a promising solution for resistance management and control of diamondback moth infestation (Qu et al, 2012). *P.xylostella* is one of the main pests that affect vegetable commodity output. Current treatment by chemical pesticide spray has been considered the effective control of *P. xylostella*. This treatment has also developed the insecticide resistance, increased pesticide residue risks and threatened pollution-free vegetable production. In the present study, the effects of abio-chemical conditions such as temperature, soil moisture, water-logging and soil cover on *P. xylostella* pupae eclosion were investigated. The rate of pupa emergence exceeded 73% at 26-30 degrees C, which declined to 46.67% at 34 degrees C. When treated at 4 degrees C and then grown at room temperature, the rate of pupae emergence dropped significantly. The longer the 4 degrees C pretreatment, the lower was the rate of pupae emergence. However, the emergency rate recovered to normal levels after long time of growth at room temperature. When soil moisture was 10% and 20%, the emergence rate was respectively 12.5% and 6.2% of that under normal moisture condition. No pupa emergence was observed within 6 d at soil moisture of 30%. When treated with water-logging for 12 h and 24 h and then returned to surface soil, the rate of emergence of *P. xylostella* pupae dropped respectively by 25.0% and 50.0% and emergency was delayed too.

No pupa emergence was observed under extended treatment time of 36 h. Soil covering also had noticeable effects on *P. xylostella* pupa emergence. The emergence of pupae was delayed by 2 d when covered at 1 cm depth soil. Pupa did not successfully emerge when soil cover was 1.5 cm deep. The above results suggested that timely irrigation, paddy/dryland rotation and soil plowing were critical control factors of *P. xylostella* pupae in vegetable fields (Zhou et al, 2012). The effects of host-plant resistance on the olfactory response and parasitism success by *Cotesiavestalis*, a parasitoid of diamondback moth (*P. xylostella*) larvae were examined. Here, it was demonstrated that host-plant resistance can strongly influence foraging behavior and parasitism success of the parasitoid. In olfactometer experiments, *C. vestalis* did not differentiate between crucifer plant types with similar levels of susceptibility or resistance to *P. xylostella* but showed a strong preference for susceptible compared with partially-resistant host plants. The influence of previous oviposition activity varied with the host-plant type experienced by the parasitoid. In cage experiments, *C. vestalis* preferred to parasitize *P. xylostella* larvae on a susceptible plant compared with larvae on a partially resistant host plant when exposed to hosts for 24 h. However, this preference appeared to be transitory, and was not found after 96 h exposure. Combining partial host-plant resistance with biological control by *C. vestalis* for the control of *P. xylostella* may in some circumstances be antagonistic and negatively affect parasitism success (Karimzadeh et al 2013).

The susceptibility of field populations of *P. xylostella*, increased their resistance to lambda-cyhalothrin, but there is little or no resistance to spinosad and indoxacarb and reduced resistance to methamidophos. This mitigation of resistance in DBM is attributed to, in particular, a decade-long regional adherence by the vegetable industry of rotating spinosad with indoxacarb in a two-windows-per-year rotation strategy. The original insecticide resistance management rotation strategy had to be updated to incorporate chlorantraniliprole registered as a foliar spray, and recently a mixture of chlorantraniliprole and thiamethoxam as a seedling drench. Seedling drenches have been removed from the two-window strategy used for foliar sprays, with drenches now aligned with periods targeting the highest pest pressure, allowing mode of action (MoA)-free periods and rotation of different MoA insecticides to mitigate any resistance build-up in DBM (Walker, 2012). The feeding potential of *P. xylostella* was significantly higher on cauliflower (6.35 cm²) followed by cabbage (6.22 cm²), and then broccoli (4.22 cm²) and mustard (2.37 cm²) (Tufail et al, 2012). Fipronil 80 WG was tested in the field at three dose levels (50, 62.5 and 75 g a.i./ha) against Diamond back moth in Cabbage in rabi season of two consecutive years, 2009 and 2010 at University Experimental Farm, BCKV, Kalyani, West Bengal. Two standard check i.e., Cartap Hydrochloride 50 SP @ 250 g a.i./ha, Spinosad 2.5 SC @ 15 g a.i./ha along with a untreated check were also taken for comparison. The highest yield were recorded in Fipronil 80 WG treated plots @ 75 g a.i./ha followed by 62.5 g a.i./ha of the same product. Fipronil 80 WG was also found to be very soft to major predatory groups (Alam et al 2014). Eleven pesticides were effective (emamectin benzoate, cartap, tolfenpyrad, fipronil, pyridalyl, chlorfluazuron, teflubenzuron, BT-kurstaki, BT-aizawai, chlorantraniliprole and flubendiamide: 85.7 to 100% lethal), whereas three (permethrin, acetamiprid and clothianidin) were ineffective (6.7 to 36.7%). Nine pesticides were harmless against the native parasitoid *Cotesiavestalis* (acetamiprid, emamectin benzoate, pyridalyl, chlorfluazuron, teflubenzuron, BT-kurstaki, BT-aizawai, chlorantraniliprole and flubendiamide: 0 to 20%), whereas five were harmful (permethrin, clothianidin, cartap, tolfenpyrad, and fipronil: 53.3 to 100%) (Kikuchi et al 2013). Using high doses of insecticides is very dangerous for the environments and for humans. Decreased concentrations are necessary. Insecticides have lethal and sublethal effects. Understanding of some fundamental aspects of DBM biology and ecology, particularly host plant relationships, tritrophic interactions, and migration, has improved considerably but knowledge of other aspects, e.g., its global distribution and relative abundance, remains surprisingly limited. Biological control still focuses almost exclusively on a few species of hymenopteran parasitoids. Although these can be remarkably effective, insecticides continue to form the basis of management; their inappropriate use disrupts parasitoids and has resulted in field resistance to all available products. Improved ecological understanding and the availability of a series of highly effective selective insecticides throughout the 1990s provided the basis for sustainable and economically viable integrated pest management (IPM) approaches. However, repeated reversion to scheduled insecticide applications has resulted in resistance to these and more recently introduced compounds and the breakdown of IPM programs.

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ABSTRACTS

THEME-I, VOLUME-I

**RECENT TRENDS IN AGRICULTURAL
SCIENCES AND TECHNOLOGY**

DEVELOPMENT OF ORGANO-CHEMICAL FERTILIZER WITH HORMONE MIXED FORMULA FOR SOIL IMPROVEMENT AND GROWTH OF MAIZE (ZEA MAYS L.)**AGBESI KWADZO KETEKU*, PUMISAK INTANON AND SUWAT TERAPONGTANAKORN***Department of Agronomy/Fertilizer Technology, Faculty of Agriculture, Naresuan University, Muang Phitsanulok, Thailand*

In this study, a new fertilizer was developed for soil improvement and growth of maize. Six treatments; T1 control (no fertilizer), T2 NPK (15-15-15), T3 chemical and granular organic fertilizer with hormone mixed formula 1 (HO-1), T4 formula 2 (HO-2), T5 formula 3 (HO-3) and T6 granular organic fertilizer (GOF) were replicated thrice in RCBD, in a plot size of 6 m x 5 m at Phitsanulok, Thailand, 2017. The maize cultivar (*Pacific 999 Super*) was sown at a row and inter-row spacing of 75 cm x 25 cm. Fertilizer rate of 50 kg rai⁻¹ (rai = 0.16 ha) was used. Among the fertilizers treatments, T5 (HO-3) had the highest best balanced plant nutrients N (10.9 %), P (9.3 %), K (9.2 %), Ca (7.97 mg kg⁻¹), Mg (1.6 mg kg⁻¹), S (0.05 mg kg⁻¹), micronutrient, OM (1.25 %), CEC (21.9 cmol kg⁻¹), EC (1.9 dS m⁻¹) and pH (7.6). The initial soil analysis showed a lower rate of soil properties, however after the trial a significant ($p < 0.05$) improvement were observed, the highest residual NPK (0.875 %, 0.0275 % and 0.0267 %) and other properties were evident in T5 (HO-3). Plant height, leaves number, stem diameter, dry matter, leaf area and leaf chlorophyll content (275.5 cm, 19.4, 33.4 mm, 286.56 g, 155.09 dm² and 57.98) respectively were highest in HO-3 treatment. A significant 54.6 % increment in total dry matter was obtained with HO-3 over control. Plant growth indices; RGR (0.142 g g⁻¹ day⁻¹), LAI (5.92) and dry matter efficiency (36.4 %) were best in HO-3. The percentage increment of leaf area index of HO-3 was 57.1 % compare to the control. HO-3 was the best fertilizer for soil improvement and enhancement of maize growth.

Keywords: Growth: HO: maize: NPK: soil improvement**COMPARATIVE ANALYSIS OF FERTILIZER MANAGEMENT SYSTEMS ON YIELD, YIELD COMPONENTS AND PRODUCTION ECONOMICS OF "PACIFIC 999 SUPER" MAIZE CULTIVAR IN THAILAND.****AGBESI KWADZO KETEKU*, PUMISAK INTANON SUWAT TERAPONGTANAKORN AND RUANKWAN INTANON***Department of Agronomy/Fertilizer Technology, Faculty of Agriculture, Naresuan University, Muang Phitsanulok, Thailand*

This trial was conducted to offer on-research evidence to the universal dispute on the economic viability and productivity of divergent fertility management strategy (chemical, organic and integrated approach), Six treatments: T1 control (no fertilizer), T2 NPK (15-15-15), T3 chemical and granular organic fertilizer with hormone mixed formula 1 (HO-1), T4 formula 2 (HO-2), T5 formula 3 (HO-3), T6 granular organic fertilizer (GOF), replicated thrice in RCBD, in a plot size of 6m x 5m at Phitsanulok, Thailand. A fertilizer dose of 50 kg rai⁻¹ (rai = 0.16ha) was used. The maize cultivar (*Pacific 999 Super*) was sown at a row spacing of 75 cm and intra-row spacing of 25 cm. The experimental results revealed that T5 (HO-3) treatment produced the highest yield components and a significant ($p < 0.05$) yield of (1,524.27 kg rai⁻¹), representing an increase of (54 %) over the control. Also, HO-2 and NPK treatments recorded equal effects on maize yield (1,287.20 and 1,262.67 kg rai⁻¹) respectively. From the economic studies, the production cost of HO-3 was the highest (6,103.98 baht rai⁻¹), seemingly, it gave the best revenue of (12,663.49 baht rai⁻¹) and profit (6,559.51 baht rai⁻¹). A significant 17.4 % rise in profit was realized with HO-3 application over NPK treatment. Moreover, the Benefit: Cost ratio of HO-3 fertilizer was the best (2.33) and ideally suitable for maize farmers to maximize returns in Phitsanulok.

Keywords: Fertilizer: hormone: maize: profit: yield improvement**ISOLATION OF METHYL EUGENOL FROM OCIMUM BASILICUM LEAVES AND INFLORESCENCE AND ASSESSMENT OF THE PLANT POTENTIALITY AS FRUIT FLIES ATTRACTANT****AMANI M. K.ABBAS¹, FAIZA M. A. MAGID² & SELMA M. O.ABDULLAH³***^{1&3}Department of Zoology, faculty of science and Technology, University of Shendi, Sudan. ²Department of Pests and Plant Health, College of Agriculture, University of Bahri, Khartoum North, Sudan*

Ocimum basilicum L. (basil), which is annual plant belong to the plant family Lamiaceae. Methyl Eugenol was found as one of the basil oil component. This study was carried out at Shendi area to assess the amount of Methyl Eugenol extracted from the plant and the potentiality of raw plant as fruit flies attractant. Basil plant parts were extracted using Soxhlet apparatus, steam and water distillation, the highest produced oil percentages from flowers and leaves were (5.75 and 3.03%) respectively, while, the lowest percentages were obtained from the seed and stem (0.02 and 0.21%) respectively. The produced oil was analyzed using GCMS, Methyl Eugenol was found as one of 32 compounds produced. The raw plant parts (leaves and flowers) were baited and used into two forms (powder and paste) to test the basil efficiency in fruit flies attraction. The basil traps catch was too low compared with that of the control traps. The Methyl Eugenol extracted from basil plant was verified and compared with the standard synthetic Methyl Eugenol. The extracted Methyl Eugenol from basil

plant when used in the insect traps gave lower catch of fruitflies numbers than the synthetic Methyl Eugenol traps, but the difference was not significant.

Key words: *Ocimum basilicum* , Attractant . Fruitflies.

EFFECT OF ORGANIC PLANT NUTRIENT MANAGEMENT ON GROWTH, YIELD AND POST HARVEST STATUS OF BROAD LEAF MUSTARD (*BRASSICA JUNCEA* VAR. *REGOSA*)

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The field experiment was conducted to evaluate “Effect of organic plant nutrient management on growth, yield and post harvest status of Broad Leaf Mustard (*Brassica juncea* var. *rugosa*)” was carried out in Dakshinkali municipality-2 , Kathmandu , Nepal in 2017. There were five treatments viz. T₁ (24 t.ha⁻¹ FYM), T₂ (8 t.ha⁻¹ vermicompost), T₃ (4 t.ha⁻¹ poultry manure) , T₄(12 t.ha⁻¹ compost) and T₅ (Control) with three replication. The experiment was laid out in a Randomized Complete Block Design. The results showed that maximum plant height (36cm), number of leaves per plant (13) , leaves size (868.89cm²) and leaf canopy (0.053m³) were found in with the treatment T₂(8 t.ha⁻¹ vermicompost). The yield per plant (0.149kg/plant), yield per plot (4.37 kg/plot) and yield per hector (8.65kg/ha) were found maximum in T₂ (8ton/ha vermicompost). The maximum vitamin C contained in BLM was found in the treatment T₂ (8 t.ha⁻¹ vermicompost) (48mg/100gm). Similarly in case of post harvest status, the maximum shelf life period in BLM was observed in T₂ (8 t.ha⁻¹ vermicompost) and T₄ (12 ton/ha compost) (9 days each). In terms of organoleptic test, maximum acceptance was found in T₂ (8 t.ha⁻¹ vermicompost) (7.5).

Key world: Organic, FYM , vermicompost , poultry manure , growth , yield

EVALUATION OF SOME WHEAT GENOTYPES UNDER SOWING DATES AND NITROGEN LEVELS: 1. GROWTH AND STRAW YIELD

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A study on the response of five wheat genotypes (Sids 1 and Gemmiza 9 from Egypt, L.R.-52 from Sudan, L.R.-62 and L.R.-67 from Yemen) to three sowing dates (25th November, 10th and 25th December) and two nitrogen levels (120 and 240 kg N/ha.) was conducted at the Agricultural Experimental and Research Station, Faculty of Agriculture, Cairo University, Egypt during 2011/2012 and 2012/2013. The experiment was laid out in RCBD in a split plot design, placing sowing dates in the main plots, nitrogen levels in the sub plots and genotypes in the sub sub-plots with three replications. Sowing dates had significant effect on the number of days to 50% heading, flag leaf area, plant height and straw yield in both seasons. The highest values of the previous traits were obtained at early sowing on 25th November in both seasons. All the studied traits significantly increased by increasing nitrogen levels up to 240 kg N/ha. The genotype L.R.-67 emerged 50% of its heads earlier, Gemmiza 9 and L.R.-67 gave taller plants, L.R.-62 produced the highest number of tillers, whereas Gemmiza 9 and L.R.-62 produced the highest straw yield in both seasons. The earliest heading and the largest flag leaf area were obtained from sowing on 25th December at 240 kg N/ha. in both seasons. Late sowing (December) and low nitrogen applications significantly declined the yielding capacity of the wheat genotypes. Gemmiza 9 and L.R.-62 performed better in term of straw yield as compared to the other genotypes.

Key words: Wheat, sowing dates, N levels, genotypes.

MANAGEMENT OF FRUIT FLIES IN SHENDI AREA, SUDAN FOR SUSTAINABLE MANGO PRODUCTION

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Mango (*Mangifera indica*) is universally considered as one of the most important. Fruit crops in tropical and subtropical areas in the world. In Sudan, more than 40 commercial mango cultivars of international recognitions for their excellent quality grown in different regions of the Sudan. However, in recent years production targets have been seriously hampered, mainly, because of the Sudden and persistent out breaks of fruit flies infestations which exceeded 80% in some of the seriously effected areas This study was conducted at Shendi area in the River Nile State (one of the main mango production areas in Sudan) to investigate the role of cultural practices as a part of integrated pest management to control fruit flies. Three orchards within the study area were chosen and subjected to a package of cultural practices -included hoeing, flooding, orchard cleaning and early harvesting of fruits before ripening. Results showed a highly significant difference in the level, percentage and degree of infestation for the different mango varieties grown on the study areas. The reduction percentage

ranged from (49-73%, 57.3-99 %),(44.9-72%,64.6-83.4) and (29-55%49.6-75.4)% for the three parameters respectively for the two seasons. This result was in accordance with the number of trapped fruit flies per month. High performance of cultural practices on lessening infestation levels of fruit flies give it the priority to be applied as an effective method in management of fruit flies to avoid overlapping of generations and to reduce the growth rate of insects' population.

Sudan is a wide country estimated 1,765,048 Km² with population 41,511,526 in 2018 (World Bank 2018), the arable land estimated to reach 83.333.3 million hectares. Different climatic zone enable the production of many crops especially horticultural crops through out the year. Agriculture sector in Sudan is the most important source of income and livelihood for 60 – 80% of the population. Mango (*Mangifera indica*) is universally considered one of the most important Fruit crops in tropical and subtropical areas in the world. In Sudan, more than 40 commercial mango cultivars of international recognitions for their excellent quality grown in different regions of the Sudan. However, in recent years production targets have been seriously hampered, mainly, because of the sudden and persistent outbreaks of fruit flies infestations which exceeded 80% in some of the seriously effected areas. In the year , 2007 the fruit flies problem became so severe to the extent that they were up graded and added to the list of the notorious national pests of the Sudan. There is always a growing demand locally regionally and globally for fruits and vegetables and thriving export and import trade on these commodities. Sudan is producing fruits and vegetables in, almost, all the comers of the country and its center, especially in areas along the Nile valley and areas where adequate irrigation water is available. The modest production of Sudan fruits and vegetables has always been far less than the local or the regional demand. Consequently there is a serious attempt to increase the production to meet the ever increasing demand . However, in recent years production targets have been seriously hampered, mainly, because of the sudden and persistent outbreaks of fruit flies infestations which exceeded 80% in some of the seriously effected areas. In the year , 2007 the fruit flies problem became so severe to the extent that they were up graded and added to the list of the notorious national pests of the Sudan.

Keywords: Mango, fruit flies , management.

YIELD AND QUALITY OF RHODES GRASS (*CHLORIS GAYANA L. KUNTH.*) AS AFFECTED BY SEED RATE AND NPK FERTILIZER APPLICATION

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A field experiment was conducted for one season (2006/2007) at the Demonstration Farm of the Faculty of Agriculture, University of Khartoum, Shambat, Sudan, to investigate the effect of seed rate and NPK fertilization on yield and quality of Rhodes grass forage (*Chloris gayana* L. Kunth) cv. Finecut. The treatment consisted of three seed rates (SDR₁, SDR₂ and SDR₃) namely 5, 10 and 15 kg/ha and three NPK fertilizer levels (F₀, F₁ and F₂) namely 0, 120 and 240 kg/ha respectively. NPK fertilizer compound N₁₇ P₁₇ K₁₇. The experiment was laid out in a Factorial CRBD with four replications. The results showed that seed rate significantly increased forage fresh and dry yield. NPK fertilization significantly increased forage fresh and dry yield. Neither seed rate nor NPK fertilization were significantly affected crude protein and fiber content of leaves and stems of Rhodes grass, but the increase in seed rate and fertilizer levels slightly increased crude protein and decreased fiber percentage. Seed rate × NPK fertilization interaction showed significant effect on crude protein and crude fiber contents. The highest protein percentage obtained under SDR₂ with highest fertilization level (F₂), and lowest value obtained under SDR₁ with (F₁) fertilization and SDR₁ under control of fertilizer treatment (F₀). Regarding crude fiber, highest value obtained under SDR₂ with F₁ and SDR₃ under control treatments of fertilization (F₀).

Keywords: Rhodes grass, seed rates, NPK fertilizer, yield, quality

EFFECT OF ROOT AND FOLIAR APPLIED FERTILIZER ON YIELD OF POTATO AND CABBAGE

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An investigation was conducted to estimate the absorption efficiency of root and foliar applied nutrients on cabbage and potato in Regional Agriculture Research and Development Centre, Bandarawela (6°49'59.99" N 80°58'59.99" E), Sri Lanka during 2014 and 2015. Experiment was conducted in 1x1x0.2 m wooden boxes filled with soil less medium (Cair dust based) and maintained in protected environmental conditions. A complete nutrient mixture (Albert solution) was applied directly into plant roots, sprayed into leaves to drain out the excess into medium, foliar application only without allowing draining out to medium and compared with no fertilizer control. Experiment was laid out in CRD with three replicates. Plant growth and yield were recorded and Nutrient Use Efficiency (NUE) was calculated. Results showed that, growing medium pH and EC

were varied with initial values and after the crop pertinent to fertilizer application methods and root applied treatment showed higher variations. Root application of plant nutrients was recorded significantly higher yield than foliar application. Significant yield increment recorded by root absorbed nutrients from drained portion of fertilizer to growing medium than only foliar applied treatment according to plant growth and yield of cabbage and potato. It reflected superior NUE in root applied plant nutrients and always cabbage shows higher NUE than potato. Foliar application was not able to fulfill the total plant nutrient demand of cabbage and potatoes.

Key Words – Cabbage, Fertilizer, Foliar application, Potato, Root application

GROWTH AND PRODUCTIVITY OF BARELY (HURDIUM VULGARE L.) AS AFFECTED BY SOWING METHODS AND NITROGEN FERTILIZER LEVELS

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Growth and productivity of barely (*Hurdium vulgare* L.) as affected to two sowing methods (drilling and broadcasting) and three nitrogen levels, i.e. 60, 80 and 100 kg N/fed. (one feddan = 4200m²) were studied at the Agricultural and Experimental Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt during two successive winter seasons 2015/2016 and 2016/2017. The experiments design was split-plot in randomize complete pluck design in four replications. Results indicated that both of sowing method and nitrogen levels significantly affected all growth characters, except leaf area index in the second season, as well as grain yield and its related favorable, except spike length and grain weight/spike, in both seasons. Increasing nitrogen levels up to 80 kg N/fed. caused an obvious increase in net assimilation rate, plant height, number of spikes/m², spike length, weigh of grains/spike, grain yield, straw yield and harvest index. On the contrary, number of days to 50% heading, leaf area index and crop growth rate produced the maximum values at 100 kg N/fed. Drilling method exceeded broadcasting in all studied characters in both seasons. The interaction had significant effect on leaf area index, number of spikes/m² and grain yield which produced the highest values with using drilling method and application of 100 kg N/fed. and 80 kg N/fed., respectively in both seasons. It could be concluded that planting barley with drilling method and application of 80 kg N/fed. are the optimum for increasing barley production under the experimental site and the same conditions.

Key words: Barley, sowing method and nitrogen fertilizer.

ENHANCING MICRONUTRIENTS IN SOIL THROUGH THE USE OF IRON SLIME

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Micronutrient deficiencies are critical in South East Asian Countries and huge amount of government annual budget in health sector has been continuously spent in Zinc and Iron supplement in Bangladesh, Nepal, India, etc. for many years. Micronutrient deficiency in the soils of this region is pertinent and therefore cheaper sources for micronutrient supplementation should be explored. In this line, a research was conducted using waste product of iron and steel industries-iron slime as source of micronutrient and evaluated in cabbage and rice both under green house and field condition. Results in rice growing soil under greenhouse condition showed that the concentration of available Zn was found extremely high in all the treatments and stages of crop growth. Irrespective of treatments, DTPA extractable Zn increased at harvesting stage of rice. Addition of iron slime to soil in proportion of 1:1 showed better availability of Zn than the soil amended with 2:1 proportion of iron slime. Similarly, there was higher concentration of available Cu in both sole soil and iron slime systems. But in case of rice plant, higher amount of total Fe and Cu was observed in rice plant grown with iron slime. With increasing proportion of iron slime, the total Fe and Cu were also found increased. In the soil growing cabbage under greenhouse condition, the concentration of available Zn in iron slime was found of higher order under all the treatments and stages of crop growth. Higher amount of available Cu and available iron content were observed in iron slime throughout the period of experimentation. Addition of iron slime in soil influenced soil available Fe to a great extent. Higher the amount of iron slime added to the soil, higher was the amount of available Fe in the system. With respect to the period of experimentation, the available iron was of higher order at the last stage of the experiment. The total micronutrients content in cabbage plant especially Fe, Mn Cu and Zn were found to be of higher order in cabbage grown in sole iron slime and iron slime treated soil. The total Fe content in cabbage was directly proportional to the amount of added iron slime. Under field condition in rice crop, the total Zn content increased progressively as the crop tended to mature. Higher concentration of Zn was obtained at harvesting stage. Sole iron slime treated soil showed least amount of total Mn in rice plant. Irrespective of treatments, the total iron increased significantly with the period of experimentation up to dough stage of crop growth and then decreased at harvesting stage. Plots amended with iron slime showed higher amount of total iron in plant samples. Addition of iron slime to soil increased micronutrient uptake by rice grains. Comparatively higher amount of Fe and Zn than that of Mn and Cu

were taken up by rice grains. Practically very lower amount of Cu is taken by rice grains. Very little variation was recorded in uptake of micronutrients under different iron slime added treatments. However, it was recorded that grains contain appreciable amount of Zn, Fe and Mn but contained very less amount of Cu.

Having studied all the parameters by treating soil with iron slime, it could be concluded that for enhancing micronutrient in soil system, application of iron slime can be a cheap and environment friendly option.

Keywords: Iron slime, Micronutrients, Greenhouse experiment, Soil, etc.

NEED OF COMMUNITY BASED ANIMAL HEALTH CARE (CBAHC) FOR ANIMAL HEALTH DELIVERY SYSTEM

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Livestock health service delivery requires massive infrastructure by the government. However, the existing infrastructure is not adequate considering the vastness and the population. As such, livestock health service delivery—like other services—, in many countries privatization as part of an international re-structuring for economic development. One important initiative to refocus livestock health service delivery has been the introduction of community based animal health service (CBAHS). The CBAHC is an approach aimed at delivering service that are controlled by the community as opposed to the conventional government controlled or central service delivery approach. It is the delivery of animal health service by selected members of the community who are trained to handle basic animal health care issues at village level. These trainers are called as CAHWs. For sustainability, they are linked to a drug supply system as well as a referral system with veterinary professionals. The CBAHS has now become very popular in many countries. This approach has also been used in the provision of animal health care service in India.

Key words: - CBAHS, CBAHC, CAHWs, Infrastructure, Veterinary

CHARACTERIZATION AND CLASSIFICATION OF SOILS OF SOHAG-RED SEA ROAD SIDES, EASTERN DESERT, EGYPT

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An investigation was carried out to characterize and classify the soils of area about 204 km² where lies between 26° .75, 26° .65 latitudes (N) and 32° .70, 32° .90 longitudes (E) of Sohag-Red Sea Road-sides, Eastern Desert, Egypt. Twelve representative pedons were chosen based on six mapping units identified from the DEM extracted from the Landsat 8 ETM+ satellite image. All pedons were moderate to deep in depth, well drained, slightly to strongly alkaline in soil reaction (7.6-8.4), slightly to moderately saline (3.5- 16 dS m⁻¹), low in organic matter (0.1-0.4%), CEC is low (1.5-7.0 cmol (p+) kg⁻¹), Calcium Carbonates ranged from (1.2-18.2%). Regarding nutrients, the soils were low in available N (1.5-30kg ha⁻¹), low in available P 1.0-9.0kg ha⁻¹), medium to high in available K (100-680 kg ha⁻¹). Further, the soils were low to moderate in available Fe, Mn, Zn and Cu. Soil classification of the investigated area done according to the field survey, morphological description and soil analyses. Two orders of Entisols and Aridisols were recognized representing three subgroups Typic Torriorthents, Typic Torripsammets and Typic Haplocalcids. These results can be used by decision makers to focus on prospective agricultural areas and to achieve land reclamation and better agricultural production.

Keywords: Characterization – Classification – Sohag Red Sea. Corresponding author: Ali R. A. Moursy

IN VITRO AND IN VIVO STUDIES OF SYRIAN NATIVE ISOLATES OF *TRICHODERMA* SPP. AGAINST ROOT KNOT NEMATODE *MELOIDOGYNE INCOGNITA* ON TOMATO

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Seven isolates of three *Trichoderma* species *T. viride*, *T. longibrachiatum* and *T. harzianum* were isolated and tested in order to identify the most appropriate native strains to control root knot nematodes (RKN) under laboratory and semi-field conditions comparing with commercial imported product of *Trichoderma*. Results showed that all native isolates had a potential virulence to parasite some stages of RKN. *T. harzianum* isolate showed highest rate of parasitism on egg masses, the eggs inside them and female stages 95, 43.7% & 90.6% respectively, compared with the commercial product 39.8, 26.2% & 63.2% respectively, this isolate also damped eggs hatching of (RKN) to 5.75% compared with commercial product and control 41.50 & 51% respectively. Three isolates, which had proved its superiority in vitro, was evaluated against

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Meloidogyne incognita in vivo on tomato seedlings under greenhouse conditions, after 30 days the outcomes indicated the ability of *T. harzianum* isolate to decrease the numbers of knots and egg masses per root, but after 90 days the *T. longibrachiatum* isolate exhibited significantly reducing in knots and egg masses' numbers per root 181.30, 166.50 respectively comparing with the commercial product 332.26, 305.76 and comparing with control 493.61, 488.94 respectively. In addition, *T. longibrachiatum* isolate significantly improved plant parameters especially shoot wet weight 198.66 g comparing with the commercial product and control 161.06, 123.86 g respectively.

REJUVENATION OF OLD SENILE ORCHARDS TO RESTORE FRUIT PRODUCTION

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Old and senile orchards that have lost their production potential are a matter of great concern for orchardists. The trees which have become old with dense tree canopy are less productive and produce fruits with inferior quality. This is attributed to overcrowded and intermingled branches and meager foliage, allowing poor light availability to growing shoots within the canopy and renders them uneconomical. There are several reasons for the low productivity and quality of fruit trees which can be compensated by adopting rejuvenation technique. It has been found that replantation of old orchard sites is also cumbersome as it leads to drastic economic loss due to uprooting of old trees combined with poor establishment of new plants on old orchard sites *vis-a-vis* its juvenile period. Thus every effort should be made to invigorate old and neglected trees in order to restore their production potential. However, it must be noted that every tree cannot be rejuvenated. For instance it will be useless to invigorate a tree which is too old, suffering from an inherent virus disease or growing poorly as it has been grown on poor soil, hard pan or rock. Rejuvenation produces best results on trees which have otherwise healthy root system, good vigour but are unproductive because of defects in pruning or cultural practices. The technique of rejuvenation will be different for every large apparently healthy tree, stunted tree and aged and less vigorous tree. Reduced crop productivity in fruit trees because of repeated planting of the same or closely related species has been definitive and recognized by various names including soil sickness, soil exhaustion, and replant disorder and replant problem. In temperate fruits replant problem and replant disorder have been attributed to diminished soil fertility, degraded soil structure and residual herbicide activity. Therefore, retention of juvenility though a tedious practice is important in plant propagation to restore productivity and fruit quality and thus needs to be adopted scientifically to avoid tree mortality or excessive damage.

OPTIMIZING DRIP IRRIGATION FOR CAPSICUM USING CROPWAT MODELING UNDER PROTECTED POLYHOUSE CONDITIONS

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Due to overexploitation of available water resources, it has become very important to optimize water requirements for management of water resources. The study aims to develop an optimal irrigation scheduling, to increase crop yield under water scarcity conditions. The crop water requirement was found to be 560.7 mm and irrigation requirement 540.2 mm. On refilling soil to field capacity with irrigation at critical depletion gave a yield reduction of about 0 %. The research shows that the irrigation management model can effectively and efficiently estimate the crop water requirements. The model, that calculates evapotranspiration and crop water requirements, allows the development of recommendations for improved irrigation practices, the planning of irrigation schedules under varying water supply conditions and yields reduction under various conditions.

AGRONOMIC BIOFORTIFICATION

YOGITA

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Nearly 2 billion people suffer from iron (Fe), zinc (Zn) and/or other (multiple) micronutrient deficiencies in the world. Hidden hunger or micronutrient deficiency retards the growth and development of both crops and humans. Agronomic biofortification is the application of mineral micronutrient fertilizers to soils or plant leaves. Through agronomic biofortification micronutrient concentration in edible crop products can be enhanced and indirectly it will aid in improving human health. There is evidence that agronomic biofortification can increase yields and the nutritional quality of staple crops. Micronutrient fertilization is found to be effective when combined with NPK, organic fertilizers and improved crop varieties, accentuating the importance of integrated soil fertility management. Application of micronutrient-enriched fertilizers is considered to have minimal negative environmental impact.

COMBINED APPLICATION OF MANURES AND FERTILIZERS ON THE GROWTH OF YOUNG TEA PLANTS (CAMELLIA SINENSIS (L.) O. KUNTZE) INTER-PLANTED IN ARECANUT GARDEN**ANJANEYULU*, H. BHATTACHARJEE AND P. S. MEDDA***Department of Plantation Spices Medicinal and Aromatic Crops, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741252.*

Combined application of manures and fertilizers on the growth of young tea plants (*Camellia sinensis*(L.) o. kuntze) inter-planted in arecanut garden, was investigated at Instructional plots of the Department of Plantation Crops and Processing, UBKV, Pundibari, West Bengal during March, 2016 to May, 2017. The experiment was conducted with five treatments (T_1 : Control), (T_2 : FYM@2.0kg+1/2RDF), (T_3 : Vermicompost@1.0kg+1/2RDF), (T_4 : FYM@2.0kg+RDF) and (T_5 : Vermicompost@1.0kg+RDF) with four replications and laid out in Randomized Complete Block Design (RCBD). Fertilizer is one of the major agro-inputs contributing to the cost of production and productivity in tea plantation, for proper maintenance of the health of tea bushes and to obtain high yield a well-balanced fertilization is necessary throughout the year. For maintaining the soil health integration of various factors like physical, chemical and biological properties of soil, climate, addition of organic matters are vital for achieving maximum return from the investment and productivity of the soil, so that the use of integrated nutrient management is very important, best approach to maintain and improve soil fertility thereby to increase crop productivity in an efficient and environmentally, without sacrificing soil productivity of future generations. Growth parameters were recorded from 30 to 360 days after planting. Experimental results were not statistically significant difference among the treatments on 30 days after planting. The treatment T_5 : VC+RDF has given best results regarding the growth parameters like minimum number of days taken to reach pluckable height of 55cm (98.00), maximum number of leaves (75.5 per plant), number of branches (15.55 per plant) and plant girth (29.43 mm) at collar region, followed by T_4 : FYM+RDF and T_3 : VC+1/2 RDF whereas the minimum results was recorded by T_1 : control. Results were varied significantly with application of manures and fertilizers inter planted in arecanut garden among the treatments from 60 to 360 days after planting.

Key words: Growth, Integrated nutrient management, Form yard manure and Vermicompost.

SURVEY OF RICE SHEATH ROT DISEASE AND ASSESSING THE GROWTH AND PATHOGENICITY OF *SAROCLADIUM ORYZAE*.**VENGADESHKUMAR AND T. MEERA***Department of Plant Pathology, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu, India-608 602.*

Rice sheath rot is caused by *Sarocladium oryzae* also one of the major factor of rice production constrain. Hence, the present study was conducted with an objective to assess the prevalence and incidence of rice sheath rot disease in different regions of Nagapattinam district, Tamil Nadu, India and assess the cultural characters and pathogenic variability among the isolates of *S. oryzae*. The survey clearly revealed that the disease incidence ranged from 12.32 to 30.43 per cent showing the endemic nature of the disease. Among the media tested both solid and liquid, PDA and PD broth was found to be the best in supporting the mycelial growth (4.55cm) and mycelial dry weight (317.34mg) of the pathogen. Among the isolates SO_{17} was found as the most virulent which recorded maximum per cent disease incidence (58.33%) with maximum lesion size 39.40 mm length and 5.31 mm width on rice variety ADT 39. Also, the study proved that grain inoculation method is a best in taking infection and affecting crop among the different methods of artificial inoculation tested.

CONSORTIUM OF FUNGAL AND BACTERIAL ANTAGONIST FOR THE MANAGEMENT OF STEM ROT OF CLUSTER BEAN**A. MUTHUKUMAR***Department of Plant Pathology, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002, Chidambaram, Tamil Nadu, India.*

Cluster bean (*Cyamopsis tetragonaloba* L.) which is known as Guar means "cow food" (Hindi) belonging to the family leguminosae. It is an annual, arid and semi-arid legume crop. The crop has got a special importance because of gum content in its seed. The crop is subjected to be infected by several fungal diseases. Among these, stem rot caused by *Sclerotium rolfsii* Sacc. cause 50-70% mortality of seedlings in the field. The objectives of the present study were isolation and identification of antagonistic microorganisms from native soil and tested for its efficacy against *S. rolfsii* *in vitro* and *in vivo*. Results of the *in vitro* studies reveals that *T. harzianum* isolate 4 (THM) recorded maximum growth inhibition (68.10 per cent) of pathogen by using dual culture technique. Of the bacterial antagonists tested, *P. fluorescens* isolate 3 (PFV) recorded the maximum inhibition zone (13.33 mm)

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with a minimum mycelia growth (23.00 mm) of *S. rolfsii* over control. Results of the *in vivo* studies reveals that the combined application of selected isolate of talc-based formulation of *T. harzianum* + *P. fluorescens* (ST+SA) and challenge inoculated with *S. rolfsii* to soil recorded maximum plant height (110.33 cm), pod length (9.8 cm) and highest pod yield (8.0 t/ha) of cluster bean.

EFFECT OF DIFFERENT MULCHES FOR MANAGEMENT OF OKRA FLEA BEETLE (*PODAGRICA BOWRINGI*) Baly

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The research was conducted to evaluate different mulches for management of okra flea beetle (*Podagrica bowringi*) Baly at Agronomy farm, College of Agriculture, Dapoli during *kharif* 2017. The observations recorded at 1st week after first soil application indicated that the treatment (M₃) black polythene mulch (7.17) was found to be effective treatment. At 2nd week, (M₃) black polythene mulch treatment recorded (6.97 shot holes/three leaves/plant). At 3rd week the treatment (M₃) black polythene mulch was found to be the effective treatment which recorded 7.17 shot holes/3 leaves/ plant. At 1st week after second soil application indicated that the treatment black polythene mulch (M₃) was found to be effective treatment (8.70 shot holes per three leaves per plant). At 2nd week, minimum numbers of shot holes were recorded in the treatment (M₃) black polythene mulch (9.50 shot holes/3 leaves/ plant). At 3rd week revealed that (M₃) black polythene mulch, (M₂) silver polythene mulch and (M₁) transparent polythene mulch recorded 8.60, 9.77 and 10.11 shot holes per three leaves per plant, respectively and all these treatments were at par with each other. There was same trends observed during third soil application.

Key words: Mulches, *Podagrica bowringi*, Flea beetle, transparent mulch, Silver mulch, Black mulch etc.

STUDIES ON SEEDS MYCOFLORA OF *WITHANIA SOMNIFERA* (L.) DUNAL DURING PRE HARVEST, POST HARVEST AND STORAGE CONDITIONS ALONG WITH BIOCHEMICAL ESTIMATIONS OF INFECTED STORED SEEDS

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Withania somnifera (L.) Dunal is an important medicinal plant belonging to family Solanaceae. In order to screen the succession of mycoflora associated seeds of *W. somnifera*, seeds were obtained at pre harvest, post harvest and at storage conditions. In total 36 fungal species were isolated by using three incubation methods i.e. agar plate method, standard blotter paper method and deep freezing method. A qualitative and quantitative differences were recorded with seeds obtained from three different stages. A significant changes in the mycoflora was noted with the advancement of age. In general, the number of fungal species associated were found to be the highest in storage seeds followed by post harvest seeds and then in pre harvest seeds. Fungal association with seeds not only affected seed health but also caused loss in nutrients. Healthy and infected seeds of *W. somnifera* were also evaluated quantitatively for their protein, carbohydrates and total alkaloid contents. A comparative study revealed a reduction of 1.70%, 2.74% and total 15.39 mg/kg in protein, carbohydrate alkaloid contents respectively in infected seeds in comparison to their healthy counterparts.

DROUGHT ASSESSMENT UNDER CLIMATE CHANGE BY USING NDVI AND SPI FOR MARATHWADA

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Drought is considered to be the most vulnerable natural hazards which affect large amount of people. The impacts of drought are nonstructural and spread over a large geographical area damaging the life of human beings. Marathwada the most vulnerable region to frequent droughts located in central India was selected as the study area. The spatial and temporal data of region required for the drought analysis was collected from meteorological stations and satellite data Resourcesat-1 Awifs was procured from NRSC, Hyderabad. GIS was used to analyze the spatial and temporal variation of drought across the study area to determine the drought affected area accurately so as to provide effective drought proofing. Meteorological drought analysis was performed by Standardised Precipitation Index (SPI) to determine drought severity classes. Using NDVI analysis, Marathwada region is classified into severe, moderate, mild drought classes. Frequencies of various drought classes were determined by using SPI. Drought classification based on SPI indicated that majority of the region suffered from extreme to severe drought conditions for 2 to 3 times during study period. Based on the drought risk

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area map was prepared for Marathwada region.

Keywords: Meteorological Drought, Standardized Precipitation Index, Agricultural Drought, NDVI, GIS

AZOLLA AN ALTERNATIVE GREEN FODDER FOR LIVESTOCK

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India has the largest livestock population and is first in terms of milk production in the world too. But the average milk productivity has become stagnant and needs to be improved. Nowadays greatest problem that Indian livestock farmers are facing is the shortage of fodder due to cultivation of high yielding varieties, shrinkage of grazing lands, urbanization, replacement of traditional sources of cattle feed like coarse grains and oilseeds by cash crops etc. Under such pressure a number of steroids, synthetic antibiotics and vitamins are used to increase production of milk, meat, egg etc. These chemicals accumulate in the human body, through the consumption of animal products and could cause various degenerative diseases. If we can substitute the cattle feed with natural feeds that are rich in useful nutrients, it will be of great importance for human and animal health. Hence Azolla can be used as unconventional high potential feed for non-ruminants. Azolla is highly beneficial in terms of - good source of protein (contains almost all essential amino acids), vitamin A, precursor beta-carotene, vitamin B₁₂, growth promoter intermediaries and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium etc., contains 25-35% protein, 10-15% minerals and 7-10% of amino acids, bio-active substances and bio-polymers on dry weight basis, the carbohydrate and fat content is very low, its nutrient composition makes it a highly efficient and effective feed for livestock as livestock easily digest it, owing to its high protein and low lignin content, and quickly grow accustomed to it, easy and economical to grow, Azolla as feed substitute shows overall increase of milk by 15-20%, Azolla feeding improves the quality of milk and animal health, improves the weight of broiler chicken and increases the egg production in case of layer and it can also be feed to sheep, goat, pig and rabbit as feed substitute for better growth. By this way, Azolla can be used as a good substitute for the cattle feed. It is palatable and cheapest nutrition to cattle, buffaloes, ducks, chickens, pigs, goats, sheep and rabbits. Cultivation and harvesting of Azolla is also very easy. Moreover, the bio-product of Azolla cultivation after 6 month can be used as bio fertilizer in organic farming or fields. Azolla cultivation is thus a sustainable way out for fodder crises

AMELIORATION OF TEMPERATURE STRESS DAMAGE IN FRUIT CROPS

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Any deviation from this optimal condition of any factor essential for its growth will lead to aberrant change in physiological processes and due to this plant body will experience tension and this state can be referred as plant under stress. Abiotic stress is defined as the negative impact of non-living factors on the living organisms in a specific environment. This stress may have adverse effect on germination, photosynthesis, respiration, water relations and membrane stability, may also modulate levels of hormones and primary and secondary metabolites. Among the abiotic environmental factors temperature is the most important factor which significantly affects life processes of all organisms. Temperature stresses experienced by plants are usually classified into three types: high temperature stress, chilling stress (occurring at temperatures below freezing) and freezing stress (occurring at low temperatures above freezing). Both low and high temperatures affect plant growth and development at whole plant level, tissue and cell level and even at sub-cellular level. Temperature variation may affect morphology, anatomy, phenology and plant biochemistry at all levels of organization. Direct injuries due to high temperatures in plants include protein denaturation and aggregation, and increased fluidity of membrane lipids. Indirect high temperature injuries include inactivation of enzymes in chloroplast and mitochondria, inhibition of protein synthesis, protein degradation and loss of membrane integrity. Low temperature stress during reproductive development induces flower abscission, pollen sterility, pollen tube distortion, ovule abortion and reduced fruit set, which ultimately lowers yield. Temperature stress is a multigenic trait and a number of approaches are being used to alleviate the effect of temperature stress in fruit crops: addition of low concentration of inorganic salt, osmoprotectants, signalling molecules (growth hormones), oxidants (H₂O₂), preconditioning of plants, exogenous application of Ca²⁺ (CaCl₂), organic compounds (glycinebetaine and polyamines), plant nutrients like macronutrients (nitrogen, potassium, calcium and magnesium), micronutrients (boron, manganese, and selenium) and salicylic acid, mycorrhizal efficacy.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**FOLIAR APPLICATION OF MICRONUTRIENTS ON GROWTH AND YIELD OF AONLA (EMBLICA OFFICINALIS GAERTN.) CV. NEELUM****ABHIJITH, Y.C1*, DINAKARAADIGA, J2., HONNABYRAIAH, M.K3., KISHOR, H4 AND SINDHU, C5**

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Aonla (*Embllica officinalis* Gaertn.) belongs to family Euphorbiaceae and is popular as backyard fruit throughout the country. Owing to its hardy nature, suitability to waste land, high productivity, high nutritive and therapeutic value, it became an important fruit for small and marginal farmers. Though it is a hardy crop, growers are experiencing the problem of heavy premature fruit drop, incidence of nutritional disorders which leads to reduced yield and reduced quality which is accompanied with deficiency of nutrients, particularly micronutrients. Hence, to overcome the issue, the present study was conducted and the results revealed that the foliar spray of micronutrient combination of 0.5 % $ZnSO_4$ + 0.5 % $FeSO_4$ + 0.25 % Borax significantly increased overall growth of plants including plant height (0.86 m), spread in both East-West (0.90 m) and North- South (0.92 m) directions, reduced the incidence of fruit drop (45.60 % as against 79.63 % in control) resulting in increased fruit set (53.73 % as against 21% in control). The said combination of micronutrients was also associated with increased fruit physical parameters like increased fruit weight (43.69 g), pulp weight (43.03 g), fruit:pulp ratio (22.18) and higher yield levels (24.96 kg/plant).

Key words- deficiency, foliar spray, fruit drop

FARMER DISTRESS AND IMMEDIATE RELIEF FOR AGRICULTURAL DEVELOPMENT**ABHILASH SINGH MAURYA AND JOGINDER SINGH MALIK**

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Natural disasters such as droughts, floods, cyclones, storms, landslides and earthquakes can lead to extreme distress and hardship among farmers who predominantly lead subsistence existence. In these situations, they need at least a minimal amount of relief at rapid pace. In the past, crop insurance has been the vehicle for such relief but crop insurance typically covers only those farmers who have outstanding loans from banks. This leaves out marginal farmers who are unable to borrow from the banks. It also leaves out landless workers who depend on agricultural employment but are themselves not farmers. Therefore, a mechanism is required to bring quick relief to all those impacted directly or indirectly by natural disaster. Given that much of the cost of insurance is borne by the government, it is effectively a transfer rather than genuine commercial program. Therefore, it may be best to conduct the relief transparently as an emergency social program. The government should create a database that identifies farmers and landless workers with their respective Aadhar seeded bank accounts. In case of a natural disaster, transparently identified by weather data and a set of weather related criteria, the government should then transfer a minimum specified sum of cash immediately into these accounts. The cash would provide instant relief to those damaged by the natural calamity. For richer farmers who may want insurance above this relief, a separate commercially viable crop insurance program may be operated. If the government has a preference for an insurance program for this purpose, it should evolve a mechanism for the introduction of a diversified set of crop insurance products offered by different insurers who compete against one another. The objective should be to cover all farmers small, marginal and others with those having 2 ha or less land covered at substantial subsidy on the premium. Farmers with more than 2 ha land should be required to pay the premium in full to avail the benefits. Appropriate avenues should also be explored to create jobs for those farmers interested in exiting farming. Farm-oriented processing and small-scale industries offer two such avenues.

Key words: Natural disasters, Crop insurance

"EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA L.)."**ABHILASH SINGH, D. K. SINGH AND ASHISH K. SINGH**

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The experiment was conducted at research farm, Department of Horticulture, Udai Pratap College, Varanasi (U.P.) during the year 2016-17. The Nine treatments are T_1 -Recommended dose of NPK ha^{-1} (150 kg:125 kg:100 kg), T_2 - Half dose of NPK ha^{-1} + FYM @ 15 t ha^{-1} , T_3 - Half dose of NPK ha^{-1} + FYM @ 15 t ha^{-1} + *Azospirillum* @ 5 kg ha^{-1} , T_4 - Half dose of NPK ha^{-1} + FYM @ 15 t ha^{-1} + Phosphorus Solubilizing *Mycorrhiza* @ 5 kg ha^{-1} , T_5 - Half dose of NPK ha^{-1} + FYM @ 15 t ha^{-1} + Phosphorus Solubilizing *Mycorrhiza* @ 5 kg ha^{-1} + *Azospirillum* @ 5 kg ha^{-1} , T_6 - Half dose of NPK ha^{-1} + Vermicompost @ 2.5 t ha^{-1} , T_7 - Half dose of NPK ha^{-1} + Vermicompost @ 2.5 t ha^{-1} +

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Azospirillum @ 5 kg ha⁻¹, T₈-Half dose of NPK ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹ + Phosphorous Solubilizing *Mycorrhiza* @ 5 kg ha⁻¹ and T₉-Half dose of NPK ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹ + *Azospirillum* @ 5kg ha⁻¹ + Phosphorus Solubilizing *Mycorrhiza* @ 5 kg ha⁻¹ were evaluated in randomized block design with three replications.

The experimental findings was revealed that the treatment T₈ (Half dose of NPK ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹ + Phosphorous Solubilizing *Mycorrhiza* @ 5 kg ha⁻¹) showed better response to plant growth and its attributes on quality of cabbage (TSS and Ascorbic acid). Therefore, treatment T₈ can be used further in growth enhancement of cabbage.

A VIEW ON SITE-SPECIFIC NUTRIENT MANAEMENT IN RICE

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Site-specific nutrient management (SSNM) is a plant-based approach for managing the nutrient requirements of rice. It provides principles and tools for supplying rice with nutrients as and when needed to achieve high yields while optimizing use of nutrients from indigenous sources. Three steps in SSNM are to establish a grain yield target, effectively use existing nutrients and apply fertilizer to fill the deficit between crop needs and indigenous supply. SSNM could decrease N rate to a greater extent without any sacrifice in grain yield, when compared with farmers' fertilizer practice. Number of productive panicles under SSNM but productive tiller rate was much higher under SSNM. Leaf area index LAI and root weight were lower under SSNM than those under Farmer field practices before panicle initiation, but the results were reversed after heading stage. SSNM increased efficient and high efficient LAI rates at the heading stage, dry matter accumulation from heading to maturity stage, ratio of root to shoot, photosynthetic rate in flag leaves after heading stage and light transmission rate in rice population at the full heading stage. Reasons for yield increase and nutrient uptake laws in rice under SSNM were that SSNM significantly reduced nitrogen applied rate without any sacrifice in grain yield. When compared with farmers' fertilizer practice, SSNM increased milling quality and transparency, whereas decreased chalky grain rate, chalky area and chalkiness, leading to an improvement in appearance quality. SSNM also decreased amylose content, gelatinization temperature and protein content, but increased gel consistency. This approach advocates optimal use of indigenous nutrients originating from soil, plant residues, manures, and irrigation water. Fertilizers are then applied in a timely fashion to overcome the deficit in nutrients between the total demand by rice to achieve a yield target and the supply from indigenous sources.

Keywords : Site specific nutrient management, nitrogen mangement, paddy rice system

“POPULATION DYNAMICS OF RICE INSECT-PESTS AND MANAGEMENT OF YELLOW STEM BORER (*SCIRPOPHAGAINCERTULAS WALKER*)”

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The present investigations were carried out at NDU&T Crop Research Station of Masodha, Faizabad during *Kharif* 2015, with objectives to study population dynamics of insect-pests of rice, to study correlation between population of insect-pests of rice and abiotic factors and evaluation of newer insecticides against rice yellow stem borer. Population dynamics of insect-pests at different stages *viz.*, maximum tillering, panicle initiation, flowering and dough stages of crop. The Green Leaf Hopper, Leaf Folder, Yellow Stem Borer, Grass Hopper, and Rice Hispa were the prevailed insect pests of rice. The incidences of insect-pests were found maximum at tillering stage of crop and lowest at initial crop growth stage except Rice Hispa. The correlation coefficient between population of insect-pests and abiotic factors revealed that Yellow Stem Borer, Grass Hopper, and Leaf Folder population was negatively correlated with minimum temperature, relative humidity and rainfall. The population of Rice Hispa and Green Leaf Hoper was positively correlated with abiotic factors. Among the various insecticides evaluated against yellow stem borer, fipronil 5 SC @ 50 gm a.i./ha treated plots showed lowest infestation and gave higher grain yield (32.90q/ha) followed by imidacloprid 17.8 SC (31.90q/ha) and carbofuran 3 G (30.25q/ha). The highest cost: benefit ratio was also obtained from fipronil 5 SC followed by imidacloprid 17.8 SC and monocrotophos 36 SL which were economical than others.

Key word- Population dynamics, Rice, Abiotic factors and cost: benefit ratio.

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PLANT GROWTH REGULATORS (PGR) IN NURSERY**ABHINAV KUMAR, ATUL YADAV, DHEERAJ YADAV, SNEHA SINGH, SACHI GUPTA, RAVI PRATAP SINGH, HARENDRA AND ARCHIT SINGH***Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad*

Plant growth regulators are the chemical compounds other than nutrients which are required in small or minute quantities to regulate modify or inhibit the plant physiological processes. Plant growth hormones are the chemical compounds synthesized by the plant inside its body and transported from site of production to site of action to regulate, modify or inhibit the plant physiological processes. Gibberellins: Play important role in cell elongation in plant cells e.g., Gibberellic Acid GA1, GA3, GA7, Auxines: Play important role in cell division and cell multiplication. These substances are used mainly for the root initiation, e.g., Indol Acetic Acid (IAA), Indol Butaric Acid (IBA) and Naphthalic Acetic Acid (NAA), Cytokinins: Play important role in cell elongation, e.g., Kinetin, Zeatin, Absciscic Acid: Growth retarding substance and plays an important role in fruit drop and thinning, e.g., ABA, Ethylene: Mainly called as ripening hormone which hastens ripening in fruit crops. Ethrel also useful for sex expression in cucurbitaceous vegetable crops. Eg, Ethephon, Ethrel. Large number of plants are propagated by stem cutting, leaf cutting and layering. For promoting rooting, the commonly used hormone is IBA followed by NAA. IBA enhances root formation on cuttings. Cytokinins also help in quick and profuse root formation on cutting and layers. By use of IBA, profuse root formation is observed in cutting at fig, pomegranate, croton, rose rootstock, hibiscus, grape etc.

Keywords - Plant growth regulators, physiological processes, site of action etc

BONSAI STYLES, PLANTS, CONTAINERS, CULTURAL PRACTICES, SPECIAL PRACTICES, CARE AND MAINTENANCE**ABHINAV KUMAR¹ AND A.K.SINGH²***Department of Floriculture and Landscaping¹, Department of Fruit Science², N.D.U.A. & T. Kumarganj, Faizabad, U.P., India*

The word Bonsai is derived from Chinese Penjing and in Japanese 'bon' means, 'shallow pot' and the 'sai' means "plant" which is translated as 'tray planting'. Bonsai is the art of growing trees, proportionately in small containers, occasionally in combination with rocks of many forms, by treating them with certain techniques in order to reproduce in miniature the lordly appearance of large and aged trees or landscape as found in nature. In recent days, the demand for bonsais is growing rapidly in leaps and bounds and has attained the status of an exclusive sector in the landscape gardening industry. *Ficus benjamina*, *Ficus neriifolia*, *Schefflera arboricola*, *Crassula ovate*, *Portulacaria afra*, *Dracaena marginata*, It takes long time, in the first place growing a house plant and then successfully shaping into perfect bonsai. This system is highly practical and commonly used. It is carried out by taking cutting from the matured shoots, layering, grafting and budding methods. Seedlings of mature trees of local origin viz., gardens, terraces and fields along side of roads. For collection of these seedlings soil from the plants must be loosened using shovel, then only gently lift the plants without injuring the taproot. If the seedlings are to be planted immediately, simply cover the roots with loose and wet soil to prevent drying. If the planting delayed for few days, then cover the seedling with moist sphagnum moss or newspaper to keep the plants from drying out. After collection 2-3 year old seedling from the field, immerse the roots in a bucket of water or emulsion of clay and water.

Keyword Bonsai, small containers, demand, trees or landscape etc.

MODERN ASPECTS OF MUSHROOM CULTURE**ABHIRAM***Maya Group Of Colleges*

The production and culture of new species of mushrooms is increasing. The breeding of new strains has significantly improved, allowing the use of strains with high yield and resistant to diseases, increasing productivity and diminishing to use of chemicals for pest control. The improvement and development of modern technologies, such as computerized control, automated mushroom harvesting, preparation of compost, production of mushrooms in non composted substrate, and new methods of substrate sterilization and spawn preparation, will increase the productivity of mushroom culture. All these aspects are crucial for the production of mushrooms with better flavor, appearance, texture, nutritional qualities and medicinal properties at low cost. Mushroom culture is a biotechnological process that recycles ligninocellulosic wastes, since mushrooms are food for human consumption and the spent substrate can be used in different ways. Discover the world's

Modern aspects of mushroom culture.

USE OF AGRO-INDUSTRIAL WASTE IN CROP PRODUCTION**ABHISHEK ANEJA¹, AMAN DEEPRANGA², SOURAV KUMAR²***Department of Agronomy, ²Department of Genetics and Plant Breeding, School of Agriculture, Lovely Professional University, Phagwara-144411*

In India, about 960 million tonnes of solid waste is being generated annually as by-products during industrial, mining, municipal, agricultural and other processes. 350 million tonnes are organic wastes from agricultural sources. Agro-industrial waste is the waste generated by the agro-industrial activity which involves any material that is rendered purposeless during a production process such as that of factories, industries and mills. Most of the agro-industrial wastes are untreated and underutilized and are disposed of either by burning, dumping or unplanned landfilling. Due to high nutritional composition, these residues are not labelled as “wastes” but considered as raw materials for other product formation and developments. The existence of such nutrients in these residues offers suitable conditions for the prolific growth of microorganisms. These microorganisms have potential to reuse the waste as raw materials for their growth through fermentation processes. These raw materials consist of molasses, husks, bagasse, seeds, leaves, stem, straw, stalk, shell, pulp, stubble, peel, roots, etc. and used for animal feed, soil improvement, fertilizers, manufacturing, and various other procedures. Agricultural residues are rich in bioactive compounds and are also free from phytotoxic compounds as evident from the phytotoxicity test. The organic substrates in solid waste can be biodegraded and stabilized by composting and the final compost products could be applied to land as the fertilizer or soil conditioner. Most of the field wastes can be used globally for the production of biofuels, biogas in place of heat, and power through various technologies.

Keywords: Untreated, Underutilized, Bioactive, Phytotoxicity Test

SHIITAKE MUSHROOM: A NEW HOPE FOR MUSHROOM CULTIVATION**ABHISHEK PANDEY***Department of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut-250001*

The Shiitake mushroom is used as anticarcinogenic, anti-inflammatory, antioxidant, antifungal, antibacterial, antiviral as well as antithrombotic in cardiovascular disorders. This article has been written to throw some light on Shiitake mushroom which has many nutritional values. In (15 gram) Niacin 11% of the RDI, vitamin B5 33% of the RDI, selenium 10% of the RDI, vitamin B6 7% of the RDI, Lentinan (1,3 beta D glucan). Cultivation practices for this mushroom where recently done with willow tree it is nearly calculated that average 750 gm of mushroom from 1 kg of willow sawdust this mushroom has a good self life and dried shiitake fetching Rs.2000/kg. This mushroom is grown with very low economic investment with high return. A successful story related to Shiitake, has further refined the growing technology by using willow wood as a substrate. He is the first farmer in the country to use willow tree wood as a substrate to grow Shiitake variety. It was found that growing Shiitake on sawdust but return was not so good production later on some scanty reference in literature about using willow tree logs as a medium for growing. Some reports are found in favor of high return with an investment of just Rs. 6,000 some years back today it is estimated worth nearly Rs. 4 crores all earned from mushroom cultivation. Explaining the procedure the entrepreneur says, “willow logs of 40 inch length and three to four inch diameter are ideal. Holes are drilled into the logs and spawns (in the form of bullets) are inserted into the holes and sealed with wax. The logs are kept in the open under shade. Fruiting of shiitake starts in just three months and continues for four to five years. Basically shiitake is boon for the medical field in relation with cancer treatment & depression patient.

MUSHROOM CULTIVATION BY WASTAE**ABHISHEK SHUKLA***Department of plant pathology, Chandra Shekhar Azad University Of Agriculture And Technology Kanpur 208002, UP, India*

Mushroom cultivation is an effective method for the production of nutritional food in addition to offering a holistic approach to agro waste management by utilization of the abundant lignocellulosic waste including sisal leaf decortication waste (SLDW). Production of 1 kg of mushrooms generates 5 kg of a co-product called spent mushroom substrate (SMS). Alternative means of disposal of the resulting SMS is production of extracellular enzymes generated by mushrooms during their growth and development. In this study, *Pleurotus HK 37* was studied for its ability to produce laccase manganese peroxidase (MnP), lignin peroxidase (LiP) and xylanase on SLDW under solid-state fermentation. Laccase activities reached the highest values of 27.3 U/ml when the substrate was fully colonised. The activity declined with each subsequent harvest to 15.0 U/ml. MnP assay had two peaks of 8.9 U/ml and 8.0 U/ml on full colonisation and during the 3rd flush, while LiP and xylanase activities had highest recorded activities of 0.34 U/ml and 0.28 U/ml, respectively. The results of this study demonstrate the potential utilization of sisal leaf decortication waste as raw materials for simultaneous production of edible mushrooms and extracellular enzymes from a commercial fungus, *Pleurotus HK 37*, which is a potential biotechnological application.

EFFICACY OF OIL CAKES EXTRACTS AGAINST LARVAL MORTALITY OF RICE ROOT KNOT NEMATODE (*MELOIDOGYNE GRAMINICOLA*).**ABHISHEK KUMAR, KAMAL KHILARI, JASKARAN SINGH, AMIT KUMAR YADAV, AJAY KUMAR MISHRA AND SATPAL SINGH***Department of Plant Pathology SVPUA&T Meerut 250110 (U.P.)*

Rice is one of the most important food crops in the world. In India, rice contributes 43 per cent of the total food grain production and 46 per cent of the total cereal production. Rice crop is affected by many fungal, bacterial, viral and nematode diseases. Among the nematodes, rice root knot nematode (*Meloidogyne graminicola*) is considered as a major problem in rainfed upland and low land rice. Root knot nematode produced different type symptoms on rice like stunted growth, leaf yellowing and wilting during the hottest part of the day. The main symptom produced by root-knot nematode was gall formation. Galls on rice roots were club and hooked shaped. In present study, the experiment was conducted to test the efficacy of oil cake extract against mortality of rice root knot nematode. In this experiment, eight oil cakes viz. Neem, cotton, linseed, groundnut, sunflower, sesamum, mustard and mahua oil cake were taken in three different @ 5, 10 and 25% concentration. The nematicidal activity of extract of oil cakes was also tested against J₂ of *Meloidogyn graminicola*. At 5% concentration, maximum larval mortality (89%) was observed in linseed cake extract after 48 hours of inoculation. After 72 hours of inoculation, 100% larval mortality was observed in all tested cake extract. At 10% concentration, after 48 hours of inoculation, maximum larval mortality (100%) was observed in linseed cake extract followed by neem cake extract (99.67%). At 25% concentration, all tested oil cake extract were effective against J₂ of *Meloidogyn graminicola* with 100% larval mortality within 24 hours of inoculation.

Key words:- *Meloidogyne graminicola*, Larval mortality, and oil cakes extract.

FARM MECHANIZATION & POST HARVEST TECHNOLOGIES AND THEIR MANAGEMENT**ABHITEJ SINGH SHEKHAWAT¹, AKANSHADEORA², PUSHPENDRA SINGH³ & BHAWANI SINGH PRAJAPAT⁴**

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Agriculture Mechanization technology plays a key role in improving agricultural production in developing countries and should be considered as an essential input to agriculture. The term "Farm Mechanization" is used as an overall description of the application of the variety of tools, implements, equipment, machinery, power & other mechanical inputs. Empirical evidence confirms that there is a strong co-relation between Farm Mechanization and Agricultural Productivity. State with greater availability of farm power shows higher productivity as compare to others. The Govt. of India had launched Central Sector Scheme "Sub-Mission on Agricultural Mechanization (SMAM)" under the aegis of National Mission on Agricultural Extension & Technology in all states to promote the usage of farm mechanization and increase the ratio of farm power to cultivable unit area up to 2 kW/ha and the most ambitious scheme "Chief Minister Samagra Gramya Unnayan Yojana (CMSGUY)" with an objective to achieve the desired growth of Agricultural Mechanization by providing one Tractor Unit to each revenue village of the State covering 25 villages. Post harvest technologies deals in the operations required to make agricultural commodities edible after harvesting and to increase the usable economic life of the crops and commodities. By performing the operations, value addition is done to the commodities with subsequent benefits such as more profit to the producer / trader, avenues for entrepreneurs & employment generation, food security and socio-economic uplift. It is done through performing operations such as primary & secondary processing and by performing operations of preservations like canning, refrigeration, controlled atmospheric storage, dehydration or drying, chemical treatment and use of subatomic particles. The application of sustainable mechanization in post-production operations through more efficient use of labour, the timeliness of operations and more efficient field and off field operations contribute to high-productivity systems. Examples of the application of mechanization in post-production operations are threshing, dehulling and milling operations, drying, processing of roots and tubers, transportation, hire services, repair and maintenance.

STORAGE QUALITY OF POTATO TUBER MOTH (*PHTHORIMAEA OPERCULELLA*)**ABHIVIVEK* NAVEEN KUMAR** VINAY KUMAR KARDAM*****

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Potato tuber moth (PTM), *Phthorimaea operculella*, is a serious pest in field and storage system, in most countries where potatoes are grown, where the use of repellent plants is an environmentally sound alternative to the application of chemical pesticides. Potato tuber moth is a highly destructive pest of the cultivated potato (*Solanum tuberosum* L.) in the tropics and subtropics and causes significant damage to both leaves and tubers. Entomopathogens offer promise as alternatives to broad spectrum insecticides for management of this

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pest. Many cultural practices that are used by farmers to improve the yield and quality of potato can also limit the development of the potato tuber moth and minimize damage to tubers. Low infestation at harvest and rapid handling of the potatoes going into store established good initial storage conditions and decreased the likelihood of post-harvest losses. Potato tuber moth control was achieved by applying a synthetic pyrethroid (permethrin) or *Bacillus thuringiensis* at the beginning of the storage period.

Keywords: repellent, infestation etc.

STUDIES ON SEED MYCOFLORA OF *WITHANIA SOMNIFERA* (L.) DUNAL IN RELATION TO DIFFERENT STORAGE CONDITIONS AND THEIR EFFECT ON SEED GERMINATION AND SEEDLING VIGOUR

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Withania somnifera (L.) (Ashwagandha) is an important medicinal plant belonging to the family Solanaceae. Present studies were carried out to investigate the fungi associate with seeds in relation to different storage conditions (Nature of containers, duration and temperature) and their effect on seeds germination and seedling vigour. The experiments were conducted at Deptt. Of Botany, MBPG College Haldwani, K.U. Nainital. The seeds were stored in three different containers i.e. gunny bags, polythene bags and tightly sealed steel containers at three different temperatures i.e. 20°C, 30°C & 40°C for the durations of 2, 4 & 6 months. A total 17 fungi were isolated from seeds kept in different storage conditions by using standard blotter paper method. Among three containers used in studies, the highest number of fungi was found to be associated with the seeds kept in gunny bags at all temperatures viz. 20°C, 30°C & 40°C and durations viz. 2, 4 & 6 months followed by polythene bags and tightly sealed steel containers. Similar results were also found when seeds were tested for percent germination and seedling vigour. The lowest percent germination and seedling vigour was recorded with the seeds kept in gunny bags at all durations of storage and temperatures used in experiment. The gunny bags were not found safe for storage of *W. somnifera* seeds in comparison to tightly sealed steel container and polythene bags. Seeds kept in gunny bags absorbed higher moisture as compared to other two containers. Thus the tightly sealed steel containers can be suggested as good container for storage of *W. somnifera* seeds at different temperatures for long durations of storage.

INCIDENCE OF CHICKPEA DISEASES UNDER NICRA VILLAGES

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India is the largest producer of pulses in the world with 24% share in the global production. The major pulse crops, viz. chickpea (*Cicer arietinum* L.), pigeonpea [*Cajanus cajan* (L.) Millsp.], mungbean [*Vigna mungo* (L.) Hepper.], urdbean [*Vigna radiata* (L.) R, Wilczek], lentil (*Lens culinaris* Medikus) and field pea (*Pisum sativum* L.) of India. Chickpea contributes the single largest share in India's export basket of pulses registering 85.64% and 84.87% share in the total pulses export during 2014-15 and 2015-16 respectively. Nearly 172 pathogens have been reported so far that infect chickpea (*Cicer arietinum* L.) in different parts of the world, but only a few of them have the potential to devastate the crop. Some diseases are persistent problems in chickpea production in wide geographical areas, notably, ascochyta blight, fusarium wilt, dry root rot, stunt [caused by bean (pea) leaf roll virus], botrytis gray mold, collar rot, black root rot, phytophthora root rot, and pythium root and seed rot, while others are sporadic in occurrence or endemic indistribution. In this study, NICRA villages (Gandhinagar and Birgua come to Block Badagaon, Jhansi) were survey during Rabi 2017. It was observed that two disease namely Fusarium wilt (*Fusarium oxysporum* f. sp. *ciceri*) and Dry root rot (*Rhizoctonia bataticola*) reported in the farmer's field with different disease incidence. It was revealed that the maximum disease incidence (20% and 18%) was found Fusarium wilt and Dry root rot respectively. Ascochyta blight disease and Botrytis gray mold are usually not seen in the field. The field symptoms of wilt are dead seedlings or adult plants, usually in patches. The disease can affect the crop at any stage.

BREEDING CLIMATE-SMART PULSE VARIETIES

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Food legumes also play an important role in low-input agriculture by reducing the dependence on nitrogen fertilizers. India ranks first in the pulse production in the world but lags behind in productivity because of constraints like decline in area, low genetic yield potential, climate change, poor seed replacement and post-harvest losses. Climate change has major impact on the pulse production since various abiotic and biotic stress factors which are influenced by climate change directly or indirectly which ultimately affects the yield. In order to achieve high productivity, adaptability and sustainability of pulse crops breeding climate-smart varieties appears to be most practical and economical approach for managing stresses in this era of changing climatic conditions. Breeding for resistance to various abiotic and

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biotic stresses we need to have the knowledge about the effect of various stress, resistance mechanism, and sources of resistance, breeding methods, selection environment, selection criteria and screening techniques for selection of elite genotypes. For obtaining better results there should be improvement in screening techniques, use of molecular markers for identifying and utilizing economically important genes, use of in vitro culture for transferring desirable genes from wild to cultivated species, use of genetic engineering using alien genes which offer opportunities for improving stress resistance in future cultivars of food legumes. The relative importance of various stress factors differs not only from crop to crop but also from region to region for same crop, therefore it is challenging since several stresses occur together requiring multiple stress resistance. Conventional breeding approaches show success but effectiveness can be improved by application of suitable biotechnological tools.

Keywords: Legumes, Climate Change

EFFECT OF DIFFERENT LEVEL OF PHOSPHORUS ON CHICKPEA AND THEIR SPACING.

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A field experiment was carried out to study the effect of different spacing and levels of phosphorus on growth and yield of desi gram (*Cicer aeritimum*) variety PBG-5 at the Crop Research Farm of Lovely Professional University of agriculture and technology and sciences, Phagwara, during winter season in 2017. The results revealed that different Spacing (20cm, 30cm, and 40cm) and phosphorus levels (25 kg ha⁻¹, 40 kg ha⁻¹, 55 kg ha⁻¹, and 70 kg ha⁻¹) significantly affected plant height, no. of root nodules and number of pods per plant. The maximum plant height (28.22 cm) was recorded from treatment no. 8 (55 kg P ha⁻¹ and 30 cm spacing) at 60 DAS. Similarly, higher number of root nodules (23.62) per plant was recorded from the treatment no. 12 (40 cm spacing and 70 kg Phosphorus ha⁻¹) at 60 DAS. The maximum number of pods per plant (24.33) was observed from the treatment no. 8 (55 kg P ha⁻¹ and 30 cm spacing). Generally the results revealed that treatment no. 8 (55 kg P ha⁻¹ and 30 cm spacing) gave better performance in approx all the parameters studied.

KEYWORDS : Crop ; Chickpea; Variety ; Treatment; Fertilizer.

MULCHING IN VEGETABLE CROPS

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Mulching technical term means 'covering of soil'. Mulching in general is a beneficial practice for crop production. It is the practice of covering the soil or ground and enabling it favourable conditions for plant growth, development and optimum crop production. It prevents the direct evaporation of moisture from the soil and thus limits the water losses and conserves moisture. Mulch facilitates fertilizer placement and reduce the loss of plant nutrient through leaching, can improve soil biology and also provide a barrier to soil pathogens. It maintains warm temperature at night time, relatively cooler temperature at day; which enhances rapid seed germination, prevent weed growth in crop land area and helps in quick establishment of a strong root growth system which favours healthy growth of young plant seedlings as well as develop a microclimate underside of the sheet, which is higher in carbon-di-oxide due to the higher level of microbial activity. Mulching techniques for vegetable production such as very thin film is used for short duration crops and round holes are made at the centre of the film using a punch or a bigger diameter pipe and a hammer or a heated pipe end could be used. Prepare the soil well and apply the required quantity of FYM and fertilizer before mulching. Mulch film is then inserted (4-6") into the soil on all sides to keep it intact. Seeds are sown directly through the holes made on the mulch film. In transplanted crops, the seedlings are planted directly into the hole. Mulches of indigenous origin which are readily available on farm land (paddy straw, dry leaves, compost mixes etc.) and in turn, reduces the cost of cultivation and conserves the optimum moisture for efficient crop production.

GREEN SYNTHESIS OF SILVER NANOPARTICLES AND ITS EFFECT ON SEED GERMINATION AND SEEDLING GROWTH IN VIGNA MUNGO

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Nanotechnology is emerging as new subject of research in various fields including agriculture. Keeping this in mind experiment was carried out to study the effect of green synthesised nanoparticles from leaf extract of Castor. The synthesised nanoparticles were characterised by UV-Vis spectroscopy and particle shape and size by SEM and EDX. The results showed that the seeds treated with silver nanoparticles improved both germination index and seedling growth of *Vigna mungo*. Thus, nanotreated seeds can be used in agriculture to increase the production and improve plant health for better yield.

Keywords: Castor, Green Synthesis, Plant growth, seed germination, *Vigna mungo*.

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SEED LEGISLATION IN INDIA

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Seed is a key component among all inputs for sustainable crop production. It is estimated that quality of seed accounts for 20-25% of productivity. The response of all other inputs depends on quality of seeds to a large extent. The need for a good viable seed for prosperity of human race is mentioned in Rigveda of ancient India. It is mentioned in the primeval manusmriti as "Subeejam Sukshetre Jayate Sampadyate" which literally means "A good seed in a good field will win and prosper". It is very much essential to maintain its purity and quality through various stages of seed production i.e. Breeder, foundation, registered and certified seed. Government of India besides had framed and brought out different legislations to protect the quality of seeds and planting materials. The rapid development of agricultural production necessitated the enactment of seed legislation. Need to maintain quality in terms of genetic and physical purity is realized for first time in 1963 with the establishment of National Seeds Corporation (NSC). The Seeds Act was formulated in 1963 and has come into force in 1966. On 29th December 1966, the Seeds Act was passed followed by Seed rules, 1968. It came into force throughout the country on 2nd October 1969. India is still importing the vegetable seeds from other countries major being radish followed by cabbage and pea. Therefore, The Seed Act, Seed Rules, Seed (control) order, National Seed Policy, Plant quarantine order, PPV & FR Act to not only to protect breeders, researchers but also a common farmer. These legislations have taken care of the quality of the seeds at production, processing and marketing levels to ensure that the farmer get the best quality seed. Therefore it is necessary that the information regarding seed legislations must reach to farmers also to make them aware of their rights.

IMPACT OF LAND CONFIGURATIONS, IRRIGATION SCHEDULING AND WEED MANAGEMENT ON YIELD AND ECONOMICS OF CHICKPEA (*CICERARIETINUM* L.)

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The field experiment was conducted during Rabi 2013-14 at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur to study the impact of land configurations, irrigation scheduling and weed management on yield and economics of chickpea. The treatments comprised three land configurations (Flat bed, Broad bed furrow, Ridge-furrow); three irrigation schedules (Irrigation at branching, Irrigation at pod development, Irrigation at branching and pod development) as main plot treatments and three weed management (Weedy Check, Hand weeding twice at 25 and 50 DAS, Pendimethalin @ 1.0 kg ha⁻¹ as pre emergence) as sub-plot treatments. These treatments were tested in split plot design with three replications. Ridge-furrow method resulted in significantly higher seed yield (1512.33 kg ha⁻¹), gross monetary returns (₹74794 ha⁻¹), net monetary returns (₹43991 ha⁻¹) and benefit: cost ratio (2.40) over flatbed and broad bed furrow. Irrigation at branching and pod development gave appreciably higher seed yield of 1483.33 kg ha⁻¹, gross monetary returns (₹73366 ha⁻¹), net monetary returns (₹42089 ha⁻¹) and benefit: cost ratio (2.31) over rest of the irrigation scheduling. Application of Pendimethalin @ 1.0 kg ha⁻¹ PE resulted in 52.17 per cent more seed yield (1592.74 kg ha⁻¹), gross monetary returns (₹79225 ha⁻¹), net monetary returns (₹49504 ha⁻¹) and benefit: cost ratio (2.66) over weedy check. However, hand weeding twice registered in significantly higher seed yield 1719.56 kg ha⁻¹ and gross monetary returns (₹84998 ha⁻¹) but had lower B: C ratio.

FORECASTING WHEAT YIELD USING TIME SERIES MODELLING IN HARYANA

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India is an agrarian country in which Agriculture is the single most important contributor to the Indian economy because of its significance in food security, trade and industry. Wheat is the most important food grains of human in India. Wheat crop is India's prime most staple harvest, placed after Rice. It is mostly consumed in the north and north-west parts of the country. At the time of independence in 1947, production and productivity of wheat were quite low at 6.46 million tones and 663 kg/hectare respectively. At present, India is the second largest producer of wheat in world after China. The purpose of this study was to fit a model that forecast the production of wheat in Haryana by using annual time series data from 1970 to 2014. Random walk, random walk with drift, linear trend, moving average, simple exponential smoothing, Brown's linear exponential smoothing, Holt's linear exponential smoothing and ARIMA models were employed and compared for finding out a best model to forecast the yield of wheat in Haryana. The best fitted model was selected based on performance in goodness of fit criterion; Akaike Information Criterion (AIC) and Schwarz's Bayesian information criterion (SBIC). This study found that on the basis of AIC and SBIC, linear trend = 623.247 + 4.47523t and Simple exponential smoothing with alpha = 0.2093 respectively be the best model to forecast wheat yield in Haryana. The forecast value by using AIC was obtained as

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851.484 million tones in 2020 and 878.336 million tones in 2026. Further by using SBIC, the forecasting value obtained as 793.433 million tones in 2026.

Keywords: ARIMA; Time Series Models; Forecast; Wheat yield; Exponential smoothing.

EFFECT OF DIFFERENT MEDIA ON MYCELIAL GROWTH OF THREE *PLEUROTUS* SPP. (*PLEUROTUS FLORIDA*, *P. FLABELLATUS* AND *P. SAPIDUS*)

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The cultivation and various uses of mushroom have been reported from ancient time in several literatures including Vedas. The present investigations were carried out on oyster mushroom, in which three strains of *Pleurotus* spp. were used for variability in colony characters. For this purpose six different media, Barley Extract Agar, Oat Extract Agar, Wheat Straw Extract Agar, Wheat Extract Agar, Malt Extract Agar and Potato Extract Agar were used. Among the evaluation of six media, maximum radial growth in *Pleurotus florida* was observed in Barley extract agar medium and oat extract agar medium (89.50 mm). While minimum radial growth was observed on PDA (61.25 mm). In case of *P. flabellatus* maximum growth rate was observed in Barley extract agar medium (81.50 mm) while minimum growth rate was observed on PDA (50.50 mm) and In case of *Pleurotus sapidus* maximum growth rate was observed in Barley extract agar medium and oat extract agar medium (90.00 mm), while minimum growth rate was noticed on malt extract agar medium (63.50 mm). This Study Concludes that Barley extract agar medium and oat extract agar medium are the best media for radial growth of *Pleurotus florida*, and *Pleurotus sapidus*, while in case of *Pleurotus flabellatus* barley extract agar medium is the best media for radial growth.

NEMATODES AS CONSTRAINTS TO AGRICULTURAL FOOD PRODUCTION

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One of the most important objectives of the Millennium Development Goals is to eradicate extreme poverty and hunger. Sufficient nourishment for the whole population of the world is one of the challenges of the present era. According to an estimate plant parasitic nematodes are causing much more damage annually compared to insect pests. A crop yield loss due to these tiny unseen pests in various countries is enormous. They caused projected yield loss of 12.3 % (\$157 billion dollars) worldwide. Out of which \$40.3 million is reported from India. Farmers/growers identified insect pests, and other constraints as production problems but overlooked plant parasitic nematodes. Nematode diseases are difficult to control because of their hidden nature and hence, more often overlooked. Plant parasitic nematodes not only cause damage individually but form disease-complexes with other micro-organism and increased the crop loss. Also the symptoms of nematode damage are not specific, resemble with the symptoms of other pathogens and abiotic stresses such as water and mineral deficiency. Future agricultural growth must come from productivity growth to address the persistent problems of poverty, food insecurity and malnutrition. Recommended measures against nematode diseases include use of clean nematode free planting material, resistant varieties, and crop rotations to suppress nematode infestation. Integrated nematode management can be promoted through farmers-nematologists interactions, local production of bio-control agents and strict chemical pesticide regulations. Farmer's/grower's awareness and skills are equally important in minimizing nematode infestation and yield losses, to sustain the agriculture production.

Keywords: Plant parasitic nematodes, yield losses, Integrated nematode management etc.

EFFECT OF LOW COST MEDIA IN MICROPROPAGATION ON BANANA

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Tissue culturing has become a routine method for propagating plants in high technology laboratories. Bananas (*Musa* spp.) are important staple crop in tropical and sub-tropical countries providing a good source of carbohydrates, minerals and vitamins. The low cost alternative components of tissue culture media were evaluated for their potential to supply nutrients and to support growing explant of Banana cultivar *in vitro* for their cost effectiveness against conventional high cost media. Micropropagated plants are increasingly becoming the planting material of choice, but the higher costs of plantlets have prevented the growers from benefiting from tissue culture technology. Agar is the most commonly used gelling agent for preparation of media, which adds significantly to the cost of media. The use of cheaper alternative to agar eliminates the need of agar. Therefore, the efficacies of sago, isabgol, asparagus of tapioca, and corn

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flour, as a gelling agents have been tested to reduce the cost of plantlets. The performance of low cost gelling agent's sago and tapioca starch were found to be best and could compare well with that of agar. The results showed the potential of the cheaper substitutes for economic commercial tissue culture production of banana cv. 'Udhayam' replacing the costliest gelling agent agar.

Keywords: Banana, low cost media, agar, micropropagation.

ADVANCES IN DAIRY TECHNOLOGY

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Many of milk's functional molecules could not be discovered until the right concordance of novel separation and analytical technologies were developed and applied. Many health-promoting components still await discovery due to technical challenges in their identification, isolation and testing. As new analytical technologies are assembled, new functional milk molecules will be discovered. Bovine milk is a source of a wide array of known bioactive compounds from a variety of molecular classes, including free glycans, lipids, peptides, proteins, glycoproteins, stem cells and microRNA. Because milk is such a complex mixture, when analyzed without fractionation or purification, many components mask the analytical signal of others, so some components cannot be detected. Modern analytics allow for the discovery and characterization of hundreds of novel milk compounds with high-resolution and high accuracy. Liquid chromatography paired with electrospray ionization allows the separation of peptides, glycans and glycolipids for improved mass spectrometric detection. Target proteins and glycoproteins can now be purified from intact milk or other dairy streams by chromatography in order to better characterize these proteins for new bioactivities. The combination of advanced analytics with the new engineering capabilities will allow for high molecular resolution and separation techniques that can be scaled-up to semi-industrial and industrial scale for translation of lab-based discoveries. Bioguided analysis and design of dairy processing side streams will result in the transformation of waste into isolated functional ingredients to add value to dietary products.

Key words :-proteins, microRNA, purification, processing, Bovine milk.

ANALYSIS OF GENETIC DIVERSITY OF INDIAN MELON (*Cucumis melo* L.) LAND RACES AND ITS COMPARISON WITH GLOBAL REFERENCE MELON POPULATIONS

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The investigation entitled, "Analysis of genetic diversity of Indian melon (*Cucumis melo* L.) land races and its comparison with global reference melon populations" was conducted at Department of Vegetable Science and School of Agricultural Biotechnology, Punjab Agricultural University Ludhiana. Eighty-eight melon accessions collected from Uttarakhand and Uttar Pradesh states of India representing four agroecological regions (six sub-regions) and eight reference accessions from USA were characterized and evaluated for nineteen morphological traits of plant and fruit, biochemical traits such as TSS, ascorbic acid content, titrable acidity and dry matter content, SSR genotyping and reaction to diseases. Significant differences were noted among all the accessions for all the characters observed. Phenotypic and genotypic coefficients of variation were found to be high for fruit weight and node at which first hermaphrodite flower appears. High heritability along with high genetic advance was recorded for fruit weight, node at which first hermaphrodite flower appears, fruit length, seed cavity length, number of primary branches per vine and total soluble solids content. D2 analysis grouped the accessions into ten clusters. The reference accessions obtained from USA and land races collected from different agro-ecological zones of India were found to be scattered in different clusters. No parallelism was found between genetic and geographic diversity. DNA polymorphism was utilized to cluster the genotypes into different clusters based on similarity as well as dissimilarity coefficients. On basis of SSR analysis, dendrogram clustered 96 accessions into three major groups. There was a significant correlation between botanical groups and the clustering pattern. Accessions belonging to *cantalupensis* cluster together in cluster I, accessions of *reticulatus* group cluster together in cluster II and *momordica* group cluster together in cluster III. However, some accessions of *cantalupensis* and *reticulatus* were intermixed in cluster I and II. Reference accessions cluster together forming a genetically unique assemblage in subgroup IIA and shared similarity coefficient of 0.65 with sub-group IIB. This suggested that reference accessions shared genetic affinities with Indian melon accessions which further established the fact that have been taken from India through trade route during ancient times, that could not have been predicted based on their geographic origin. Four accessions were free from CMV and two accessions exhibited immune reaction to downy mildew. The results inferred that these melon accessions could be used to broaden the genetic base of melon.

Keywords: CMV, downy mildew, genetic advance, heritability, melon, SSR

SOIL MICROBIAL DYNAMICS AS INFLUENCED BY SOIL MOISTURE CONDITIONS**AJEET KUMAR*, AMARJEET KUMAR AND RAMJEET YADAV***Department of Soil Science & Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India 813 210*

Soil moisture being a strong determinant of microbial activity, exerts dominant control over gaseous and liquid diffusion rates and at the same time affects oxygen and substrate availability. Increasing soil moisture reduces gaseous diffusion rates, directly affecting microbial physiological status and activities by limiting the supply of the dominant electron acceptors. As the matric potential in soil water decreases, cells must spend energy to attain osmotic equilibrium with the surrounding solution that reduces their growth and activity. Wetting and drying also affects microbial activity in soil, respiration rate, DHA and microbial community structure. Physiological drought induced by salinity induced osmotic stress results in poor plant growth and low soil microbial activity. The response to soil drying varies widely across organism functional types (e.g., soil fauna, bacteria, fungi) and species. Fungi are generally considered more tolerant than bacteria to soil drying. This is due to their ability to accumulate osmo-regulatory solutes that do not impair metabolism and to their filamentous structure, which allows them to reach and exploit substrates even at very low soil moisture levels, where diffusivity is low. The documented scientific literature converges towards the conclusions that soil moisture affects the microbial population, diversity and their biological and biochemical properties by affecting substrate availability, diffusion of liquids and gases and regulating the osmotic stress faced by soil micro-organisms. The functional relationships between water content or potential and the soil microbial demography appear to be hysterical in case of wetting drying cycles because usually the response time for the microbial characteristics to adapt to an altered soil moisture regime is far from instantaneous. Soil moisture conditions are inherently more dynamic than any other soil characteristic. Therefore, present study was focused on understanding of the microbial characteristics under dynamic moisture conditions together with the biochemical pathways of nutrient availability and transformations, organic matter decomposition and substrate availability that can be help in better manage of soil water and diverse soil microbial resources in agriculture.

Keywords: *Soil moisture, soil microorganisms population and activity*

UNRAVELING THE EFFECT OF FOLIAR FEEDING OF CARRAGEENAN OLIGOMERS ON GROWTH, PHYSIOLOGY, TRICHOMES AND ESSENTIAL OIL PRODUCTION IN PEPPERMINT (*MENTHA PIPERITA* L.)**AJMAT JAHAN¹*, M. MASROORA. KHAN¹, BILAL BHAT¹ AND ARSHIYAAKEEL¹***¹Plant Physiology Section, Department of Botany, Aligarh Muslim University, Aligarh, 202002, India*

Carrageenan, a marine polysaccharide, after depolymerization by Co-60 gamma rays has shown promising plant growth promotion and other biological activities. Peppermint (*Mentha piperita* L.), member of Lamiaceae family, is one of the most important medicinal plants. Considering the medicinal importance of peppermint and growth promotion activity of irradiated carrageenan, a pot experiment was conducted to investigate the effect of foliar feeding of different aqueous concentrations of radiation degraded carrageenan on growth, physiology, peltate glandular trichomes (PGTs) and essential oil production of peppermint. Crop performance was assessed 150 days after planting in terms of growth, physiological and biochemical attributes and production of menthol and menthone in peppermint. Characterization of carrageenan before and after irradiation was done by gel permeation chromatography (GPC), Fourier-transform infrared (FT-IR), Ultra Violet visible (UV-Vis) and nuclear magnetic resonance (NMR) spectroscopy. Among the various concentrations of irradiated carrageenan (IC) [0 (control), un-irradiated carrageenan (UIC), 40, 80, 120 160 and 200 mg L⁻¹ of IC], foliar application of 80 mg L⁻¹ of IC proved the best treatment followed by 120 mg L⁻¹ that gave maximal values for most of the attributes studied including essential oil content, menthol content and peltate glandular density. Thus, it may be concluded that the yield and quality of EO of peppermint may be improved by this economical, ergonomical, safe and novel technique.

Keywords: NMR, FT-IR, Menthol, PGTs, GC

INTEGRATED NUTRIENT, WEED, DISEASES AND PEST MANAGEMENT**AKANSHA DEORA¹, DEEPANSHI DEORA², ABHITEJ SINGH SHEKHAWAT³ & PUSHPENDRA SINGH⁴***¹Department of Plant Pathology, ²Graduation, ³Department of Soil Science & Agricultural Chemistry, ⁴Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur.*

In agriculture, local varieties and practices are of low productivity, prone to pests and grown without proper fertilizer management resulting in poor yield and poor soil fertility. Modern technologies are often inappropriate due to lack of knowledge and training. However, a combination of traditional and appropriate modern technology like INM, IWM, IDM and IPM can reap a good harvest and support livelihood and nutritional security of farmers. Soils represent dynamic ecosystems and are the resources that provide humans with more than 90 % of all the food we eat. Our challenge is to manage soils in a sustainable fashion so that they will provide for human needs in future. Integrated Nutrient Management (INM) holds out great promise for meeting the growing nutrient demands of intensive

agriculture and maintaining crop productivity at higher levels. INM involves proper combination of chemical fertilizers, organic manure, crop residues, nitrogen fixing crops, pulses and oil seeds and bio-fertilizers suitable to agro ecosystem. Pathogens, weeds, and invertebrates cause significant crop losses worldwide and present a barrier to the achievement of global food security and poverty reduction. Integrated Pest Management (IPM) aims to protect agricultural crops from economic damage by insect pests, weeds, plant pathogens, and other harmful organisms, while reducing reliance on hazardous pesticides. Some cultural practices for organic IWM fulfil multiple functions. Diverse crop rotations reduce disease, insect pest and weed pressures, enhance beneficial habitat and balance nutrient demands on the soil. A farming system that utilizes an array of interdependent cultural, biological and herbicidal weed control practices is generally referred as Integrated Weed Management (IWM). Integrated Disease Management (IDM) involves the selection and application of a harmonious range of disease control strategies that minimize losses and maximizes returns. IDM can be considered at two levels. An integrated control program may be aimed at all of the diseases that affect a particular crop or an integrated control program may be developed for a specific disease that affects a crop.

EFFECT OF NATURAL AGENTS IN INCREASING PHOSPHATE AVAILABILITY TO UPLIFT CROP PRODUCTIVITY

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Phosphate anion which is the least mobile element soil, precipitates as orthophosphate or is absorbed by Fe, Al and Ca ions, which makes it immobile. The concentration of bio-available P in soil solution is very low(1.0 mg kg⁻¹). Phosphorus solubilizing microbes enhancing its availability to plants through release from inorganic and organic soil P pools by solubilization and mineralization processes. Efficiency of P fertilizer throughout the world is low(10-25 %) and rest part gets wasted that's why PSB and plant growth promoting rhizobacteria (PGPR) are used, they together could reduce P fertilizer application by 50% without any significant reduction in crop yield. From the whole microbial population in soil, PSB constitute 1 to 50 %, while phosphorus solubilizing fungi (PSF) are only 0.1 to 0.5 %. Strains from bacterial genera *Pseudo-monas*, *Bacillus*, *Rhizobium* and *Enterobacter* along with *Penicillium* and *Aspergillus* fungi along with a nemato fungus *Arthrobotrys oligospora* are the groups of most powerful phosphate solublizers which has the ability to solubilize phosphate rocks. A gram of fertile soil contains 10¹ to 10¹⁰ bacterias. Phosphorus solubilizing activity leads to release metabolites such as organic acids, which through their hydroxyl and carboxyl groups which chelates the cation bound to phosphate and to other soluble forms of phosphates. The PSB dissolve the soil P through production of low molecular weight organic acids mainly gluconic and keto gluconic acids, which can also lower the pH of rhizosphere. Inorganic acids like hydrochloric acid can also solubilize phosphate but they are less effective compared to organic acids at the same pH. Phosphorus desorption potential of different car-boxylic anions citrate > oxalate > malonate / malate > tartrate > lactate > gluconate > acetate > formiate. Production of siderophores , acid phosphatase and alkaline phosphatase enzymes by plant roots or microbes hydrolyzes the soil organic P or split P from organic residues. Use of PSMs can increase crop yields up to 70 percent. *Pseudomonas* spp. enhanced the number of nodules, dry weight of nodules, yield components, grain yield, nutrient availability and up-take in soybean crop. Phosphate solubilizing bacteria. enhanced the seedling length of *Cicer arietinum*, while co-inoculation of PSM and PGPR reduced P application by 50 % without affecting corn yield. Inoculation with PSB increased sugarcane yield by 12.6 percent. Mycorrhiza along with *Pseudomonas putida* increased leaf chlorophyll content in barley. Seed yield of green gram was enhanced by 24 % following triple inoculation of *Bradyrhizobium* + *Glomus fasciculatum* + *Bacillus subtilis*. Integration of half dose of NP fertilizer with biofertilizer gives crop yield as with full rate of fertilizer; and through reduced use of fertilizers the production cost is minimized and the net return maximized.

Keywords: Phosphate, Organic acids, Phosphate Solubilizing Microorganisms (PSMs), Plant Growth Promoting Rhizobacteria (PGPR)

GENE EDITING AND CROP IMPROVEMENT USING CRISPR-CAS9 SYSTEM

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Advancements in Genome editing technologies have revolutionized the fields of functional genomics and crop improvement. CRISPR/Cas9 (clustered regularly interspaced short palindromic repeat)-Cas9 is a multipurpose technology for genetic engineering that relies on the complementarity of the guideRNA (gRNA) to a specific sequence and the Cas9 endonuclease activity. It has broadened the agricultural research area, bringing in new opportunities to develop novel plant varieties with deletion of detrimental traits or addition of significant characters. This RNA guided genome editing technology is turning out to be a groundbreaking innovation in distinct branches

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of plant biology. CRISPR technology is constantly advancing including options for various genetic manipulations like generating knockouts; making precise modifications, multiplex genome engineering, and activation and repression of target genes. The review highlights the progression throughout the CRISPR legacy. We have studied the rapid evolution of CRISPR/Cas9 tools with myriad functionalities, capabilities, and specialized applications. Among varied diligences, plant nutritional improvement, enhancement of plant disease resistance and production of drought tolerant plants are reviewed. The review also includes some information on traditional delivery methods of Cas9-gRNA complexes into plant cells and incorporates the advent of CRISPR ribonucleoproteins (RNPs) that came up as a solution to various limitations that prevailed with plasmid-based CRISPR system.

Keywords : Genome editing technologies, guide RNA, Cas9 endonuclease

EFFECT OF ZINC AND SULPHUR ON WHEAT CROPS

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Zinc plays very important role in plant metabolism by influencing the activities of hydrogenase and carbonic anhydrase, stabilization of ribosomal fractions and synthesis of cytochrome. Plant enzymes activated by Zn are involved in carbohydrate metabolism, maintenance of the integrity of cellular membranes, protein synthesis, regulation of auxin synthesis and pollen formation. The regulation and maintenance of the gene expression required for the tolerance of environmental stresses in plants are Zn dependent. Its deficiency results in the development of abnormalities in wheat crop which become visible as deficiency symptoms such as stunted growth, chlorosis and smaller leaves, spikelet sterility. Micronutrient Zn deficiency can also adversely affect the quality of harvested products, wheat susceptible to injury by high light or temperature intensity and to infection by fungal diseases can also increase. Zinc seems to affect the capacity for water uptake and transport in wheat and also reduce the adverse effects of short periods of heat and salt stress. Sulphur is present in some amino acids and vitamins and required for the production of chloroplast. That's why sulphur is very important for photosynthesis in green plant as its presence in iron sulphur complexes of the transport chain. The deficiencies of sulphur first affect younger tissues of plant because sulphur is immobile in plants. The deficiencies of sulphur are reported as the appearance of these symptoms such as yellowing of plant leaves and stunted growth of plants. Sulphur deficiency significantly effects the production and quality of wheat.

Key words: environment, waste management,

MAJOR AGRICULTURAL PROBLEMS IN INDIA

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Small and fragmented land-holdings:-The seemingly abundance of net sown area of 141.2 million hectares and total cropped area of 189.7 million hectares (1999-2000) pales into insignificance when we see that it is divided into economically unviable small and scattered holdings. Seeds:- Seed is a critical and basic input for attaining higher crop yields and sustained growth in agricultural production. Distribution of assured quality seed is as critical as the production of such seeds. Unfortunately, good quality seeds are out of reach of the majority of farmers, especially small and marginal farmers mainly because of exorbitant prices of better seeds. Manures, Fertilizers and Biocides:- Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soils resulting in their low productivity. The average yields of almost all the crops are among the lowest in the world. This is a serious problem which can be solved by using more manures and fertilizers. Irrigation:- Although India is the second largest irrigated country of the world after China, only one-third of the cropped area is under irrigation. Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic India cannot achieve sustained progress in agriculture unless and until more than half of the cropped area is brought under assured irrigation.

Key Word:- Agricultural production, manures and fertilizers etc.

DOUBLING FARMERS INCOME THROUGH COLD CHAIN NETWORK

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Agriculture is a backbone for Indian farmers because India is one of the largest producers and consumers of food products. This sector plays an important role in contributing to the development of rural economy. Domestically the spending on the food and food products

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amounts to nearly 21 percent of gross domestic product of the country. The most important problem faced by the Indian agriculture is the highly inefficient supply chain. Because of lack of cold chain infrastructure and also food processing industry, about 50 percent of the food produces gets wasted and farmers are suffering from the distress sale. A well developed food processing industry is expected to increase farmers produce price, reduce wastages of fruits and vegetables, ensure value addition, and it also generate employment opportunities to the rural poor as well as export earnings and thereby helping farmers to increase their incomes. A Cold chain is the uninterrupted handling of the food product within a low temperature environment during the post harvest steps of the value chain including harvest, collection, packing, processing, storage, transport and marketing until it reaches the final consumer. Cold chain network will help to boost the farmers income by establishment of modern cold chain networks it not only reduces the food losses, but also empowers the farmers to reach across to more distant markets. As the cold storage facilities reduce the transpiration, the water content in the perishables is retained and causes less shriveling. Further it inhibits the ethylene production and slows down the ripening process of fruits. Efficient cold chain network reduces the post harvest losses and it generates additional income to the farmer. So It will be helpful the farmers to more market driven and profitable farming activities.

Keywords: Post harvest losses, Doubling farmers income and cold chain network

ENRICHED COMPOST AND ITS APPLICATION IN CROP PRODUCTION

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The use of high analysis fertilizers has increased the crop productivity over the years. However, indiscriminate and non-judicious use of fertilizers has caused several ill-effects on soil health. Therefore, to sustain the productivity and soil health in long run, organic nutrient sources could be an alternative. However, due to lack of proper composting technique and low nutrient concentration in organic sources, their use is limited in crop production. The conversion of organic waste into the compost not only helps to enhance soil organic matter and efficient crop nutrition but also reduces environmental pollution and associated health risk. The enrichment of organic manure with nutrient enhances the crop productivity and nutrient use efficiency. The effectiveness of low grade rock phosphate (RP) could be improved through compost enrichment.. The enriched compost (EC) supplies a substantial amount of P and also helps in mobilizing the native pool of soil P. The recycling of rice residues through composting with RP and bio-inoculants serves as a supplemental source of plant nutrients. Application of enriched Farm yard manure (FYM) with inorganic fertilizers + plant growth promoting rhizobacteria (PGPR) enhances grain yield and improves the physico-chemical properties of soil. FYM enriched with non-edible oil cake resulted highest yield and economics in rice based cropping system. Application of EC enhances nutrient mineralization in soil. The use of microbial consortia for nutrient enrichment is a viable option to enhance nutrient concentration in organic manures. The use of EC for crop production could help in improving soil health and sustaining crop productivity.

Key word: Compost, nutrient, production, recycling, rock-phosphate, sustainable

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND PRODUCTIVITY OF HYBRID RICE

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Sustaining rice (*Oryza sativa* L.) productivity at high level is a great challenge, particularly in areas where rice productivity declines in spite of following recommended nutrient management practices. Nutrient management by integrating organic manures, inorganic fertilizers and biofertilizers may play an important role in improving and sustaining rice productivity. In this study, the authors tried to evaluate the suitable proportion of organic manures and inorganic fertilizers along with biofertilizer to maximize growth and productivity of hybrid rice on sandy-loam lateritic soils of West Bengal, India. The crop having 50% recommended dose of fertilizer (RDF) + 50% recommended dose of nitrogen (RDN) through mustard oil cake (MOC) and 75% RDF + 25% RDN through MOC + biofertilizer significantly increased plant height, number of tillers/m², leaf area index (LAI), dry matter accumulation (DMA) and crop growth rate (CGR) at initial and vital period of grain growth over those of 25% RDF + 75% RDN through MOC and 100% RDN through MOC. The former two treatments also increased number of panicles/m² and number of grains/panicle over those of only organic manuring (100% RDN) or only chemical fertilization (100% RDF) or 25% RDF + 75% RDN through MOC. Crop with 75% RDF + 25% RDN through MOC + biofertilizer or 50% RDF + 50% RDN through MOC produced 20.2%-33.8% higher grain yield and 11.0%-33.3% greater straw yield, and paid higher gross and net returns over other treatments. This study suggests growing hybrid rice with 75% RDF + 25% RDN through MOC + biofertilizer or 50% RDF + 50% RDN through MOC for better growth, higher productivity and greater profit.

Keywords : Nutrient management, biofertilizer, organic manuring, higher productivity

SUCCESSION OF POLLINATORS/VISITORS AND EFFECT ON YIELD OF FENNEL, *FOENICULUM VULGARE* (MILL.) AKSHAY KUMAR^{1*}, SACHIN KUMAR¹, POPIN KUMAR² AND KRISHNA KUMAR²

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Fennel, *Foeniculum vulgare* (Mill.) commonly known as *saunf*, is one of the most important winter season seed spices, grown in northern India. Fennel belongs to the family Apiaceae (Umbelliferae). Fennel crop is cross pollinated in nature. It revealed that the pooled averages of all the insect pollinators/ visitors, irrespective of species, on six observational hours (06:00, 08:00, 10:00, 12:00, 14:00 and 16:00 hrs. of the day) interval of observations were 1.50, 3.14, 1.52, 1.21, 1.39, 0.62 and 1.19 number of bees/branch/5 min., respectively. The succession of insect visitors was maximum at 08:00-10:00 hrs. followed by 06:00-08:00 hrs. of the day during all the three intervals. Irrespective of observational hours *Apis dorsata* was the most abundant visitors of fennel flowers i.e. 3.14 followed by *Apis cerana indica* 1.52 throughout the period of observation. The *Mesembrius bengalensis* 0.62, *Epasyphus balteatus* 1.21, *Coccinella spp.* 1.39 and *Polistes hebraeus* 1.19 were significantly lower than the *Apis dorsata*, *Apis floria* and *Apis cerana indica* 3.14, 1.52 and 1.50 respectively during 12:00 hours of the day were at per each other. The abundance of insect visitors was more during morning hours (06:00-10:00 hrs.) in the day and their population during afternoon hours (15:00-18:00) was comparatively less than the morning hours but abundance of pollinators at were very less during noon hours (12:00-14:00). The data on effect of bee pollination in different treatments on fennel flowers increases the yield. Effect on yield of fennel by bee pollination was 16.39 gram per plant while self-pollination and open pollination were 9.28 gram and 12.96 gram, per plant respectively. Bee pollination significantly against self-pollination and open pollination on fennel flowers under agro-ecological conditions of Kumarganj, Faizabad

COMPARATIVE PROFITABILITY ANALYSIS OF MUSHROOM AND VEGETABLE CULTIVATION: A CASE STUDY OF SOLAN DISTRICT OF HIMACHAL PRADESH

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The present study was conducted in Solan district of Himachal Pradesh. A complete list of registered and non-registered mushroom growers was obtained from Department of Horticulture, Govt. of Himachal Pradesh and from the supplier of spawn and manure. A sample of 60 mushroom growers was drawn by using simple random technique from the list of mushroom growers for the collection of data. The average size of land holding was found to be 1.29 ha. When production, net return over total cost, gross return and output input ratio of mushroom were compared with tomato and found that there is more production of tomato but farmers' get higher price per unit for the mushroom than tomato and growing mushroom has been a profitable venture respectively. Comparative analysis for breakeven point revealed that growing mushroom had more benefit over tomato as it require lesser quantity to cover the total cost. Diversification in the agricultural activities is important to avoid the risk in production and to provide the food and nutritional security for population. Diversification in any farming system impact the sustainability, thus mushroom cultivation has enormous potential to improve food security and income generation, which in turn can boost rural economic growth regularly.

Key words: Mushroom, tomato, benefit, breakeven point, diversification

RESPONSE OF INTEGRATED FERTILIZER PRESCRIPTION AND YIELD TARGET ON YIELD OF CAULIFLOWER (*BRASSICA OLERACEA* L VAR. *BOTRYTIS*)

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An experiment was conducted at Crop Research Centre during 2016-17 of G.B. Pant University of Agriculture and Technology Pantnagar, Udham Singh Nagar (Uttarakhand) to study the effect of integrated fertilizer prescription and yield target on yield of Cauliflower. The experiment was conducted in the Randomized Block Design (RBD) with ten replications of different doses of fertilizer and yield target as Control T₁, General Recommendation Dose T₂, Target Yield 1 (250 q ha⁻¹) T₃, Target Yield 2 (300 q ha⁻¹) T₄, Target yield 1 (250 q ha⁻¹) + 10 t ha⁻¹ FYM T₅, Target Yield 1 (250 q ha⁻¹) + 20 t ha⁻¹ FYM T₆, Target Yield 2 (300 q ha⁻¹) + 10 t ha⁻¹ FYM T₇, Target Yield 2 (300 q ha⁻¹) + 20 t ha⁻¹ FYM T₈, 10 t ha⁻¹ FYM T₉ and 20 t ha⁻¹ FYM T₁₀. These treatments were compared with general recommended dose. Results of this experiment indicated that treatment T₇ gave significantly higher yield followed by (T₈ > T₆ > T₄ > T₅ > T₃ > T₂) as compared to control (T₁). Treatments (T₇) and (T₈) gave significantly higher yield as compared to general recommendation (T₂). Treatment (T₉) and Treatment (T₁₀) were not showing significantly difference as compare to treatments T₁ and T₂. Among the two targets yield, target 300 t ha⁻¹ recorded relatively higher yield than target yield 250 t ha⁻¹ and it has also recorded significantly higher yields over general

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recommended dose. Higher yield observed at higher target (300 q ha⁻¹) with 10 tonne FYM indicating the 300 q ha⁻¹ appropriate yield target for cauliflower. This might be due to balanced supply of nutrients from fertilizer, efficient utilization of applied fertilizer nutrients in the presence of organic sources and the synergistic effect of the conjoint addition of organic sources of nutrients. Efficient nutrient management is a prerequisite for achieving maximum yield in cauliflower with good curd quality. Neither the chemical fertilizers alone nor the organic manures exclusively sustain the productivity of cauliflower but a judicious combination of both along with their efficient management is potential tool for sustaining the productivity.

EXAGGERATIVE DEFENSE MECHANISM OF *BRASSICA JUNCEA* L. BY BRASSINOSTEROIDS (24-EPIBL AND 28-HOMOBL) TREATMENTS UNDER HIGH TEMPERATURE STRESS

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Agriculture represents a core part of the Indian economy and provides food and livelihood activities to much of the Indian population. While the magnitude of impact varies greatly by region, climate change is expected to impact on agricultural productivity and shifting crop patterns. Climatic changes and increasing climatic variability are likely to aggravate the problem of future food security by exerting pressure on agriculture. Increased concentration of greenhouse gases (GHGs) in the atmosphere resulted in warming of the global climate system by 0.74 °C between 1906 and 2005. The trends of rise in temperature, heat waves, droughts and floods, and sea level shown by the Indian scientists are in line with the Inter-Governmental Panel on Climate Change (IPCC) though magnitude of changes could differ. The mean temperature in India is projected to increase up to 1.7 °C in kharif (July to October) and upto 3.2 °C during rabi (November to March) season, while the mean rainfall is expected to increase by 10% by 2070. This increased temperature affects the agriculture productivity and shifting crop patterns in India. Adaptation of crop plants to environmental stresses is dependent upon the activation of cascades of molecular networks involved in stress perception, signal transduction and the expression of specific stress-related genes and metabolites. To mitigate the impact of high temperature on agriculture crops, biotechnological and breeding approach play a crucial role followed by physiological approaches (by applying phytohormone). Applications of Phytohormones has several advantages over the biotechnological and breeding approach like cost effecting and time saving and without altering the genome of crops. Presents study was pertaining to explore the role of 24-epiBL (brassinosteroids) in the mitigation of harsh effect of high temperature on *Brassica juncea* L. RLM 619 at physiological, biochemical and molecular level. In order to explore the ameliorating potential of BRs in plants particularly in agriculture crops like *Brassica juncea* L. subjected to high temperature stress with various concentrations of 24-epiBL. The morphology of *B. juncea* L. seedlings has revealed remarkable reduction under high temperature stress and 24-epiBL helps in ameliorating this reduction. Photosynthetic pigments such as chlorophyll and carotenoids decreased significantly in seedlings subjected to high temperature (25 °C to 45 °C). 24-epiBL helps in ameliorating photosynthetic ability by protecting chlorophyll and carotenoids content from high temperature stress. All concentrations ameliorate carbohydrate, vitamin C and Proline content in seedlings exposed to different temperatures as compared to control seedlings. Enzymes of antioxidant defense system ameliorate in 24-epiBL treated seedlings as compared to untreated control seedlings when exposed to different temperatures. Observation suggested that photosynthetic machinery reduce their efficiency under high temperature and 24-epiBL treatment helps in maintaining the efficiency of photosynthesis by increasing the activities of antioxidant enzyme followed by enhance level of osmolytes compounds. Improved health of plants with 24-epiBL at morphological level increasing activity of antioxidant enzyme followed by the enhance level of Vit. C and Osmolytes indicate, 24-epiBL can be used to mitigate the toxic effect of environmental stress in agriculture crops.

INTEGRATED FARMING SYSTEM: AN APPROACH FOR DOUBLING FARMERS' INCOME

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Indian agriculture has been shouldering the responsibility of providing food and nutrition to its teeming millions. After the advent of green revolution in late-1960s and economic liberalization in early-1990s, the farmers gradually started focusing on a few enterprises due to several imposing factors including shrinking farm sizes, fluctuating commodity prices, livelihood diversification and shortage of labour during peak agriculture season. An integrated farming system has been proved as an ideal system integrating physical, agronomic and socio economic milieus for development of eco-friendly, eco viably and environment sustainable farming in India and other countries of world. It is an indigenous agricultural practice aimed to develop eco-friendly farming system. There is reciprocal behavior in

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utilization of waste products generated from different constituent entities of the system. Crop residues as dry fodder, feed grains and green fodder are derived from cropping system. Dung, manures, compost mixed of urine, dung and plants, as by products from livestock are used in enriching soils for best production. The goal of such integrated farming systems also encompasses the objective of conservation of existing natural resources and efficiently using them for sustainable growth of productivity as well as profitability to the farmers. The focus of present government is on doubling farmers' income by 2022. Hence, adoption of IFS is the right approach in this direction and should be supported through institutional, extension, policy and marketing interventions in a system approach.

Keywords: Doubling income, sustainable and integrated

PROSPECTS OF ECOTILLING IN CROP IMPROVEMENT

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TILLING (Targeting Induced Local Lesions in Genomes), a reverse genetics tool of molecular biology that allows direct identification of mutations in a specific gene. EcoTILLING is a molecular technique that is similar to TILLING, with the exception that it uses natural genetic variation in contrast to induced mutations in TILLING. EcoTILLING is of special significance in species which are not amenable to chemical mutagenesis, thereby helping in detection of natural variants and their putative gene function. This approach allows rapid screening of samples possessing the gene of interest and identifies naturally occurring SNPs, small INDELS or both. The method has the potential to detect DNA polymorphisms (including variations in satellite repeat number) and determine heterozygosity levels within a gene fragment (in highly heterozygous outcrossing species). This reduces the time and effort for SNP discovery generally required by weeding out identical haplotypes. This method eliminates the requirement of otherwise cumbersome sequencing the genome of all individuals in a population to identify polymorphisms. Though, it has advantage of detecting multiple polymorphisms in a single fragment, it has not been widely employed as TILLING. EcoTILLING has been used to examine DNA variation in natural populations of black cottonwood; first large deciduous trees to have its genome completely sequenced. As the number of SNPs detected per fragment increases, the scoring and tracking of cleaved fragments becomes more difficult which is major challenge in the EcoTILLING. But one of the valuable applications of EcoTILLING is mining for variation in resistance genes to expedite the process of identifying alleles that could provide immunity to various diseases.

Keywords: TILLING, EcoTilling, SNPs

PLANT GROWTH RETARDANTS AS TOOL FOR ENHANCING GROWTH AND YIELD OF PULSES

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Pulses are the most significant food crops after cereals. Pulses are rich in proteins and found to be main source of protein to vegetarian people of India. Apart from being a sound source of protein, pulses also contain substantial amount of minerals, vitamins, crude fibre etc. Pulses being legumes, fix atmospheric nitrogen into the soil. Apart from nitrogen fixation pulses add organic matter into the soil in the form of leaf mould and they are generally used as green manure crops. The seeds, pods and leaves of pulses are used by human and livestock being rich in nutrition. They play an important role in crop rotation, mixed and intercropping, as they help maintaining the soil fertility. Pulses have more leafy growth and close spacing so they are helpful for checking the soil erosion. The deep rooting system helps in better extraction of water and nutrients from deeper soil layers, thus making them suitable for grown under rainfed conditions. Majority of pulses are short durational so that second crop may be taken on same land in a year, so they can fit easily in cropping systems and give ready cash to farmers. They provide raw material to various industries like Dal industry, Roasted grain industry etc. Pulses have indeterminate growth habit with low harvest index. The pronounced vegetative growth habit of pulse crops leads to the production of infertile or poorly productive branches with large number of unproductive flowers and pods, fruit drop and non synchronous flowering/fruitletting which poses a significant constraint to its productivity. So achieving a higher pod set and retention of sink is very important aspect. Therefore, pulses productivity can be substantially improved by curtailing excessive growth and flower or fruit drop. Plant growth regulators (PGR's) are organic substances which in small quantities increase or decrease or modify the physiological processes in plants which are finally expressed in the form of growth and development. Plant growth retardants are the chemicals substances that slows down the cell division and cell elongation of shoot tissue and regulate plant height physiologically without formative effects for example, AMO 1618, phosphon-D, CCC, MC and alar. These do not occur naturally in plants and acts in retardation of stem elongation, preventing cell division. Growth retardation is primarily induced by inhibition of gibberellins biosynthesis between ent-kaurene and ent-kaurenoic acid (Rademacher 2000).

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IMPORTANCE OF BIOLOGICAL CONTROL AND ITS UTILIZATION

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Biological control is defined broadly as the "use of natural or modified living organisms, genes, or gene products" to reduce the effects of pests and diseases. Biological control depends on knowledge of biological interactions at the ecosystem, organism, cellular, and molecular levels and often is more complicated to manage compared with physical and chemical methods. Today we have deteriorated the soil and human health with the excessive use of pesticides moreover pests now a days have become resistant. Only solution to this problem is to use new concept of Biological Control. We can achieve control of insect in a wide area and for longer period as bio control agent is prevalent till control is effective. Though initial cost is more but it is cheaper in a long run. Also, compatibility with other methods is very good. While using bio agents in any IPM programme care should be taken to use insecticides which are safe to natural enemies. With the use of biological control pests which are very difficult to manage otherwise are managed effectively. Biological control is the new emerging technique which will prove as a boon for farmers in recent time. Biological control application is completely safe to human as well as environment. It not only manage the pest effectively but also don't disturb the ecosystem by disturbing food chain. Biological control of insects are available for a variety of insects and in various formulations and are at par with the synthetic control measures if used at proper time and with right technique.

Keyword: Biological control, Pest, Insects, Diseases, Human health.

EFFECTS OF INTEGRATED NUTRIENT MANAGEMENT ON SOIL-CROPS SYSTEM

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Soil is a fundamental prerequisite for crop production as it provides plants with water and nutrients. A certain supply of mineral and organic nutrient sources is present in soils, but these often have to be supplemented with external applications, or fertilizers, for better plant growth. Fertilizers boost soil fertility and are applied to promote plant growth, improve crop yields and support agricultural intensification. Organic fertilizers are obtained from substances of plant or animal origin, such as manure, compost, seaweed and cereal straw. Organic fertilizers generally contain lower levels of plant nutrients as they are combined with organic matter that improves the soils physical and biological characteristics. The most widely-used mineral fertilizers are based on nitrogen, potassium and phosphate. Integrated Nutrient Management refers to the maintenance of soil fertility and the supply of plant nutrient at an optimum level for sustaining the preferred productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. The aim of Integrated Nutrient Management (INM) is to integrate the use of natural and man-made soil nutrients to increase crop productivity and preserve soil productivity for future generations (FAO, 1995a). INM aims at optimal use of nutrient sources on a cropping-system or crop-rotation basis which encourages farmers to focus on long-term planning and make greater consideration for environmental impacts. INM relies on a number of factors which includes appropriate nutrient application, conservation and the transfer of knowledge about INM practices to farmers and researchers. INM practices also include new techniques such as deep placement of fertilizers and the use of inhibitors or urea coatings that have been developed to improve nutrient uptake.

Keywords: Organic, Biological Components, Crop Rotation

"A STUDY ON GROWTH RATE AREA OF POTATO PRODUCTION IN UTTAR PRADESH."

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Potato is a major food crop, grown in more than 100 countries in the world. According to FAO (2008), Potato is consumed by more than one billion people in the world. It is high quality vegetable cum food crop and used in preparing more than 100 types of recipes. The protein content of Potato has a high biological value than cereals and considered to be better than milk. Hence, Potato is supplementing meat and milk products by lowering energy intake and also by reducing food cost.

The present investigation entitled "A study on growth and instability of potato production in Uttar Pradesh." This study has been carried out to examine the trend and growth rate of potato area different periods in Uttar Pradesh.

The time series data on potato area in Uttar Pradesh, pertaining to periods 1977-78 to 2017-18, is used for investigation of trend and growth rate of potato area. The relevant statistical tools & technology like regression analysis etc. have been used for the purpose of investigation mentioned above.

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The results obtained from different statistical tools and technique shows that the growth rate of potato area has increased during all the decades.

Keywords: Statistical Tools, Regression Analysis, Trend and Growth Rate.

POTASSIUM MINING IN INDIAN SOIL

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India Increasing population demands higher production and productivity of crops. Consequently, maintenance of soil fertility is a must for sustainable agriculture and future food security. FAO (2006) reported that India registered an ever recorded food grain production of 230 mt with a consumption of 23 mt of NPK's during 2007-08 and it was estimated that about 45 mt of nutrients are needed to produce 300 mt of food grains by 2025 to sustain the requirement of growing population. Out of these macronutrients (NPK), Potassium is probably the most pertinent nutrient that has been potential of significantly affecting agricultural production in the India (Sanyal *et al.* 2014). Present intensive production systems in India characterized by heavy removal and inadequate replenishment of Potassium resulted in Potassium deficiency and depletion of soil Potassium reserves. Historically low application rates of K in crops have led to over-dependence on the native soil reserve of K (Sarkar *et al.* 2014). For sustaining the crop productivity and to restore the soil fertility, there is a need to arrest depletion of soil Potassium reserves for which understanding of crop nutrient balances is important. There were many attempts to examine the potassium mining at the individual plot level, long term fertilizer experiments, state level and country level. In most of these reports, fertilizer inputs and crop removals were only considered, thus resulting in the large scale negative Potassium balances in Indian agriculture. Srinivasarao *et al.* (2011) were found that by considering all these inputs and outputs, the Potassium balance in Indian agriculture is about 3 million tones per year. In agroecosystem, Potassium is contributed by many sources like animal manure, crop residue, compost, rice burning residue, irrigation water and rain etc. Similarly, besides crop Potassium removal, Potassium is lost to deeper layers by rain or irrigation water by leaching. This total balance can be further refined by considering area under conservation agriculture, green leaf manuring like *Glyricidia* and other non-conventional sources of potassium being used in Indian agriculture, which may further reduce the overall negative balance of K Indian agriculture.

Key words: Potassium mining, Human population, Reserve potassium, Sustainable agriculture

RESPONSE OF TRANSPLANTED PIGEON PEA (*CAJANUS CAJAN* (L.)MILLSP.) CV. BSMR-736 TO DIFFERENT PLANTING GEOMETRY

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The field investigation entitled "To study the Response of Transplanted pigeon pea (*Cajanus Cajan* (L.) Millsp.) cv. BSMR-736 to different planting geometry" conducted at Department of Agronomy, College of Agriculture, Latur. The soil was clayey in texture, moderate in available nitrogen, low in available phosphorus, high in available potassium and moderately alkaline in reaction. The environmental conditions prevailed during experimental period was favorable for normal growth and maturity of pigeonpea crop. The experiment was laid out in RBD with three replication and seven treatments and 21 plot, the gross and net plot size of each experimental unit was : 7.2 x 5.40 M² and 5.40 x 3.60 M² respectively. The treatments were T₁ Dibbling of seed 90 cm x 20 cm, T₂ Transplanting 90 cm x 20 cm, T₃- Transplanting 90 cm x 30 cm, T₄ Transplanting 90cm x 60 cm, T₅ Transplanting 120 cm x 30 cm, T₆ Transplanting 120 cm x 60 cm, T₇ Transplanting 120 cm x 90 respectively.

Transplanted pigeonpea at 90 x 20 cm was significantly higher grain yield (2149 kg ha⁻¹) over all of the treatment. The second best was ... at 90 x 30 cm (1977 kg ha⁻¹). Lowest seed yield was recorded by treatment of pp at 120 x 90 cm (1412 kg ha⁻¹), The B:C ratio was maximum with Treatments at 90 x 20 cm.

(Keyword: transplanting, pigeonpea, planting geometry, land configuration, economics)

DOUBLING OF FARMER INCOMES THROUGH PRECISION FARMING OF VEGETABLE CROPS

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Although cereal-based diet is the characteristic feature of Indian foods habits, the recent trend is diet shift towards the inclusion of more

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vegetable in diet provide a needful opportunity to farmers to grow more vegetable, vegetable farming is also provided a continuous source of cash with good use of land particularly for small and marginal farming. Doubling of farmers income depend on to the farm's income which emphasized the need to make the substantial changes in the farming practices by adopting precision vegetable farming. Most of the Indian farmer's inputs applying in excess amounts like more use of fertilizers, pesticides, and seeds which leads to losses of crop production sustainability and land deterioration. Precision farming is a site-specific management practices, it's delivering the idea of doing the right thing, at the right place and at the right time. Precision farming provides a way to mechanize site-specific management using information technology and providing the substitutes information to manage the farm inputs. It's can assist in managing crop production inputs in an eco-friendly way to the long-term sustainability of vegetable production, confirming that it should reduce environmental loading by applying inorganic chemicals. Precision farming benefits to the environment comes from the more targeted use of inputs that reduce losses from excess applications farm inputs and from the reduction of losses due to nutrient imbalances, weed escapes, insect damage, etc. which will be resulted from raised two to four-fold farm incomes.

PLANT BREEDING FOR DROUGHT RESISTANCE

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Drought stress is the most prevalent environmental factor limiting crop productivity, and global climate change is increasing the frequency of severe drought conditions. Drought resistance' (DR) is a broader term applied to plant species with adaptive features that enable them to escape, avoid, or tolerate drought stress. Drought escape' is the ability of a plant species to complete its life cycle before the onset of drought. Thereby, plants do not experience drought stress, as they are able to modulate their vegetative and reproductive growth according to water availability, essentially through two different mechanisms: rapid phenological development and developmental plasticity. Drought tolerance' (DT) is the ability of plants to endure low tissue water content through adaptive traits. These adaptive traits involve maintenance of cell turgor through osmotic adjustment and cellular elasticity, and increasing protoplasmic resistance. Improvement of yield and maintaining yield stability of crops, under normal as well as drought stress conditions, is essential for the food security of the growing global population. It is difficult to resolve the role of different components of DR in the stability of the crop yield as the major objective. However, there exist a variety of different mechanisms for drought escape, avoidance, or tolerance in natural populations that can improve DR and maintain grain yield in crop plants. In nature, extreme DR is found in resurrection plants which possess strong drought escape mechanisms.

Keywords : Drought stress, tolerate, phenological development etc.

INTER-SPECIFIC HYBRIDIZATION IN *CUCURBITA* SPECIES: CHALLENGES AND ACHIEVEMENTS

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Genus *Cucurbita* is an economically important group of vegetables grown worldwide. This genus has the highest genomic number among all cultivated cucurbits which is $2n=40$. It consists of 27 species. Among them, most commonly cultivated species are *C. moschata*, *C. pepo*, *C. maxima*, *C. mixta* and *C. ficifolia*. *C. moschata* occupies a central position among the annual species. It includes crops such as squash, pumpkins, and gourds. The wild species of this genus possesses resistance to various biotic and abiotic stresses. Inter-specific hybridization is an important technique for gene transfer from a wild relative species (*Cucurbita lundelliana*, *C. mixta*, *C. ficifolia* etc.) to another cultivated genotype. In general, success of hybridization within genus *Cucurbita* is a species-dependant. For example, good quality flesh from *C. maxima* to *C. moschata*, bushy growth habit from *C. pepo* to *C. moschata*, disease resistance from *C. lundelliana* or *C. martinii* to *C. moschata*. F_1 hybrids can be obtained from most inter-specific matings, usually with difficulty. The main problems are the crossing barriers and the male sterility of the F_1 and subsequent generations. Techniques like *in vitro* pollination and fertilization, embryo rescue, bridge lines, somatic hybridization, and manipulation of ploidy level have been utilized successfully to overcome these barriers. Therefore, different *Cucurbita* species can be utilized to develop many varieties with desirable traits by employing inter-specific hybridization, if cross compatibility is achieved between the wild and cultivated species.

Key words: *Cucurbita*, Inter-specific hybridization, wild relative species

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**IMPACT OF DROUGHT IN CHICKPEA****AMIT KUMAR¹, SHENDE R. T.¹ AND ROSHAN SHINDE²**¹Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut, UP; ²Indira Gandhi Agriculture University, Raipur, India;

Chickpea is a cool season legume traditionally grown under rainfed conditions globally. The crop is exposed to drought stress due to recent changes in climate conditions. The major chickpea-growing areas are in the arid and semiarid zones. Chickpea generally faces terminal drought, increasing towards the end of the growing season, due to the depletion of soil moisture; or intermittent drought, caused by a break-in rainfall followed by insufficient rains during the growing season. Approximately 90% of the world's chickpea is grown under rainfed conditions where terminal drought is one of the major constraints limiting productivity. Terminal drought stress is typical in the post-rainy season in semiarid tropical regions where crops grow and mature on a progressively depleting soil moisture profile. Flowering and pod setting in chickpea are the stages of development that are most sensitive to drought stress. A number of yield components including dry matter and harvest index of rainfed chickpea were less in plants exposed to drought stress than irrigated plants. Seed yield losses due to drought range from 30% to 100% depending on genotype and the type of drought experienced in the target environment. There is a need to develop new high throughput phenotyping techniques and/or physiological, biochemical or molecular markers that determines reproductive function. Future research should focus on screening germplasm collections to quantify genetic variability and identify the drought tolerant genotypes for use in breeding programs.

SEASONAL INCIDENCE OF *SCIRPOPHAGA INCERTULAS* (WALKER) ON BASMATI-1 IN WESTERN PLAIN ZONE OF UTTAR PRADESH.**AMIT RANA¹, RAJENDRA SINGH¹ S. K. SACHAN¹ D.V. SINGH¹ GOPAL SINGH¹, VIVEK³, ARUN KUMAR¹ AND SUCHARU SINGH¹**¹Department of Entomology, ²Department of Plant Pathology, ³Department of Agronomy, College of Agriculture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut-250110 (U.P). India.

The present investigation was carried out to study the at Crop Research Center of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. The yellow stem borer, *S. incertulas* (Walker) was recorded as major pest. The incidence of *S. incertulas* (Walker) was recorded on the incidence of yellow stem borer *Scirpophaga incertulas* (Walker) showed that it was recorded on 26th standard week for the first time and continued till second week of November i.e. 46th standard week. The infestation of stem borer recorded as dead heart/ white ear head ranged from 0.85 to 15.25 per cent during the crop season *Kharif* 2017, and positive correlated with all the other weather parameters.

ECO FRIENDLY MANAGEMENT OF YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* (WALKER) ON BASMATI-1 IN WESTERN PLAIN ZONE OF UTTAR PRADESH.**AMIT RANA¹, RAJENDRA SINGH¹ S. K. SACHAN¹ D.V. SINGH¹ GOPAL SINGH¹, VIVEK³, ARUN KUMAR¹ AND SUCHARU SINGH¹**¹Department of Entomology, ²Department of Plant Pathology, ³Department of Agronomy, College of Agriculture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut-250110 (U.P). India.

The present investigation was carried out to study the “Eco friendly management of yellow stem borer, *Scirpophaga incertulas* (Walker) on paddy in western plain zone of Uttar Pradesh” in randomized block design with three replications and seven treatments at Crop Research Center of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. The yellow stem borer, *S. incertulas* (Walker) was recorded as major pest. Efficacy of different insecticide Fipronil 5 % SC (Regent) @ 50 ml a.i., Thiamethoxam 25 % WG, Evident, @ 25.0 g. a. i., Lambda cyhalothrin 4.9% CS, Matador, @ 12.5 ml a.i., *Trichogramma japonicum* @ 1.0 lack/ha, *Beauveria bassiana* @ 2.5 kg /ha, *Metarrhizium anisopliae* 4.7 × 10⁸ spores. @ 2 g/lit. of water and control, was tested against *S. incertulas* (Walker). Fipronil 5 % SC (Regent) @ 50 ml a.i. was found most effective treatment in reducing the dead hart as well as white ear formation as it was 2.1-3.0 percent after 21 days of 1st and 2nd application, respectively the next best treatment were Thiamethoxam 25 % WG, Evident, @ 25.0 g. a. i. and Lambda cyhalothrin 4.9% CS, Matador, @ 12.5 ml a.i. with 3.65 and 3.13 percent dead hart formation, respectively after 21 days both the spray. The higher yield (46.15q/ha) and cost benefit ratio (1: 9.45) were also obtained from Fipronil 5% SC. *Trichogramma japonicum* was found safer to spider population followed by *Beauveria bassiana*.

ROLE OF PLANT PHYSIOLOGY FOR ADVANCES IN AGRICULTURE**AMIT KUMAR SHUKLA¹, ANKIT KUMAR PANDEY², ROHIT KUMAR SINGH³, PINGIDI SOUJANYA⁴***Faculty of Bhagwant University, Ajmer, Rajasthan, 305 004*

Plant physiology is a sub discipline of botany concerned with the functioning, or physiology, of plants. Closely related fields include plant morphology (structure of plants), plant ecology (interactions with the environment), phytochemistry (biochemistry of plants), cell biology, genetics, biophysics and molecular biology. Fundamental processes such as photosynthesis, respiration, plant nutrition, plant hormone functions, tropisms, nastic movements, photoperiodism, photo morphogenesis, circadian rhythms, environmental stress physiology, seed germination, dormancy and stomata function and transpiration, both parts of plant water relations, are studied by plant physiologists. Crop yield is controlled by the interaction between the genetic potentialities of crop plants and the environment in which they grow. Variations in the genotype and in the environment, including weather and cultural practices, act through physiological processes to control growth. Thus the physiological processes of plants are the machinery through which both the genetic potentialities and the environment operate to produce the quantity and quality of growth or phenotype which we term yield. In a brief consideration of the relation borne by plant physiology to agricultural development it will be possible merely to call attention to some of the more important improvements in the art of agriculture that have resulted from the development of plant physiology, and to indicate some of the more important directions in which this science may affect the agriculture of the twentieth century. It will be necessary to call attention briefly to the origin of our cultivated plants, the discovery of the sexuality of plants, the discovery of the nature and sources of plant food, and the nature and causes of plant diseases. It will be desirable also to consider briefly that the training in plant physiology required for the investigator, the teacher, and the farmer.

Key Words: Agriculture, Plant Physiology, Crop, Yield, Advances etc.

COMBINING ABILITY (GCA & SCA), HETEROSIS OVER BETTER AND ECONOMIC PARENTS AND INBREEDING DEPRESSION ANALYSIS IN YELLOW SARSON (*BRASSICARAPA* VAR. *YELLOW SARSON*)**AMIT TOMAR AND MAHAK SINGH***Department of Genetics & Plant Breeding, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur-208002, U.P., India.*

The experimental materials were comprised 25 lines namely, YSC-63, YSC-41, B-09, YSK-71, YSKM-11-02, YSC-76, YSKM-10-1, YSKM-11-1, YSC-75, YSKM-10-02, YSK-9-01, YSC-80, K-88, YSC-15, Type-42, YSC-18, YSK-03, YSC-21, YSC-92, YSC-45, YSC-30, YSC-95, YSC-40, YSC-46 and YSC-46 used as female and 4 testers namely, NRCYS-05-02, YSH-401, YST-151 and Pitambari (check) used as male of yellow sarson. The materials comprising of 29 parents + 100 F₁s + 100 F₂s were sown in Randomized Block Design with three replications during *Rabi* 2014-2015 at Oilseed Research Farm, Kalyanpur of C.S. Azad University of Agriculture & Technology, Kanpur-208002. All the Twenty five females were crossed with each of four males in line x tester mating designs to produce sufficient amount of F₀ seeds of 100 crosses during the *Rabi* season 2011-12 to raise the F₁s. The F₁s were selfed in order to obtain F₂s seeds during the *Rabi* season 2012-13. The parents were also maintained through selfing in a Randomized Block Design (RBD) with three replications at the Oilseed Research Farm, Kalyanpur of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Each treatment was planted in one row, of 3 m length and 45 cm apart, Plant to plant distance was maintained at 15 cm by thinning. All the recommended agronomic practices were adopted for raising a good crop. The observations were recorded on eight characters namely; number of siliquae per plant, number of seeds per silique, biological yield per plant (g), harvest index (%), 1000-seed weight (g), oil content (%), protein content (%) and seed yield per plant. The analysis of variance for combining ability was carried out according to the method outlined by Kempthorne (1957). The oil content (% seed weight) and protein content (% de-oiled meal weight) was estimated by using Nuclear Magnetic Resonance (NMR) method. The analysis of variance indicated significant differences among the treatments for all the characters. Parents vs. F₁s, parents vs. F₂s and F₁s vs. F₂s also revealed highly significant differences for all the characters except harvest index and oil content. The estimate of σ^2_{D} were lower than σ^2_{E} for all the characters. The analysis of variance for combining ability were found significant differences for all the characters except biological yield per plant in F₁ and F₂ generations. The parents namely, YSC-41, B-09, YSC-76, YSKM-11-1 and YSKM-10-02 were found common good general combiners in both F₁ and F₂ generations based on gca effect and *per se* performance for seed yield per plant. The cross combinations namely, YSC-63 x YSH-401, YSC-41 x NRCYS-05-02, YSC-41 x YST-151, B-09 x YSH-401 and B-09 x YST-151 were found common good specific combiners in both F₁ and F₂ generations on the basis of sca effects and *per se* performance for seed yield per plant. The cross combinations namely, B-09 x YST-151, YSKM-10-02 x YST-151, YSC-15 x YST-151, YSC-30 x YST-151 and YSC-84 x YST-151 were shown desirable and significant heterotic response over better and economic parent and high inbreeding depression for seed yield per plant.

Key words: Better parent, combining ability, gca, heterosis, inbreeding depression, sca and yellow sarson.

ROLE OF ENDOPHYTIC MICRO-ORGANISMS IN BIOLOGICAL CONTROL OF PLANT DISEASES**AMRITPAL MEHTA¹, ASHWANI KUMAR BASANDRAI², VAKUL SOOD¹, JITENDER SHARMA¹, RAKESH KUMAR³**¹Division of Plant Pathology, SKUAST, Jammu-180009, India, ²Department of Plant Pathology, CSKHPKV, Palampur-176062, India³Division of Vegetable Science & Floriculture, Jammu-180009, India

Plant pathogens include fungi, bacteria, viruses are the most visible threats to sustainable food production. The total annual worldwide crop loss from plant diseases is about \$220 billion. The decreasing efficacy of the chemical as well as risks associated with residues on the plants have highlighted the need for a more effective and safer alternative control measures. In recent years, endophytes have received increasing attention as a promising supplement or alternative to chemical control. Endophytic micro-organisms (fungi and bacteria) that colonize internal plant tissues without causing visible damage to their hosts. Endophytic bacteria penetrate via stomata, lenticels, root hairs, root cracks, tissue wounds and become systemically disseminated in the host plant, actively colonizing the apoplast. Fungal endophytes invade plant tissue by direct penetration, via appresoria formed on cuticle or via natural openings or through wounds. Fungal endophytes inhibit plant pathogen by producing antibiotics and lytic enzymes secreted by endophytes, indirect effects by induction of plant resistance and stimulation of plant secondary metabolites and ecological effects. Fungal endophytes protect plant against pathogens by phytoalexins production. Plant growth promoting bacteria protect plant directly by inducing plant growth and indirectly by the production of phytohormones, through production of antifungal or antibacterial agents, siderophore production, nutrient competition and induction of systematic acquired host resistance, or immunity or by enhancing availability of minerals. Endophytes as bio control agents are effective, economically viable, practically applicable and environmentally safe. So that endophytes have enormous potential as biocontrol agents and reiterate the need for concerted efforts to obtain more basic information about endophyte biology before they can be used effectively for biocontrol.

SCREENING OF VARIOUS BOTANICALS IN THE MANAGEMENT OF *RHIZOCTONIA BATATICOLA* (*MACROPHOMINAPHASEOLINA*) INCITANT OF DRY ROOT ROT OF MUNGBEAN (*VIGNARADIATA*)**ANAM CHOUDHARY AND SHABBIR ASHRAF**

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Present experiment was conducted to study the various phytoextracts for their efficacy against *Rhizoctonia bataticola* (*Macrophomina phaseolina*) causing dry root rot of mungbean. Plant extracts of ten different plant species, viz. Garlic, Turmeric, Neem, Ginger, Onion, Amla, Castor Tobacco, Betel and Fennel were used at three different concentration 10%, 20% and 30%. In vitro inhibitory effect of the various botanicals were tested on the mycelial growth of *Fusarium* by using poison food technique. The pathogen were inoculated into the media separately previously and incubated for seven days. In general, all the test botanicals controlled the mycelial growth to varying degrees. Radial growth of *Rhizoctonia bataticola* was recorded. The growth inhibition increase with the increase of concentration of all the plant extracts. Highest mycelial growth inhibition was recorded with garlic extract at 30% concentration (100%) followed by 91.80% and 80.52% at concentration 10% and 15% respectively. Other botanicals also exhibited antifungal activity at varying percentage. The results of the experiment suggested that the use of garlic extracts are effective for minimizing dry root rot incidence of mungbean. Calotropis and castor were found least effective against the fungus. The present study revealed that these botanicals could be exploited for the eradicating this pathogen accordingly, this is an important proactive measure in preventing the spread of the wilt disease through a more ecofriendly and sustainable approach.

- Keywords: Mungbean, *Rhizoctonia bataticola*, botanicals.**STUDY ON POPULATION DYNAMICS OF MUSTARD APHID *LIPAPHIS ERYSIMI* (KALT.) IN RELATION TO WEATHER PARAMETERS****ANAM ZIA AND MASARRAT HASEEB**

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Mustard aphid *Lipaphis erysimi* (Kalt.) is the most serious pest and considered as restrictive factor in cultivation of mustard causing 35-96% reduction in yield depending upon weather conditions. The study was carried on population dynamics of mustard aphid on mustard in relation to weather parameters which was studied during rabi 2015-16 cropping season. The study will provide an opportunity to face the pest challenge and their timely management. The natural appearance of mustard aphid was observed from 3rd standard week and lasted up to 11th standard week however a change in their number is being observed in both the consecutive year. The study revealed that population of mustard aphid reaches its peak in 7th standard week with an increasing temperature and decreasing humidity, however correlation coefficient shows a contradictory result between population dynamics and weather parameters.

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SCIENCE & TECHNOLOGY IN AGRICULTURE

ANAND KUMAR AND ASHOK KUMAR GODARA

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In addition to water scarcity and increasing land degradation, Indian farmers are vulnerable to impacts of climate change as their livelihood largely depends on monsoon, markets and intermediaries who are integral part of their lives but are unpredictable and play havoc on rural livelihoods. With the agricultural growth rate hovering around 3% annually, farmers have felt severe economic distress and hence the clarion call by the Prime Minister to Double Farmers' Incomes by 2022.

However, this will be a challenge given increasing fragmentation of holdings, extreme weather events, rising input costs and post-harvest losses. It is where challenges are greatest that we require the very best that human innovation can offer. The government has already placed a clear focus on farmers' welfare with policies to enhance water availability (Har Khet ko Pani), increased water use efficiency (more crop per drop), better farm practices, improving soil health, increasing investment in agriculture research, extension and support prices, creating rural infrastructure, ensuring timely delivery of credit and technology, encouraging market reform (e-NAM) and reducing risk in agriculture through the introduction of a new insurance scheme (PMFBY). A draft strategy paper released by the Ministry of Agriculture and Farmer Welfare targeted to raise the average annual income of a farmer household in India to Rs. 2,19,724 by 2022-23, from Rs. 96,703 in 2015-16, with the help of additional public and private investment of Rs. 6.4 lakh crore. Research and technology with the support of pragmatic policies, targeted budget allocations and convergence of schemes based on agro-ecologically focused growth engines will be key to realizing this vision.

Key words: Science, Technology, Agriculture

AN EFFECTIVE WAY TO PROMOTE SUSTAINABLE AGRICULTURE THROUGH ORGANIC FARMING

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The conservation of natural resources is critical for the agricultural sector which ensures long-term sustainability. The rigorous reliance on chemical fertilizers and pesticides always questions the concept of sustainability in its all aspect. The use of chemicals in farming have serious long term effects on the environment. These chemicals contaminating soil and water sources, and enters in to the food chain. In addition to this, when cattle consume foliage that contains these chemicals become highly concentrated in the flesh and milk of dairy cows. Ultimately, it creates serious health problems to people who consume dairy products. Organic agriculture avoids all kinds of practices which damages agro-ecosystem. It provides healthy food while establishing an ecological balance to prevent soil fertility or pest problems. In order to alleviate all environmental and social problems arising from chemical based farming, the promotion of organic farming is indispensable. A shift to organic agriculture brings about significant changes: restricted use of synthetic fertilizers and pesticides, increases of other inputs such as organic materials, labor, perhaps machinery, cultural practices (e.g., crop rotation), and better knowledge of biological processes. These changes have serious implications. The concept of organic agriculture builds on the efficient use of locally available resources, and on the use of adapted technologies ex: To improve soil fertility, biodiversity and sustainability of agricultural production, To conserve natural resources, To improve agronomic and economic performance, to make yields more stable, especially in risk-prone tropical ecosystems, to achieve better food quality and food security, To provide access to attractive markets through certified products, To create new partnerships within the whole value chain as well as to strengthen self-confidence and autonomy of the farmers. The possibilities are identified regarding potential of organic farming to promote sustainable agriculture in India: 1. As India now in the initial stage of organic farming, the quantity produced not enough to feed the large Indian population. Under this situation, concentrating on the export aspect of organic farming is more suitable opportunity for India 2. Optimization of the potential trade in organic products is one of the good opportunities for improving the conditions of agricultural sector of India. Through the export of organic agricultural products, India can improve the conditions of Indian farmers as well as the entire agricultural sector 3. Organic farming can be adopted as one of the strategy for sustainable agriculture promotion with a long term perspective to foster community institutions that meet employment, environmental and health needs of the society 4. Institutional barriers to the development of the organic sector are needed to be resolved with proper strategy and execution 5. The traditional and indigenous farming knowledge should be conserved, while introducing selected modern technologies to manage and enhance diversity into farming systems. The increasing awareness about the safety and quality of foods, long term sustainability of the present farming system persuades sustainable agriculture practices. The organic farming has emerged as an alternative system of farming which not only address the quality and sustainability concerns, but also ensure profitable livelihood option for rural community of India. As India in the initial phase of Organic farming, strong institutional mechanisms and governmental support must be essential to realize its sustained growth. Strong Local institutions build up including farmers Group, Local Guidance, knowledge sharing, market linkages etc. are critical to build up successful growth of organic farming.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**“EFFECT OF GAMMA RADIATION IN CV. NOVALUX AND PRAHA OF GLADIOLUS”****ANAND S. RAWAT, B.D. BHUJ, R SRIVASTAVA, S.C. SHARMA, N.K. SINGH***Department of Horticulture, College of Agriculture, GBPUA&T, Pantnagar U.S. Nagar, Uttarakhand-263145*

The present investigation was conducted at Model Floriculture Centre, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, during 2017-18. The investigation was laid out in factorial concept of randomized block design (RBD) in open field condition. The objective of investigation was to study the effect of various doses of gamma irradiation on different cultivars and their interaction effect on plants and the identification of desirable mutants for quality and agronomic characters. The medium sized corms were used as experimental material from the two gladiolus cultivars viz. 'Nova Lux' and 'Praha' irradiated with gamma rays of various doses viz. 0.0 Kr (control), 4.0 Kr, 4.5 Kr, 5.0 Kr, 5.5 Kr, 6.0 Kr and 6.5 Kr. The observations were recorded from whole plant population. According to the findings a random reduction in survival percentage of plants were found at higher doses of gamma rays in all the cultivars. The gamma irradiation showed an inhibitory effect viz. days to emergence, plant height, number, length and width of leaves, in all the cultivars when irradiated with gamma rays. The early flowering and increment in blooming duration were recorded at higher doses. The number of tillers and corms increased with increased doses of gamma rays whereas number and size of floret, spike length, rachis length, vase life, water absorption, weight and size of corms and cormels were reduced. The plants were unable to produce flower spike between 5.0 Kr to 6.5 Kr of gamma rays. Mutation spectrum and frequency were found highest in 'Praha' and most of the variations were observed in the form of chimeras and abnormalities. Some desirable mutants were identified in all the cultivars. Erratic and non-directional changes were observed due to gamma irradiation.

EVALUATION OF CUSTOMIZED FERTILIZERS IN RESPECT TO YIELD, SOIL NUTRIENTS STATUS, UPTAKE AND ECONOMICS OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER EASTERN UTTAR PRADESH.**ANAND SINGH¹, NEERAJ KUMAR², PRAMOD KUMAR³, BHAVYARAJ PANDEY⁴ AND AKANSHA SINGH¹***Soil Science & Agril. Chemistry, SVPUAT, Meerut, Assistant Professor, Soil Science & Agril. Chemistry, NDUAT, Faizabad, Agronomy, CSAUAT, Kanpur, Soil Science & Agril. Chemistry, NDUAT, Faizabad*

Customized fertilizers can improve productivity and sustain soil health and fertility. The present research was conducted was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during Rabi 2015-16 in randomized block design with four replications and the treatment consisted of T₁ (control), T₂ (RDF), T₃ (Soil test-based recommendation), T₄ (Indo-Gulf Customized Fertilizer), T₅ (TCL Customized Fertilizer) and T₆ (Farmer's Practice). The soil of experimental field was silt loam texture, low in organic carbon (0.38%) and low in available nitrogen (151.76 kg ha⁻¹), phosphorus (14.75 kg ha⁻¹) and medium in potassium (248.00 kg ha⁻¹) and low in sulphur (9.00 kg ha⁻¹), zinc (0.50ppm) and boron (0.46ppm). The grain and straw yield (q ha⁻¹), uptake of nitrogen, phosphorus, potassium, sulphur, zinc and boron were maximum under T₃, which was at par with T₄ and T₅ and significantly superior over T₁, T₂ and T₆. The maximum grain yield of wheat (46.64 q ha⁻¹) was recorded with T₃ which was significantly higher over than T₁ (20.08 q ha⁻¹), T₆ (30.78 q ha⁻¹) and T₂ (38.10 q ha⁻¹) while at par with T₅ (43.92 q ha⁻¹) and T₄ (44.97 q ha⁻¹). The grain yield of wheat was increased with the treatment T₃ 22.41% and 51.53% over T₂ and T₆ respectively. Similarly, 3.71% and 6.19% over T₄ and T₅ respectively. The yield difference between both the customized fertilizers was not up to the level of significance. Variation in availability of nutrients was observed under most of the treatments due to different nutrients management. The higher availability of nutrient was observed under all the treatments except control and farmer's practice. The availability of S, Zn and B were maintained under customized fertilizers treatment and soil test-based recommendation. While, maximum depletion was observed in control and farmer's practice. Maximum net return (Rs. 43828 ha⁻¹) and B:C (0.95) were calculated in T₃ followed by T₄ (net return Rs. 39078 ha⁻¹ and B:C 0.82) and T₅ (net return Rs. 36925 ha⁻¹ and B:C 0.78).

Key words: Customized fertilizers, TCL, Indo-Gulf, ppm.

EFFECT OF ORGANIC MANURE AND INORGANIC FERTILIZERS ON GROWTH AND LEAF YIELD OF *ALOE VERA* (L.) AT FARMER FIELD**ANANT KUMAR, SATYAPRAKASH, VIRENDRA PAL, PK MADKE, ARVIND KUMAR AND JOGINDER SINGH***K.V.K., Ghaziabad, (SVPUA&T, Meerut)*

An experiment was conducted at farmer field during 2016-17 in the Dist. Ghaziabad UP. to study "Effect of organic manure and inorganic fertilizers on growth and leaf yield of *Aloe vera* (L.)" in a factorial randomized block design to find out the effect of organic manure (farmyard manure) and inorganic fertilizers (nitrogen and sulphur) alone and combine application of farmyard manure, graded levels of nitrogen and sulphur on growth and leaf yield of *Aloe*. The quintessence of results relating to the mean data revealed that the treatments involving combination of higher levels of FYM, nitrogen and sulphur viz: farmyard manure at 25t. per hectare along with nitrogen 60kg/ha and sulphur 18kg/ha., recorded the highest leaf yield (48.45 t./ha). The leaf yield increases are different growth parameters viz:

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Plant height, plant spread, number of leaves per plant, leaf length, leaf thickness and leaf width. The enhanced leaf yield due to combined application FYM, nitrogen and sulphur: FYM increased the uptake of nitrogen and sulphur.

IMPACT OF MICRO IRRIGATION TECHNIQUES ON HORTICULTURE PRODUCTION.

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Micro irrigation is defined as the frequent application of small quantities of water directly above and below the soil surface usually as discrete drops, continuous drops or tiny streams through emitters placed along a water delivery line. It can also be defined as the application of water at low volume and frequent interval under low pressure to plant root zone. Drip irrigation, also known as micro irrigation or trickle irrigation, applies water slowly, directly to the soil around the crop. Drip irrigation generally uses less than half the water of overhead and furrow irrigation. Efficiency with drip irrigation exceeds 90% where as a sprinkler system is between 50 to 70% efficient. The impacts of micro irrigation technologies indicate that they are usually promoted primarily for saving water in irrigated agriculture and averting the impending water crises. Micro irrigation technologies lead to poverty reduction through substantial increases in farm income due to an increased area of cultivation, better crop yields, enhanced output quality, early crop maturity and hence higher unit prices, and reduced cultivation costs, particularly for operations like irrigation and weeding. Micro irrigation technologies enhance nutritional security by enabling the production and consumption of vegetables, particularly leafy vegetables, which are usually missing in the traditional staple diets of many cultures. Study the performance of drip irrigation on growth and development of horticultural crops. The study revealed the effect of drip irrigation treatment on growth and development of mango, sapota and cashew nut. It was found that the treatment 40 litres water day⁻¹ plant⁻¹ through drip was found superior than all other other treatment in respect of height (30.33), canopy (1043) and diameter (2.92) stem of mango plant. In respect of sapota plant, treatment 60 litre water day⁻¹ plant⁻¹ was found satisfactorily superior in respect of height (28.4), canopy (787) and diameter (2.82) stem of sapota plant.

DOUBLING FARMER'S INCOME THROUGH INNOVATIVE AND AGRONOMICAL APPROACHES

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Agriculture is the largest enterprise in the country. Indian agriculture suffers from low productivity, low quality awareness and rising imports. Farmer in distress, to alleviate the distress farmer's incomes need to increase substantially. Indian agriculture has grown at less than 2% compound annual growth rate in last five year. Agriculture sustains livelihood for more than half of the country's population. Doubling income in a short period is a daunting task. The government of India in its annual budget of 2016-17 set a policy target of doubling farmer's income by 2022 by constituting Dalwai committee through seven point strategies: adequate institutional arrangement to mitigate risk and crop loss; irrigation-Per Drop, More Crop; quality seed; soil-test-based nutrient management-Distribution Soil-health card; post harvest losses- investment in warehousing and cold chains; value addition; creation of a national agriculture market, removing distortion and e-platform across 585 markets; new crop insurance scheme: Pradhan Mantri Fasal Bima Yojana, minimum premium and maximum security; promotion of ancillary activities such as, poultry, beekeeping, fisheries, mushroom and integrated farming system module. Major sources for enhancing farmer's income through agronomic interventions should address the challenges of reducing the cost of cultivation as well as increasing the productivity of the farm. Other innovative technologies like encourage contract farming, convert the top 10 agriculture universities into centres for excellence to make region-specific strategies to raise crop yields, advise on the creation of integrated supply chains, and prepare plan to promote exports and cut imports.

Key words: Drip, Organic farming, e-NAM, Contract farming, Value addition and Allied activities

SEED AND SEED QUALITY: A BASIC UNIT FOR PRODUCTION

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Seed is the basic fundamental unit of agriculture. We can define the seed as the fertilized ripened ovule of a flowering plant containing an embryo and capable normally of germination to produce a new plant. The production of the agriculture or horticulture is mostly depends upon the quality of seed. Hence the seed quality plays an important role in a production management system. Basically the quality of seed is governed by its characteristics which bear itself like genetic potential, physical health and chemical composition. The good quality seed should bear moral characters which are high genetic purity, high physical purity, high germination ability, high vigor, better establishment, free from pest and disease, good physical appearance, high longevity / shelf life, Optimum moisture content for

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storage, High market value. The maintenance and improvement of seed quality is big challenge in field condition. There are certain recommendations regarding to seed quality during seed production in field conditions which are monitors and governs by organizing bodies. There are also several laws and acts are playing important role in maintaining seed quality like seed act (1966). Generally there are five types of seeds which are developed and produced by an organization or agency. Nucleus seed, Breeder seed, foundation seed, registered seed and certified seed. The quality seed should be fulfilled the criteria of standard quality seed, generated by an organization or agency, which produced under the basics of Seed legislation and follows the process of seed certification.

ROLE OF HOUSEHOLD PRACTICES IN INSECTICIDES DECONTAMINATION IN CHILLI (*CAPSICUM ANNUUM* L.)**ANIL KUMAR JASWAL^{1*}, S K PATYAL² AND VIKRAM SINGH³***YSP, UHF Nauni-173230 Solan, Himachal Pradesh*

The crop losses in the world would have been estimated around 40 per cent, if pesticides were not used in agriculture. However, the presence of pesticide residues in food commodities has become a major cause of concern. Vegetables are highly beneficial for the maintenance of human health or prevention of diseases. India is a major producer, exporter and consumer of chilli in the world. The chilli crop suffers major quantitative and qualitative loss in production due to chilli thrips, *Scirtothrips dorsalis* Hood and yellow mite, *Polyphagotarsonemus latus* (Banks). To control these pests malathion, dimethoate, ethion and methyl parathion are sprayed on the crop. But data generated by "Monitoring of Pesticide Residues at National Level" revealed presence of acephate, cypermethrin and profenofos residues in chilli fruits throughout the country. Hence, in view of the possible health hazards posed by these insecticides to the consumers, the study on the role of household practices in the decontamination of these insecticides from chilli fruits was carried out in the Department of Entomology, Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during the year 2014. Acephate, cypermethrin and profenofos were sprayed on chilli crop at single dose of 560, 50 and 500 g a.i.ha⁻¹, respectively and at double dose of 1120, 100 and 1000 g a.i.ha⁻¹, respectively. Different decontamination practices such as tap water washing, lukewarm water washing, saline water washing, vinegar water washing and tamarind water washing were used and found effectively in removing residues from chilli fruits upto 45.07, 48.96, 58.85, 53.54 and 54.12 per cent, respectively. The study concluded that saline water washing was found most effective (upto 58.85%) in dislodging insecticide residues.

Key words: chilli, residue, acephate, cypermethrin, profenofos, decontamination

EFFECTIVENESS AND OPINION OF AGRI-EXTENSION PERSONNEL ABOUT IT AS AN EXTENSION ADVISORY TOOL: A CASE STUDY**ANIL KUMAR MALIK^{1*}, KRISHAN YADAV² AND BABU LAL DHAYAL³**

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E-extension as a modern method of communication can be used to enhance the effectiveness and efficiency of extension services for agricultural sustainability. E-extension is the delivery of extension services using the internet and the latest information communication technologies (ICTs), which allow networking, online sharing, and collaboration. Agri-Extension personnel are a major factor in conducting an effective agricultural extension work plan; therefore, understanding extension personnel opinion towards the use of E-extension is important. So, the present investigation was conducted in CCS Haryana Agricultural University, Hisar. A total of 108 respondents (23 from main campus and 85 from outstation) were included in the sample of study. Primary data was collected using a self administered questionnaire and analyzed with the help of SPSS using descriptive statistics (Percentage, mean, rank order, standard deviation etc.). The results of the study revealed that internet has enhanced the practice of extension and personal contact adjudged as a most effective extension tool with a mean score of 4.19.

Keywords: E-extension, Agri-Extension personnel, Opinion, Internet, Effectiveness.

POSSIBILITIES OF DIFFERENT TYPE OF PLASTIC MULCHES IN LADAKH REGION**ANIL KUMAR, VIKAS GUPTA¹, T.H. MASOODI AND D. NAMGYAL¹***High Mountain Arid Agriculture Research Institute-Leh, SKUAST-Kashmir, ¹Krishi Vigyan Kendra, Leh, SKUAST-Kashmir*

Ladakh is cold arid desert area at high altitude has limited access to improved agricultural technologies in changing climatic situation especially low and high temperature during winter and summer, shrinking of water resources, lower fertility level of soil, wind velocity and attack of insect pest etc. Mulching is an essential cultural technique that can reduce the amount of work inherent in gardening,

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helping to produce healthier plants and potentially increasing vegetable yields. Mulch is often defined as any material applied to the soil surface as cover. It can be divided into two general groups organic and inorganic. Mulching is the process of covering the soil surface around the plants with an organic or inorganic material to create micro climate for plant growth, development and efficient production. Importance of different type of mulches viz., Black mulches it does not allow sunlight pass through the soil, it is especially used for weed control, clear or transparent mulches is good for soil solarization and inhibits the growth of soil borne diseases, yellow plastic mulch is attracts certain insects and thus acts as a trap for them, white colour is cools the soil, silver colour mulch is cools the soil and repels some aphids and thrips, red colour mulch is partially translucent and allows radiation to pass through and warm the soil.

OVERCOME DEMAND OF PEOPLE BY PRESERVATION AND PROCESSING OF FOOD

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India is the second most populated country in the world with seventh largest geographical area of around 3,166,414 sqkm. To fulfil the basic food requirement of whole country thorough planning and management is required. Food preservation and processing plays an important role in fulfilling food requirement of the country. Food preservation has become a part and parcel of the life of a common man. Food preservation is inevitable owing to many reasons. Some foods such as fruits and vegetables are available in specific seasons and not in others, while other foods are more abundantly available in some season than in others. In some places there is a surplus production of a food product, whereas in other places there is an inadequate supply. Foods can also be perishable (likely to decay or go bad quickly) and semi-perishable including juicy fruits, vegetables, mangoes, tomato, papaya and many more, which very quickly get spoilt. To promotion of food processing industries in the country which would result in reduction in post-harvest losses, efficient storage and transportation, processing, increase in shelf life of food products, availability of fresh and processed products at reasonable prices to consumers and better income to the farmers. Food preservation plays an important role in our life. To understand the challenges of food preservation, we need to understand the varied topography and climate of the state. Today, food preservation is very important to fulfil the food supply needs of a developing country like India. It also ensures that the food is available and its supply is maintained at all times. Furthermore, problems like food shortage or famine can also be avoided.

GENETIC BIO-DIVERSITY SURVEY AND COLLECTION OF *ALLIUM SP.* IN INDIA

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Genetic resources are the building for new varieties. India is a reservoir of genetic diversity of *Allium* species and related germplasm of wild species. These species was collected viz., *Allium cepa* L. *Allium cepa* var *aggregatum* L. *Allium ampeloprasum* L. (syn. *A. porrum* L.) *Allium kurrat* L. *Allium tuberosum* L. *Allium scheinoprasum* L. *Allium ampeloprasum* L. *Allium cepa* var. *ascalonicum* L. *Allium cepa* x *Allium fistulosum* A. *atrosanguineum* A. *auriculatum* A. *atropurpureum* A. *bakeri* Regel A. *blandum* *carolianianum* A. *consanguineum*, A. *clarkei* Hook (This species was collected from protected habitats ie kitchen garden or backyard of darma valley of munsiyari, Pithoragarh district of Uttarakhand The species collected by me, Voucher specimen AKS-126/IC-383446, altitude 1500-2000 msl. spices maintained of field Gene Bank of, National Bureau of plant Genetic Resources, Regional Station Bhowali, Nainital of UK.) A. *creoprasum* A. *fedschenkoanum* A. *humile*. The Genetic diversity is essential to develop improved cultivars with broad genetic and wide adaptability, moreover existenc of genetic diversity is also essential to meet current and future, breeding requirements. This research has full details about the same.

Keys Words : Genetic Resources, Germplasm, Wild Relatives

GENE FLOW IN SEED PLANTS

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Gene dispersal (flow, or migration) within and between plant populations has been of continuous interest to plant breeders and seed producers for many decades. Economic considerations have stimulated studies of gene flow as a function of distance, breeding system, pollinating agent, and planting design in numerous domestic plants. Only during the past two decades have a large body of plant evolutionists become interested in information accruing from these studies, and in the rates of gene flow in wild populations. Their efforts have concentrated primarily on related problems such as adaptations for and mechanics of pollen and seed (or fruit) dispersal, adaptive radiation in pollination and seed dispersal mechanisms, and colonization and the alteration of species boundaries. Early in this

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century, anecdotal evidence on the movement of pollen and seed vectors, dispersal of pollen by water, and the range extensions of weed species led to the casual assumption that gene flow must be extensive, and that it must play a major role in the cohesion of populations and population systems.

Keywords : Gene Flow, Seed Dispersal, Pollen Concentration, Seed Plant and Neighborhood Size.

FOLIAR FERTILIZATION FOR INCREASING NUTRIENT USE EFFICIENCY AND CROP PRODUCTION

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Foliar fertilization is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Foliar fertilization is gaining importance in recent times for increasing crop yields and nutrient use efficiency. Foliar feeding has been used as a means of giving supplemental doses of nutrients. The overall economics of foliar fertilization is dependent on how successful applications are and whether or not the same nutrition might have been supplied more economically through another mean, plant hormones, stimulants and other beneficial substances. We observed the effects of foliar fertilization like yield increases, resistance to diseases and insect/pests, improved drought tolerance and enhanced crop quality. Foliar applications are often timed to coincide with specific vegetative or fruiting stages of growth. Applications may also be used to aid plants in recovery from transplant shock, hail damage or the weather extremes. The soil application of any fertilizer including organic and commercial forms for higher crop production may be relatively inefficient due to biological, chemical, and physical properties of the soil that can decrease nutrient availability. Increasing costs of commercial fertilizers (nitrogen, phosphorus, and potassium) also make their non-traditional fertilizer applications, specifically foliar fertilization is more attractive, but can foliar fertilization take care of all the plant's nutrient needs. Foliar fertilization is generally used for better management of vine nutritional status, for growth, to correct deficiencies quickly, to improve disease resistance, for frost mitigation and to enhance crop quality.

FOOD PROCESSING AND VALUE ADDITION TECHNOLOGIES FOR IMPROVED FOOD SAFETY

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Food processing is the transformation of raw ingredients, by physical or chemical means into food, or of food into other forms. Combines raw food ingredients to produce marketable food products that can be easily prepared and served by the consumer. Value addition as a process of increasing the economic value and consumer appeal of a commodity with special reference to horticultural crops, Value addition is an important factor in the growth and development of the horticultural sector, both in India and around the world. The increase in global population during the past two centuries has made food processing one of the most deliberated subjects in the food value chain. The need for processed food is expected to increase even further when the global population increases further. Environmental concerns related to food processing that require consideration, such as the use of fossil fuels and the disposal of residual matters of food processing, will have to be reviewed. That can be used by industries to enhance the use of environmentally friendly technologies for food processing and enhance value addition.

Keywords : Value addition, Food safety, Economic value

MODERN CONCEPT OF CROP PRODUCTION IN AGRICULTURE

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In the traditional agriculture, increase in foodgrain production used to be through increase in area under cultivation and good cultural practices. In scientific crop production, increase in foodgrain production is expected through improved cultivars and recommended crop production technology. Modern crop production emphasises two more dimensions: time and space. Time concept related to increase the cropping intensity to 200, 300 and 400 per cent per year under irrigation by growing two, three and four crops respectively where only one crop used to be grown. In drylands, where there is no scope for increase in cropping intensity, the other concept of space can be applied. The land equivalent area can be increased by practising allied components of cropping in vertical dimension (multi-tier system). Activities such as dairying, poultry, sericulture, biogas, edible mushroom production, agroforestry etc assume critical importance in supplementing farm income. Integrated farming system (IFS) appears to be the answer to the problem of increasing food production and farm income of the small and marginal farmers with limited resources without any adverse effect on environment and agroecosystem. By integrating different agricultural and allied enterprises with cropping activity, the byproducts of cropping activity can be recycled for minimising cost of crop production leading to profitable farming. The future of Indian agriculture, therefore, appears to depend on the development out of appropriate farming systems as applicable to resource poor farm families in different agroecological situations.

GENETIC EVALUATION OF BAJRA- NAPIER HYBRIDS FOR NITRATE CONTENT UNDER MID HILL REGION OF HIMACHAL PRADESH**ANJALI KUMARI^{1*}, V.K. SOOD¹, SAWAN KUMAR¹ AND PRIYANKA¹***Department of Crop Improvement, College of Agriculture, CSK Himachal Pradesh Krishi Vishavidyalaya, Palampur (H.P.)- 176062*

Nitrate is an important source of nitrogen in plants for their growth and development but the accumulation of nitrate in large amount causes acute poisoning in the ruminants. It enters the bloodstream of the animals and combines with the ferrous ions. This creates oxygen deficiency by converting hemoglobin to met-hemoglobin which results in mortality and abortions in the ruminants. In order to assess the low nitrate content, 18 different frost tolerant Bajra- napier hybrid genotypes along with two checks were evaluated at CSKHPKV, Palampur during *Kharif* season. Significant variability for nitrate content was observed among all the genotypes studied. Mean values for nitrate content ranged from 373-1420 ppm with genotype NDFB 8 × FD 433 (373 ppm) having lowest nitrate content and genotype CO-7 × FD 464 (1420 ppm) having maximum nitrate content. High PCV (45.08), GCV (45.07) along with high heritability (99.71) coupled with high genetic advance as percent of mean (92.85) was found for nitrate content indicating the presence of additive gene action suggesting that the selection for this trait would be effective. On the basis of mean performance, genotype BAIF Bajra × FD 483 was found to be promising with high green fodder yield (604.33 g) and low nitrate content (385 ppm).

INHERITANCE OF *FUSARIUM* WILT RESISTANCE AND CERTAIN MORPHOLOGICAL CHARACTERS IN CASTOR (*RICINUS COMMUNIS* L.)**ANJANA PANERA^{*}, JALU, R. K., H. B. VIRANI***Department of Genetics and Plant Breeding, College Of Agriculture, Junagadh Agricultural University, Junagadh-362 001, Gujarat, India*

An experiment was consist of ten parents and six hybrids involving both parents as resistant, one parent resistant and both parents susceptible were screened for wilt reaction under wilt sick plot condition at Main Oilseeds Research Station, Junagadh. Observations were recorded as per cent disease infection in each genotype periodically at thirty days interval upto 150 days after sowing. Out of sixteen castor genotype screened, nine accessions were found to be *fusarium* wilt resistant with less than 20 per cent wilt incidence. The range of disease incidence was from 0.00 to 100 %. The hybrids, SKP-84 x SKI-215 and JI-368 x SKI-215 involving both resistant parents were showing resistant reaction against wilt, while other four hybrids involving at least one susceptible parent were wilt susceptible under wilt sick plot. Monogenic nature of inheritance was observed for stem colour (mahogany dominant over green and red), internode nature (elongated dominant over condensed), leaf shape (flat dominant over cup), bloom nature (triple dominant over double and single), spiny nature of the capsule (spininess is partially dominant over non-spininess), types of flowers on the primary raceme (monoecious dominant over interspersed and pistillate), shape of the raceme (conical dominant over cylindrical) and compactness of spike suggested that there was the hierarchy of genes for expression could not be judged. Genotypes should be screened for further confirmation of wilt resistance and inheritance of morphological characters. In order to get supporting results for inheritance of morphological traits, related methods should be carried out.

Keywords - Castor, Inheritance, Fusarium wilt, Morphological character

ECOFREINDLY BIOPESTICIDES*** ANJANA, KUJUR¹; VINITA, PARTE² AND URVASHI, MARKAM¹***Rajmata Vijayaraje Scindia Krishi Vishwa vidyalaya, Gwalior, MP.INDIA , ²College of Agriculture, Ganjbasoda, Vidisha, JNKVV, Jabalpur, MP, INDIA*

Bio pesticides are certain types of pesticides that are derived from natural materials like plants, bacteria, fungi and virus, and certain minerals. Integrated Pest Management (IPM) is an effective, long term, environmentally sensitive approach to pest management. Agricultural practices such as application of fertilizers and pesticides were developed long ago but with great progress. Modern agricultural practices like chemical pest control will yield good production. So we have to protect our environment from the harmful chemicals. Biopesticides was used as a component of Integrated Pest Management programme, Bio pesticides promotes growth of healthy crops with least disruption to ecosystem, these bio pesticides can greatly decrease the use of conventional pesticides, while crop yields remain high. Bio pesticides are usually inherently less toxic than conventional pesticides and are effective in very small quantities and decompose quickly resulting in lower exposures, no residues and environment friendly. Bio pesticides are Safer to use for plants and animals.

Key words- Integrated Pest Management, toxic, environment, ecosystem, Bio pesticides.

WEED MANAGEMENT IN SUSTAINABLE AGRICULTURE**ANJU BIJARNIA***Agronomy at agriculture university, Kota, Rajasthan*

Sustainable crop production is necessary to ensure global food security and environmental safety. Sustainable agriculture (SA) is gaining popularity around the globe to its sustainable approaches such as permanent soil cover, minimal soil disturbance, plant crop rotations and integrated weed management. Weed control is the biggest challenge to SA adoption. Weed ecology and management is different in SA than in conventional agriculture. In SA, weed expression, seed bank status, distribution, dispersal mechanism, diversification, growing patterns and competition trends are complex and differ from conventional systems. It is due to reduced tillage of the soil and the flora that thrives in SA. reduced tillage systems affect efficacy of herbicide and mechanical weed control measures. Weeds dominating SA and their responses to SA components are highlighted. Integrated weed management compatible to cropping patterns and climatic conditions offers the best result in SA.

ROLE OF MICRONUTRIENTS IN ENHANCING QUALITY FRUIT PRODUCTION OF FRUIT CROPS**ANKIT DONGARIYAL, RAJAT SHARMA AND DC DIMRI***Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand)*

Due to wide eco climatic conditions India is a horticulture rich country producing wide range of fruit crops along with other horticultural crops. In India fruit crops cover 31.5% of total production share among various horticultural crops. Proper nutrient management is essential for optimizing quality production of fruit crops. Although, macronutrients (N, P and K) play a key role in plant metabolism but micronutrients (B, Ca, Fe, Zn, Cu,) are equally important for various plant activities and quality fruit production, in spite of being applied in micro quantities. Micronutrients are generally foliar sprayed as it is quick, more effective and common practice to overcome micronutrient deficiency in order to improve fruit quality. Different micronutrients have key role in various plant metabolisms which together contributes to increased yield and quality. Boron (B) is responsible for increasing flowering and fruiting, fruit set, activate salt absorption, sugar translocation and carbohydrate metabolism. Calcium (Ca) is important for quality of fruits since it is required for cell division and elongation. It increases TSS and fruit firmness, consequently prolongs shelf life by slower softening during long term storage at low temperature. Iron (Fe) forms important enzymes and is associated with chlorophyll synthesis. As zinc (Zn) is precursor of auxin so its application delays the formation of abscission layer during early stages of fruit development and increases fruit set. Copper (Cu) promotes formation of Vitamin A, chlorophyll and accelerates evolution of ethylene during ripening of fruits. The rate of photosynthesis increases due to higher absorption of CO₂ in presence of Cu. Foliar application of these micronutrients alone or in combination can enhance production by increasing yield and quality.

EFFICACY OF DIFFERENT COATING MATERIALS ON POST HARVEST CHEMICAL PARAMETERS OF GUAVA (*PSIDIMUM GUAJAVAL*.)**ANKIT DONGARIYAL, NAVIN SINGH AND RAJAT SHARMA***Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand)*

Guava (*Psidium guajava* L.) is one of the most important tropical and subtropical fruit crop grown throughout the world. It is highly nutritious and contains high amounts of vitamins A, B₁ (Thiamine), B₂ (Riboflavin) and C (Ascorbic acid). Despite having high nutritive value, its market is limited due to short post harvest shelf life with poor quality fruits. Keeping in view the above consideration, the present investigation was conducted to study the response of different coating materials on post-harvest changes in guava at successive intervals of storage. Fruits of winter season were harvested and treated with different treatments i.e. T₁: Aloe vera gel @ 15%, T₂: Aloe vera gel @ 20%, T₃: Aloe vera gel @ 25%, T₄: Ascorbic acid @ 750 ppm, T₅: Ascorbic acid @ 1000 ppm, T₆: Ascorbic acid @ 1500 ppm, T₇: benzyl adenine @ 50 ppm, T₈: benzyl adenine @ 100 ppm, T₉: benzyl adenine @ 200 ppm and T₁₀: the untreated i.e., control. In all the treatments, the chemical attributes increased upto 6 days and then gradually decreased during storage. The shelf life of fruits in all treatments was extended as compared to control. Among all the treatments tested, TSS was found maximum (9.69°Brix) in T₁₀ (control) treatment whereas acidity was lowest (0.33%) in the fruits treated with T₇ (benzyl adenine @ 50 ppm) treatment. The treatment T₂ (Aloe vera gel @ 20%) reported maximum reducing sugar (3.55%), total sugar (8.27%) and ascorbic acid (133.94 mg/100g edible pulp) content. Coating provides a protective barrier around fruit which checks respiration rate and slows down the metabolic processes which consequently increases shelf life with quality of fruits.

EFFECT OF BIODEGRADABLE MULCHES ON STRAWBERRY CULTIVATION**¹ANKIT GAWRI, ²ASHOK DHAKAD***Department of Horticulture, CCS, Haryana Agriculture University (CCSHAU), Hissar-125004, Department of Horticulture, CCS, Haryana Agriculture University (CCSHAU), Hissar-125 004*

The performance, the degradability in soil and the environmental impact of biodegradable starch-based soil mulching and low tunnel films were assessed by means of field and laboratory tests. The lifetime of the biodegradable mulches was 9 months and of the biodegradable low-tunnel films 6 months. At the end of the cultivation period, the biodegradable mulches were broken up and buried in the field soil together with the plant residues. Biodegradation in soil or compost depends on a complex synergy of biological and abiotic degradative processes. One year after burial, less than 4% of the initial weight of the biodegradable film was found in the soil. The radiometric properties of the biodegradable films influenced positively the microclimate: air temperature under the biodegradable low tunnel films was 2 °C higher than under the low density polyethylene films, resulting in an up to 20% higher yield of strawberries. This review discusses the physicochemical and structural properties of biodegradable plastic mulches, examines their potential for on-site decomposition in light of site-to-site variance due to environmental and biological conditions, and considers the potential for longterm effects on agroecosystem sustainability and functionality.

Keywords: Strawberry, biodegradable, microclimate, agroecosystem

ORGANIC FARMING IN A FRUIT CROPS**ANKIT KUMAR PANDEY¹, VED PRAKESH² AND ASHOK KUMAR PANDEY³***Department of Horticulture (Fruit and Fruit Technology), BAU, Sabour-813 210, Bhagalpur, Bihar (India), ²Department of Agronomy, Bihar Agricultural University, Sabour 813 210, Bhagalpur, Bihar (India) ³Department of Horticulture, DRMLU, Faizabad-224 001, U. P. (India)*

Organic fruit production essentially excludes the use of many inputs associated with modern farming most notably synthetic pesticides and fertilizers. To the maximum extent possible, organic farming systems rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral- bearing rock powders and biological pest control. Organic farming is the practice that relies more on using sustainable methods to cultivate crops and it avoids chemical inputs that do not belong to the natural eco system. Organic agriculture can contribute to meaningful socio-economic and ecologically sustainable development, especially in developing countries. These components maintain soil productivity and tilth, supply plant nutrients and help to control insects, weeds and other pests. All factors regarding site suitability for conventional fruit plantings (air and water drainage, etc.) apply even more and so to organic operations. While conventional farmers may fall back on chemical fertilizers and pesticides to compensate for poor site decisions, organic farmers largely give up such luxuries. Environmental constraints (climate, presence of certain pests and diseases, suitable soils, etc.) can greatly impact the suitability of a given site or even a bioregion for organic production of a given fruit crop. Generally speaking, some perennial fruits are easier to grow organically than others. The small fruits (berries) for example, seem easier to grow organically than the tree fruits in almost all locations. Lastly, successful organic fruit growing may depend largely on whether the venture is for home production or for commercial sales.

KEY WORD: Organic, Fruit, Farming, Synthetic Pesticides, Fertilizers etc.

“INSECT PESTS OF STORED PRODUCTS”**ANKIT KUMAR SINGH, RAVI SHANKER, RAVINDRA NATH NISHAD, VIJAY KUMAR, SURYA PRATAP SINGH***Department of Entomology, NDUA&T-Kumarganj, Faizabad (224229) U.P.*

Stored product pests gain access to the grain storage from the standing crop in the field to various stages of grain processing and storage. Although, about one thousand species of insects have been associated with stored products in different parts of the world, a few pests are considered as pests causing severe damage to the stored grains. The stored grain insect pests can be categorized on the basis of their feeding behavior as internal and external feeder or as major and minor pests based on the severity of damage, they cause. The major pests of stored grains viz., rice weevil, *Sitophilus oryzae*, lesser grain borer, *Rhyzopertha dominaca*, khapra beetle, *Trogoderma granarium*, red flour beetle, *Tribolium castaneum*, cigarette beetle, *Lasioderma serricorne*, drug store beetle, *Stegobium paniceum*, pulse beetles *Callosobruchus* spp., Angoumois grain moth, *Sitotroga cerealella*, rice moth *Corcyra cephalonica*, saw toothed grain beetle *Oryzaephilus surinamensis*, long headed flour beetle, *Latheticus oryzae*, and almond moth *Cadra cautella*. External feeders: This group of insects feed on germ and endosperm from outside. These may attack whole seed and damage the germinal portion or feed on the seeds, which have already been damaged/ infested by other insects or broken mechanically. These insect pests or their stages are generally visible among the seeds e.g. rice weevil, pulse beetle, granary weevil, Angoumois moth etc. Internal feeders: These insects

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mostly lay eggs inside or on the surface of grains, spend a part or entire larval and pupal life inside the grains and only emerge as adults. These contribute significant loss of germination which is not detectable outside e.g. rice weevil, pulse beetle, granary weevil, Angoumois moth etc.

"EFFECT OF MICRO NUTRIENTS ON GROWTH, YIELD AND QUALITY OF CABBAGE (*BRASSICA OLERACEA L. VAR. CAPITATA*)"

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The field experiment was conducted during *Rabi* season of 2017-18 at the Horticulture Research farm, AKS university, Satna (M.P.). The experiment was laid out in a randomized block design with three replications. The treatments consisted of eleven combination of different agro input management practices viz., treatments 100%RDF+Fe 0.5% (T₁), 100%RDF+Fe 1.0% (T₂), 100%RDF+Zn 0.5% (T₃), 100%RDF+Zn 1.0% (T₄), 100%RDF+Mn 0.5 % (T₅), 100%RDF+Mn 1.0% (T₆), 100%RDF+B 0.3% (T₇), 100%RDF+ B 0.6% (T₈), 100%RDF+ Fe (0.5%) + Zn (0.5%) + Mn (0.5 %) + B (0.3%) (T₉), 100%RDF+ Fe (1.0%) + Zn (1.0%) + Mn (1.0 %) + B (0.6%) (T₁₀), 100%RDF Control (T₁₁). The maximum net profit/ha was recorded under treatment T₃ (Rs.62,037) while minimum net profit/ha was obtained in treatment T₁₁ (Rs. 40,185). The maximum gross profit/ha was recorded in treatment T₃ (Rs. 1,29,629) whereas, minimum gross profit/ha was recorded in treatment T₁₁ (Rs. 1,05,000). Thus, the maximum income (both gross and net) was obtained with T₃. The significantly maximum B:C ratio 1.93 was recorded under the treatment (T₃). And the minimum B:C ratio 1.62 was recorded under the treatment (T₁₁).

KEYWORDS: *Micro nutrient and Cabbage.*

SILICON: A BENEFICIAL ELEMENT FOR FRUIT CROPS

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Silicon is the second most abundant element in the soil next to oxygen and comprises 28% of its weight. However, still it is not recognized as an essential element for plant growth but the undeniable beneficial effects of this element on the growth and development have been observed in a wide variety of plant species. The role of silicon in plant biology is to reduce multiple stresses including biotic and abiotic stresses. In addition to naturally occurring soluble silicon in soil, many crops respond positively to additions of supplemental silicon. Plants, especially fruit crops, can take up large amounts of silicon where it contributes to their mechanical strength. Besides a structural role, silicon helps to protect plants from insect attack, disease and environmental stress. The highest number of bunches per vine, yield per vine and yield per hectare was observed in Bangalore blue grapes by foliar application of silicic acid and boron. Maximum fruit weight, volume, TSS, sugars to acid ratio and minimum acidity was recorded in guava by the application of RDF +3 kg of DE/plant. Kaolin application showed significantly positive effects on the protection of fruit against sunburn on Hicaznar cultivar of pomegranate. Silicon nutrition enhances host resistance to pests and diseases and also alleviates abiotic stresses thus protecting the crops. In the context of organic farming, the application of siliceous materials and silicon sources to not only agricultural crops but also to horticultural crops especially fruit crops may pave way for increasing the yield and reducing the use of chemical fertilizers, pesticides and fungicides. The ashes from agro industries and industrial slags free from heavy metals will find future source of silicon fertilizers in future to protect the crops and to boost the yield. Despite of this, Si has not received the attention it requires. Hence it is the need of hour to proceed wider and bring together not just strictly plant physiological evidence but to include findings and experiences gathered by botanists, agronomists, horticulturists, plant pathologists, plant biochemists and still others. There is no justification for the disregard of Si in so much science of plant biology. The evidence is forcing that in the real world of plant life, the presence and role of Si matters.

Keywords:- Silicon, beneficial effect, biotic and abiotic stress

EFFECT OF SALINE WATER ON PHYSIOLOGICAL ATTRIBUTES OF RAYAN (*MANILKARA HEXANDRAL*)

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A field study was carried out at Fruit Research Station, Navsari Agricultural University, Gandevi (Gujarat) during 2017 to find out effect of saline water on physiological attributes of rayan (*Manilkara hexandra* L.). The experiment consisted of six treatments of salinity levels

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of irrigation water viz., 0.5 dS m⁻¹ (T₁), 2 dS m⁻¹ (T₂), 4 dS m⁻¹ (T₃), 6 dS m⁻¹ (T₄), 8 dS m⁻¹ (T₅) and 10 dS m⁻¹ (T₆). It was laid out in a completely randomized design (CRD) with three repetitions. The observations on photosynthetic parameters were recorded. The results indicated that all physiological parameters were decreased with increasing salinity levels. Photosynthetic parameters viz., photosynthetic rate (26.14, 27.31 and 29.79 $\mu\text{mol CO}_2\text{m}^{-2}\text{s}^{-1}$, respectively), stomatal conductance (0.036, 0.061 and 0.066 $\text{mmol CO}_2\text{m}^{-2}\text{s}^{-1}$) and transpiration rate (0.54, 0.57 and 0.623 $\text{mmol H}_2\text{O m}^{-2}\text{s}^{-1}$) were recorded the highest in treatment T₁ (0.5 dS m⁻¹) at 40, 80 and 120 days after treatment. Whereas the lowest photosynthetic parameters were noted in the treatment T₆ (10 dS m⁻¹). The treatment T₁ (0.5 dS m⁻¹) showed higher relative water content RWC (86.25 %) in rayan seedlings. The minimum RWC (%) was recorded in treatment T₆ (10 dS m⁻¹). It is therefore, inferred from the present study that rayan seedlings can grow well upto 8 dS m⁻¹ salinity level with optimum physiological parameters in seedlings can get upto 4 dS m⁻¹ salinity level.

RECENT TRENDS IN AGRICULTURAL SCIENCES AND TECHNOLOGY

SUB THEME - INTEGRATED NUTRIENT, WEED, DISEASES AND PEST MANAGEMENT

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Agricultural production in the country has been increasing to great heights since green revolution. Development of new varieties, fertilizer application and use of pesticides to control the crop pests helped to increase production. But the negative side is that loss of rich biodiversity, soil health, pesticide residue in consumable agricultural products, higher cost of production and also excessive reliance on the chemical pest control leads to pest resurgence and resistance. For nutrient application farmer should use the organic and inorganic easily available nutrient sources in a complimentary manner with right type and right dose, at the right time, right place and by right method to sustain and enrich the soil health. For weed, disease and pest control the aim should be control of all these pest to the economic threshold level, as it will be economic for the farmer and safer for the biodiversity too. For controlling the pests the cultural, mechanical, biological, Quarantine and chemical measures should be followed in an integrated manner. Cultural measures include crop rotation, land rotation, inter and mixed cropping of cereal, legume, stale seed bed technique, deep ploughing in summer, use of resistant varieties, etc. Mechanical measures include mowing, dredging and churning, use of light, bait and pheromone traps, etc. Biological measure include use of predators, parasitoids, bioherbicides, etc. Quarantine measure means non allowance of the infested seed and plant samples to export from one area to another within same or different countries. Chemical control includes use of herbicides, fungicides, insecticide, etc at the right dose. So all these measure should be used integratedly by the farmer to maintain sustainability.

Keywords Production, biodiversity, complimentary, quarantine, sustainability

HIGH PRESSURE PROCESSING OF FOODS

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HPP subjects liquid or solid foods, with or without packaging to pressures between 100 and 800 MPa (14,500 to 116,000 PSI). Process temperature during pressure treatment can be specified below 0°C to above 100°C. Commercial exposure times can vary from a millisecond pulse to over 20 minutes. HPP acts instantaneously and uniformly through a mass of food independent of size, shape and food composition. Thus package size, shape and composition are not factors when determining the process. The work of compression will increase the temperature of the foods by approximately 3°C per 100 MPa, depending on the composition of the food. If a food contains a significant amount of fat the temperature rise can be larger. Foods cool down to their original temperature on decompression if no heat is lost or gained from the vessel walls of the chamber during the hold time at pressure. As pH is lowered most microbes become susceptible to HPP inactivation and sub lethally injured cells fail to repair. Acid foods suggests that shelf-stable (commercially sterile) products, having a water activity close to one, and pH values less than 4.0, can be preserved using a pressure of 580 MPa and a process hold time of 3 min. Acid foods between the pH values of 4.0 and 4.5 can be made commercially sterile using a pressure of 580 MPa and a hold time of 15 min. Products would have an initial temperature in the range of 22°C. Reducing water activity appears to protect microbes against inactivation by HPP. Temperatures in the range of 45 to 50 °C appear to increase the rate of inactivation of food pathogens and spoilage microbes and thus warrant the development of processes which incorporate a uniform initial food temperature in this range. Process temperatures in the range of 90-110 °C in conjunction with pressures of 500-700 MPa have been used to inactivate spore forming bacteria such as *Clostridium botulinum*.

Keywords: HPP technology, Temperature, pH, Water activity (aw)

“EFFICACY OF BIO-INSECTICIDES AND BOTANICALS AGAINST BRINJAL SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE)”**ANKUR PRAKASH VERMA AND UMESH CHANDRA (DEPT. OF ENTOMOLOGY)***N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P)*

The present investigation was carried out during the *Kharif* season, 2017-18 at Student's Instructional Farm, N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P) to study the efficacy of bio-insecticides and botanicals against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee). The bio-insecticides and botanicals tested were: Emamectin benzoate 5 SG @ 75 g a.i./ha, Spinosad 45 SL @ 18 g a.i./ha, NSKE 5 %, Karanj seed extract 5 %, Onion extract 5 %, Garlic extract 5 %, Tobacco extract 5 %, Cannabis (bhang) leaf extract 5 %, Wood ash 10 g/plant and compared with control. Results showed that Emamectin benzoate 5 SG (75 g a.i./ha) treated plots showed lowest infestation and gave higher fruit yield (313.85 q/ha) followed by Spinosad 45 SL (18 g a.i./ha) and NSKE (5%) which gave 300.58 and 284.33 q/ha fruit yield respectively. The least effective treatment was Wood ash (10 g/plant) and yielded only 225.14 q/ha healthy fruits. This study recommends the use of bio-insecticides and botanicals as they are significantly efficient in managing the brinjal shoot and fruit borer infestation.

Key words: Bio-insecticides, Botanicals, Brinjal shoot and fruit borer, *Leucinodes orbonalis*

“RESPONSE OF BORON LEVELS AND APPLICATIONS METHODS ON GROWTH AND YIELD OF RICE (*ORYZA SATIVA* L.)”**ANKUR SHUKLA AND SATYBHAN SINGH***School of Agricultural Sciences and Engineering, IFTM University, Moradabad-244102*

The experiment was laid out at research farm of Department of Soil which entitled impact of Response of Boron levels and application methods on growth and yield of Rice (*Oryza sativa* L.) in north- western plain zone of India was carried out at School of Agricultural Science and Engineering, IFTM University, Moradabad in 2017-18. Boron carries out certain important function in plants like it helps in cell wall formation, stabilization and lignifications; encourage pollen tube growth and pollen germination in grain crops. The experiment was laid out in Randomized Block Design with 10 treatments and 3 replication. These are details of treatments were $T_1 = 100\% \text{ RDF (150 : 60 : 40 kg ha}^{-1}\text{)}$; $T_2 = 100\% \text{ RDF} + 0.5 \text{ kg B ha}^{-1} \text{ (SA)}$; $T_3 = 100\% \text{ RDF} + 0.5 \text{ kg B ha}^{-1} \text{ (SA)} + 0.2\% \text{ B spray at 25 \& 50 DAT}$; $T_4 = 100\% \text{ RDF} + 0.5 \text{ kg B ha}^{-1} \text{ (SA)} + 0.3\% \text{ B spray at 25 \& 50 DAT}$; $T_5 = 100\% \text{ RDF} + 1.0 \text{ kg B ha}^{-1} \text{ (SA)}$; $T_6 = 100\% \text{ RDF} + 1.0 \text{ kg B ha}^{-1} \text{ (SA)} + 0.2\% \text{ B spray at 25 \& 50 DAT}$; $T_7 = 100\% \text{ RDF} + 1.0 \text{ kg B ha}^{-1} \text{ (SA)} + 0.3\% \text{ B spray at 25 \& 50 DAT}$; $T_8 = 100\% \text{ RDF} + 2.0 \text{ kg B ha}^{-1}$; $T_9 = 100\% \text{ RDF} + 2.0 \text{ kg B ha}^{-1} \text{ (SA)} + 0.2\% \text{ B spray at 25 \& 50 DAT}$; $T_{10} = 100\% \text{ RDF} + 2.0 \text{ kg B ha}^{-1} \text{ (SA)} + 0.3\% \text{ B spray at 25 \& 50 DAT}$. Application of boron also markedly increases yield and quality of oil seed crops. The literature on the significance of Boron in growth as well as physiological functions of pulses and oil seed crops have been reviewed and presented.

NOVEL DIAGNOSTIC TECHNIQUES FOR DISEASE DETECTION IN PLANTS.**ANNIE KHANNA^{1*}, KUSHAL RAJ¹ AND MEENAKSHI RATHI²***Department of Plant Pathology¹ and Department of Genetics and Plant Breeding², College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, Haryana, India*

Automatic methods for an early detection and diagnosis of plant diseases are vital for crop protection and management. Detection and diagnosis of the disease is the foremost requirement for managing the plant disease. Appropriate identification of pathogen viz., fungi, bacteria, viruses includes techniques like immunodiagnosis, monoclonal antibodies, which often manifests no disease symptoms. The major drawback with these techniques is that they are efficient under laboratory conditions, time consuming and labour intensive nature. In the era of robotics there is a need of new rapid and innovative technologies like electronic nose, hyperspectral imaging that provides proper identification, detection and accurate quantification of plant pathogenic microorganisms at site itself. Non destructive methods like spectroscopic, imaging techniques or volatile compound based techniques have been developed in the last few decades. In today's scenario chlorophyll fluorescence, hyperspectral sensors and thermography permit fast diagnosis in field itself because of its speed, simplicity and robustness and thus fulfils the basic requirement of proper disease management. Electronic nose also known as E-nose is an instrument that detects and discriminate among complex odours by means of a sensor array planned and developed to respond against various volatile organic compounds. It is being used for bacterial disease diagnosis and those concerning analytical tools such as gas chromatography (GC) or GC coupled with mass spectrometry for headspace analysis. The ability of E-nose to discriminate healthy potato tubers from those infected by *Ralstonia solanacearum* and *Clavibacter michiganensis* subsp. *sepedonicus* with a percentage of accuracy of 100% and 70%, respectively.

PINEAPPLE DISEASE OF SUGARCANE: CURRENT STATUS AND FUTURE PROSPECTS**ANNIE KHANNA*, KUSHAL RAJ AND POOJA SANGWAN***Department of Plant Pathology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, Haryana, India*

Pineapple disease caused by *Ceantosystis paradoxa* [Dade.] Moreau is the major disease of sugarcane (*Saccharum officinarum*) causing substantial yield and economic losses. Keeping in view the economic importance of the disease, various management strategies like use of fungicides, botanicals, biocontrol agents can be used. For the effective management systemic fungicides were found to be more effective than non systemic. In the recent years botanicals viz., *A. sativum*, *Z. officinale* and *A. indica* were found effective in managing the disease. Worldwide efforts have been to find out the resistant sources to develop resistant varieties but due to highly variable nature of *C. paradoxa*, exploitation of host resistant has remained a challenging job for breeders as well as pathologists. Still scientists are doing their best to develop the resistant varieties. Among biocontrol agents strains of *Trichoderma* sp. and *Pseudomonas* are in use. The availability of genome of pathogen *C. paradoxa* and sugarcane can open new door for isolation and characterization of R and Avr gene, development of noble fungicides, transgenic sugarcane crop etc.

WEAR STUDIES IN AGRICULTURAL IMPLEMENTS: A REVIEW**ANNU RANI, T. P. SINGH***G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India 263145*

Agricultural machinery and equipment used for soil cultivation are exposed to continuous wear and tear. Tough and challenging field work leads to abrasion wear of machinery. A major portion this wear loss in agricultural implements is attributed to the movement of tools in soil. During ploughing action, farm implements face abrasive action of sand and stone particles present in the soil. This is the most common cause of damage of agricultural machinery. Worn out agricultural tools results in poor tillage and seeding efficiency and higher fuel costs. Farmers continuously face problems with recurring labour, downtime and the replacement costs of exchanging the worn out tools. Use of heavier implements in modern agriculture increases the demand for wear resisting methods. Hard facing of the tillage tools and coating of the hard material on the agricultural implements are the widely applied methods to reduce the abrasive wear. Coating deposits a layer of hard material over the base tillage material and improves its wear and corrosion resistance properties. This increases the life of the agricultural machines and saves time and of farmers. This paper presents a thorough review on wear determining studies done in the field of agriculture and discusses the different methods to reduce the wear.

SALT AFFECTED SOILS IN INDIA AND THEIR MANAGEMENT STRATEGIES**ANOOP KUMAR DEVEDEE*, SINGH R.K.¹, VISHAL KUMAR¹, DHARMINDER¹ AND MANISH KUMAR SINGH²***Department of Agronomy, Institute of Agricultural Sciences, BHU, Varanasi, 221005, UP, Department of Horticulture, Institute of Agricultural Sciences, BHU, Varanasi, 221005, UP*

Globally, 75 countries have been recognized as having vast areas of salt-affected lands. Martinez-Beltran and estimated that nearly 831 million hectares of land are salt-affected worldwide. Salt-affected soils mostly exist in arid and semiarid regions of the world, and many salt affected waste lands have been productive lands in the past. Worldwide, about 95 million hectares of soils are under primary salinization (salt accumulation through natural processes in soils and water) whereas 77 million hectares suffer from secondary salinization (as a result of human activities and ever-rising groundwater). Of major concern is that 23 % of the arable lands in the world is affected by salinity and a further 10 % are saline sodic soils while 340 million hectares of lands suffer sodality. The high salt concentration negatively affects soil microbial activity as well as soil chemical and physical properties, thus causing a decline in soil productivity. Decline in vegetation growth due to salt toxicity and detrimental osmotic potential results in lower carbon inputs into these soils and further deterioration of their physical and chemical properties. Accumulation of excess salts in the root zone resulting in a partial or complete loss of soil productivity is a worldwide phenomenon. The problems of soil salinity are most widespread in the arid and semi-arid regions but salt affected soils also may occur extensively in sub-humid and humid climates, particularly in the coastal regions where the ingress of sea water through estuaries and rivers and through groundwater causes large-scale salinization. Soil salinity is also a serious problem in areas where groundwater of high salt content is used for irrigation (Singh and Bhumla, 1998) and the process is known as secondary salinization. The most serious salinity problems are being faced in the irrigated arid and semi-arid regions of the world and it is in these very regions that irrigation is essential to increase agricultural production to satisfy food requirements. However, irrigation is often costly, technically complex and requires skilled management. Failure to apply efficient principles of water management may result in wastage of water through seepage; over-watering and inadequate drainage result in water logging and salinity problems which reduce the soil productivity, eventually leading to loss of cultivable land.

COMPARATIVE EFFECT OF SOIL SOLARIZATION, NEEM CAKE AND GREEN MANURING AGAINST *ALTERNARIA BRASSICAE* ON CABBAGE (BRASSICA OLERACEA L. VAR. CAPITATA)**ANOOP KUMAR, VEDPRAKASH SANODIYA, AMIT KUMAR MAURYA AND VINNY JOHN***Department of plant protection, SHUATS Allahabad (211007)*

An experiment was conducted to evaluate comparative effect of soil solarization, Neem cake and green manuring against *Alternaria brassicae* on cabbage. Soil solarization was done in the month of May - June 2012, green manuring was done in the month of September and neem cake was applied in the month of October before 7 days of transplanting. The most effective treatment was T5 neem cake which significantly reduced disease intensity (20.65 %) followed by treatments T4 soil solarization (24.3 %), T2 cowpea (26.0 %), T1 dhaincha (28.07 %), T3 sudan grass (28.3 %) and including T0 control (32.52 %). Maximum yield 285.02 q/ha was recorded neem cake treatment followed by sudan grass 262.2 q/ha, dhaincha 259.22 q/ha, soil solarization 243.52 q/ha, cowpea 234.25q/ha and including control 147.92q/ha. The highest cost benefit ratio was obtained in T5 neem cake (1:3.1.3) followed by T1 dhaincha (1:3.09) as compared with other treatments including control. Neem cake was found significantly superior over other treatments.

Key words :- *Alternaria* blight, Cabbage, Cowpea, Dhaincha, Green manure, Neem cake, Soil solarization and Sudan grass.

AGRIPRENUERSHIP WAY TO UPLIFTMENT OF AGRICULTURE**ANSHIKA CHAUHAN, GIRISH TIWARI***Department Of Agriculture, Shri Guru Ram Rai University, Dehradun, Uttarakhand-248001*

Agripreneurship is the profitable marriage of agriculture and entrepreneurship. Agripreneurship turn your farm into an agribusiness. The term Agripreneurship is synonym with entrepreneurship in agriculture and refers to agribusiness establishment in agriculture and allied sector. Agripreneurship have the potential to contribute to a range of social and economic development such as employment generation, income generation, poverty reduction and improvements in nutrition, health and overall food security in the national economy. Agripreneurship plays various roles in the growth and development of national economy. It helps in inducing productivity gains by smallholder farmers and integrating them into local, national and international markets. It helps in reducing food costs, supply uncertainties and improving the diets of the rural and urban poor in the country Agripreneurship is the need of hours to make agriculture a more attractive and profitable venture. It is clear that there is a great scope for entrepreneurship in agriculture and this potentiality can be tapped only by effective management of agriculture elements such as soil, seed, water and market needs.

APPLICATION OF E-TECHNOLOGY IN MODERN AGRICULTURE: PRESENT SCENARIO IN INDIA**ANUJANWALA^{1*} AND MANOHER SARYAM¹***Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP) 221005*

E- technology has the potential to help agriculture produce higher-yielding, better-quality crops for lower cost. Collecting and interpreting data from soil, crops and the environment can help farmers understand issues from how to tackle disease and pests to when to water or fertilize fields by sensing, combining and analyzing new data, the industry can potentially see problems coming and take action early cutting costs and lowering the risk of ruined crops. E-Agriculture is a new area of knowledge emerging out of convergence of IT and farming techniques. It enhances the agricultural value chain through the application of internet and related technologies. Basically IT helps farmers to have better access to information which increases the productivity. It also enables him to get better prices through information of change in price in different markets. Agriculture in India is the core sector for food security' nutritional security' and sustainable development for poverty alleviation. It contributes approx. 14 percent of GDP. Milestones in agriculture development in India includes: Green revolution' Evergreen revolution' Blue revolution' white revolution' yellow revolution' Bio technology revolution and the most recent one is Information and communication technology revolution E-technology supports new methods for precision agriculture like computerized farm machinery that applies for fertilizers and pesticides. Farm animals are fed and monitored by electronic sensors and identification systems. Selling or buying online began to become popular in the world. However, its most important role remains communication, and the internet has provided us with an ideal opportunity to do so.

Keyword- E-technology, agriculture, information-technology, development, ICTs etc.

POTASSIUM TRANSFORMATION IN RELATION TO SOIL PLANT SYSTEMS**ANUPAM ADARSH¹, ARVIND BHAI PATEL² TEJ PRATAP³ HANUMANT SINGH⁴**

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Potassium is an essential nutrient for all plants. It plays an important role in maintaining water regime and activation of various enzymes

in plants. The potassium content in mineral soils is generally much higher than that of the other macronutrients like nitrogen and phosphorus. The concentration of potassium in soil solution varies from soil to soil depending on the parent rock, mineral matter and climatic conditions. The mica and feldspars constitute the major potassium bearing minerals which on weathering, gradually release potassium to the soil. Generally four forms of potassium present in soils namely solution, exchangeable, non-exchangeable and reserve of mineral potassium. A large portion of total potassium in soil comes from the potassium bearing and crystal lattices of silicate minerals. Mobility of potassium in soils produces dynamic equilibria among various forms of potassium. Exchangeable and soil solution potassium equilibrate quickly while difficulty or fixed form of potassium equilibrates very slowly with its exchangeable and soil solution forms. Release of potassium from the reserve or mineral forms of potassium to any other there forms of potassium is extremely slow and hence it is strictly considered unavailable form of potassium to plants particularly in a single cropping season. Fixed or non-exchangeable potassium occurs within clay minerals such as illite, vermiculite and chlorite. On the contrary, exchangeable potassium is held on soil colloids by electrostatic forces which facilitate the release of potassium into the soil solution rendering available to plants. Therefore, there is a continuous slow transfer of potassium from the mineral source to the exchangeable and slowly available forms.

EFFECTS OF "BIOPRIMING" ON RICE SEED GERMINATION AND BAKANAE DISEASE (*FUSARIUM MONILIFORME*) OF RICE.

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Rice (*Oriza sativa* L.) is the food of more than 60 % of the world's population. It is staple food of most of the people of south-eastern Asia. India is the second largest producer and consumer of rice in the world after China. Rice crop production is affected by several abiotic and biotic factors among the biotic factor bakanae disease one of the most serious problem of rice. *Fusarium moniliforme* produced different kind of symptoms on rice seed and seedling like: abnormal elongation of seedlings and foot rot etc. This disease cause 20% to 50% yield losses in Japan, 15% in India and 3.7 % in Thailand. Under favorable conditions, it may cause substantial damage, and as high as 95.40 % yield loss. In the advance stage of the disease, rotting was observed at the base of infected plant and infected plants die. Some of the infected plants survive up to maturity of the crop. Seed treatment with biocontrol agents along with priming agents may serve as an important means of managing many of the soil and seed borne diseases, the process often known as "biopriming". Seed priming is now a widely used commercial process that accelerates the germination rate and improves seedling uniformity in many crops. The minimum 8.93 and 14.48 % disease incidence were recorded in T₃ (Multani soil + *Trichoderma* + *Propiconazol* + *Molasses*) and maximum disease incidence 26.85 and 27.14 % were recorded in T₅ (Multani soil + *Trichoderma*) at 15 and 30 DAS respectively. Viability of *Trichoderma* maximum viability 326.677×10^4 cfu/gm was recorded in T₆ (Multani soil + *Trichoderma*) and maximum 252.33×10^4 cfu/gm was recorded in T₆ (Multani soil + *Trichoderma*) after 1 day incubation, the maximum 144×10^4 cfu/gm was recorded in T₆ (Multani soil + *Trichoderma*) and maximum 271.33×10^4 cfu/gm was recorded in T₅ (Multani soil + *Trichoderma* + *Neem Cake*) after 3 days incubation and the maximum 255×10^4 cfu/gm was recorded in T₄ (Multani soil + *Trichoderma* + *Molasses*) while maximum 38.67×10^4 cfu/gm was recorded in T₅ (Multani soil + *Trichoderma* + *Neem cake*) after 6 days incubation at room temperature and refrigerator temperature respectively.

DETECTION AND DIAGNOSIS OF PLANT VIRUSES

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Plant viruses cause major losses to several agricultural and horticultural crops around the world. Unlike other plant pathogens, there are no direct methods available, yet to control viruses, consequently, the current measures rely on indirect tactics to manage the viral diseases. Methods for correct & quick detection and identification of viruses, both in plants and vectors play a critical role in virus disease management. Diagnostic techniques for viruses fall into two broad categories: biological properties related to the interaction of the virus with its host and/or vector (e.g. symptomology and transmission tests) and intrinsic properties of the virus itself (coat protein and nucleic acid). Detection methods based on the coat protein include precipitation/agglutination tests rely on the formation of a visible precipitate, Enzyme Linked Immunosorbent Assay (ELISA) has been very popular for detection of viruses in plant material, insect vectors, seeds and vegetative propagules. And immunoblotting can be used to detect viruses in both plants and vectors. Viral nucleic acid based techniques like polymerase chain reaction (PCR) is an *in-vitro* method for amplifying target nucleic acid sequences and more sensitive than other methods. Availability of these diagnostic methods provide greater facility with increased sensitivity and specificity for rapid diagnosis of virus diseases and epidemiological studies, plant quarantine and seed certification and breeding programmes also greatly benefitted with these techniques.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**PLASMA AGRICULTURE: A NEW TECHNIQUE IN AGRICULTURE****ANUPAMA RAWAT*, RAJEEW KUMAR, VIJAY PALSINGH, BANDANA BHATT***Department of Agronomy, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology*

Agriculture across the globe is running out of natural resources with shortage of land and increasing population. In order to sustain the system and protect environment, the only way left is to adopt new technologies which are sustainable, economical and socially acceptable. Plasma agriculture is one of those technologies. Plasma is the fourth, a least known state of matter. Plasma is the mixture of positive and negative charges as well as neutral particles. It exists a massive range in temperatures and densities. The low temperature plasma (LTP) can be used in seed germination, seed disinfection, sterilization, growth increasing crop yield. Plasma treated seeds show enhanced germination demanding less input like chemical fertilizers and water. Plasma treated seeds imbibe more water increasing germination rate. With enhanced germination this approach gives initial uniform plant stand. The seeds are exposed to charged particles bombardments resulting in formation of functional groups on the treated surface. The plasma treated seeds could have variety of effects on morphological and sowing characteristics due to the complexity of plasma interaction with living cells and organic molecules. Plasma treated seeds shows no chromosome damage. Industrial production of plasma treated seeds can be done long before planting time as delay between plasma treatment and germination still give favorable results.

Key words: Plasma, sustainable, germination

AEROBIC RICE, A NEW APPROACH OF RICE CULTIVATION IN CLIMATE VARIABILITY AND UNCERTAINTY**ANUPMA KUMARI***Krishi Vigyan Kendra, Saraiya, Muzaffarpur*

Climate variability and uncertainty resulting in the shortage of water resource has led to the development and adoption of aerobic rice system which saves water input and increases water productivity by reducing water use during land preparation and limiting seepage, percolation and evaporation. In the past several years, the water situation in the growing area faces water shortage and rice cultivation has been challenged for near future. Due to these reasons, farmers are seeking alternate crops that require lesser water. The prediction is that the rice production in future could be drastically reduced. In an aerobic rice system, the crops are directly seeded and soil is kept aerobic throughout the growing season. Supplemental irrigation is applied as necessary. Grain yield of 5-6 t/ha can be reached in aerobic rice system. However, yield decline or even complete failure of rice under continuous monocropping threatens the widespread adoption of aerobic rice system. Here we review research findings on possible causes responsible for yield decline which are biotic and abiotic factors, selection of new aerobic rice cultivars, nutrient management and crop rotation. Identifying the causes responsible for continuous cropping obstacle of aerobic rice and adopting effective strategies are crucial to achieve sustainability of aerobic rice.

EFFECT OF KONKAN ANNAPURNA BRIQUETTES AND ORGANIC MANURES ON GROWTH AND YIELD OF SWEET POTATO**ANURADHAA. HARMALKAR*, S.B. DODAKE, M.C. KASTURE AND HARI RANE***Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dapoli, Dist. Ratnagiri, Maharashtra*

A field experiment conducted during Rabi 2016 entitled, "Effect of Konkana Annapurna Briquettes and organic manures on yield and quality of sweet potato" at Central Experiment station, Wakawali. The experiment was laid out in Factorial Randomized Block Design (FRBD) comprising twelve treatment combinations replicated thrice and observations were recorded at 35, 70 and after harvest. The effect of different inorganic fertilizers and organic manures viz., Konkana Annapurna Briquettes, straight fertilizers, FYM and vermicompost either alone or in combinations on growth and yield were studied. The growth and yield parameters showed significant improvement as a consequence of various treatment combinations. It was observed that 75% RDN through Konkana Annapurna Briquettes (KAB), which was, applied 7 briquettes per 10 plants after one month of planting along with vermicompost @ 5 t ha⁻¹ prior to planting, which found promising to enhance the tuber yield, plant height, tuber length, number of tubers per vine.

Keywords: Konkana Annapurna Briquettes, organic manures, growth, yield.

ROLE PERFORMANCE OF RURAL WOMEN IN ANIMAL HUSBANDRY PRACTICES**(ANURADHARANJAN KUMARI¹, A K SINGH², M. K. PANDEY³, KAMLESH MEENA⁴ AND AJAY TIWARI⁵)**

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Women play a significant role in dairy farming but their control over livestock and its products is very minimal. The income incurred

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from dairy animals neither remains in hands of women nor the decision making regarding sale and purchase of the various items required in a dairy unit. The study was carried out to know the participation of rural women in dairy activities of Deoria district of U.P state. The study was carried out in two blocks i.e. Salempur and Bhatparrani families owning two to three cattle heads were selected for this study. A sample of sixty families was selected randomly from each block, thus the total sample comprised of 120 families. One female member shouldering the responsibilities in dairy management from each family represented the study sample. The data were collected personally with the help of structured interview schedule. Data collected were statistically analyzed with the help of frequency and percentages. The data revealed that the participation of women was high in activities such as Cleaning of cattle shed, watering, feeding, milking, disposal of cow dung. The farm women participation was least in dairy related record maintenance, getting loans or credits from the banks, taking animals for grazing, fodder collection and harvesting the fodder crops. Thus there is need to educate them about scientific management practices for increasing livestock production.

Keywords: - Role Performance, Rural Women, Animal Husbandry.

BIOLOGICAL CONTROL OF DISEASE IN VEGETABLE CROPS: A SUSTAINABLE TOOL

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Integrated disease management (IDM) programme implies all the available disease management approaches including cultural, biological and chemical control with the main objective to keep the disease incidence below economic threshold level. One of the major components of integrated disease management is biological control. Biological control is the utilization of any living organism for the control of insect, pest, disease, nematode and weeds. Adoption of biological control against the diseases encountered in vegetable crops is very important as most of the vegetable crops are consumed raw as salad and also cooked with other ingredients and in most of the crops, products are not harvested only at the end of the crop season but it is spread over a long duration by way of several pickings, as in case of tomato, brinjal, okra, cucurbits, pea, beans, etc. Under this measure, biological agent i.e. fungus, bacteria and virus are exploited to control diseases. *Rhizoctonia* sp., *Fusarium* sp., *Pythium* sp., *Macrophomina* sp., *Ralstonia* sp. and *Meloidogyne* sp. in tomato, brinjal, pea, cucumber, controlled by using of *Trichoderma* sp., *Pseudomonas* sp. and *Bacillus* sp. Root rot, wilt and collar rot disease are also managed by *Trichoderma* sp. *Aspergillus niger* has been proved effective against *Fusarium* sp. These bioagents are effectively used either by seed treatment or soil application. By keeping in view of long residual effect of applied chemicals, it becomes imperative to concentrate alternate methods of diseases control without the negative impact of chemicals on agro-ecology, effective utilization of biological control of disease is very important for ecologically sound integrated disease management strategies.

Key Word: Integrated Disease Management, Vegetable Crops, Biocontrol Agents

DIRECT SEEDED RICE: STRATEGIC RESEARCH AND EMERGING ISSUES IN INDIA

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In India, Rice production is most important part of the national economy. India is second largest producers of rice after China, accounting for 20% of all world rice production. Transplanting is the most common method for obtaining good economic yields in rice cultivation. It requires operations like nursery raising and its management, pulling out of seedlings, transporting and distributing them to the main field for transplanting that amounts about 30-40 per cent of the total cost of cultivation (Chaudhary and Varshney, 2003). Change in rice establishment method from traditional manual transplanting of seedlings to DSR has occurred in many Asian countries in the last two decades in response to rising production costs, especially for labour and water (Pandey and Velasco 2002; Chauhan and Johnson, 2009). By 2025, it is expected that 'economic water scarcity' is bound to affect most of Asia's (22 m ha) irrigated and dry-season rice (Tuong and Bouman, 2003). With such constraints, increasing the production of rice in the future to feed increasing population is a great challenge. DSR has various methods which consume much lesser amount of water i.e.; wet-seeded rice (941.5 ha mm) and dry seeded rice (915.0 ha mm) than transplanting (1041.2 ha mm) (Bhuiyan et al., 1995; Thakura et al., 2004). In this way it reduces cost of cultivation by minimizing labour cost (reduces labour requirement as much as 50 percent than transplanting) and irrigation cost also.

Key words: national economy, economic water scarcity, wet-seeded rice.

PROBABILITY ANALYSIS FOR PREDICTION OF ANNUAL MAXIMUM RAINFALL OF ONE TO FIVE CONSECUTIVE MONTHS FOR SULTANPUR REGION, UTTAR PRADESH**ANURAG PATEL¹, RAJKUMAR VERMA² AND SUSHEEL KUMAR PATEL³**^{1,2,3}*Vaugh School of Agricultural Engineering and Technology, SHUATS, Allahabad (U.P.) 211007*

The present study was conducted for probability analysis of previous 17th years (1994-2010) with the prime objective for prediction of annual maximum rainfall (145.00, 239.06, 302.74, 424.5, and 483.3) of one to five consecutive months of Sultanpur region. The maximum rainfall values were estimated by proposed prediction models viz. Gumbel, Log Pearson Type III and Log Normal. The predicted and observed values were also established. The rainfall data has been in the above distributions and their corresponding rainfall events were estimated at 5.5, 11.5, 16.6, 33.3 and 50 percent probabilities level. The goodness of fit models was tested by Chi-square formula proposed by Hogg and Tanis. The comparison between the measured and predicted maximum value of rainfall clearly shows that the developed model can be efficiently used for the prediction of rainfall. The statistical comparison by Chi-square test for goodness of fit clearly indicates that the Gumbel distribution was found to be best model for predicting two, three, four and five consecutive month's annual maximum rainfall. While Log Pearson types III are fairly close to observed for one and four consecutive month's annual maximum rainfall. The rainfall prediction by Log Normal distribution shows very close relation to the observed rainfall for one consecutive month's annual maximum rainfall (mm).

Keywords: Log Pearson Type III Log, Prime objective, Chi-square test, Sultanpur and Rainfall

DEVELOPMENT AND TESTING OF TRACTOR OPERATED VARIABLE DEPTH FERTILIZER APPLICATOR ON APPLICATION OF GRANULAR UREA IN WHEAT CROP (TRITICUM AESTIVUM) PLANTED ON BEDS.**ANURAG PATEL,²R.C. SINGH,²DUSHYANT SINGH,¹ASHOK TRIPATHI¹S.C. MOSES AND²PRABHAKAR SHUKLA***Vaugh School of Agricultural Engineering and Technology, SHUATS, Allahabad (U.P.) - 211007, Central Institute of Agricultural Engineering, Bhopal (M.P.) 462038*

High fertilizer rate and labor requirement are common problems in traditional application of fertilizer. Fertilizer applicator was tested and evaluated for wheat crop (*Triticum aestivum*) planted on bed cultivation system. Study included suitable measurement techniques for recording various field parameters. Physical properties of granular urea fertilizer have been studied such as size and shape, sphericity, moisture content (18.7 %), bulk density (0.76 g/m³) and hundred particles weight (0.8 gm). The machine was calibrated in the laboratory for different rate of fertilizer application and determination of coefficient of variation. The field tests of machine were conducted on the wheat crop planted on bed in 5 rows. Operating parameters such as operational speed (3.7 km/h), wheel slippage (4.69 %), average field capacity (0.65 ha/h), field efficiency (80.10 %) and plant damage (4.33 %) were found respectively. Crop and Straw yield 5.72 t/ha, 5.38 t/ha, 6.1 t/ha and 15.82 t/ha, 15.89 t/ha, 16.5 t/ha, were found for three fertilizer application methods broadcast, foliar application and tractor operated fertilizer applicator. The tractor operated variable depth fertilizer applicator resulted 3 % and 6.5 % increase in yield as compared to broadcast and foliar application. Because in this method ammonia did not evaporate to the atmosphere due to placing of fertilizer at a depth of 100 mm below the soil surface. The saving of fertilizer by placing it in the soil by tractor operated fertilizer applicator was 33.33 and 16.6 kg/ha as compared to broadcast and foliar methods, which leads to saving of Rs 341 and Rs 611/ha respectively.

Keywords: Wheat crop, Tractor operated, Fertilizer applicator, Broadcast and foliar application

CONSERVATION AGRICULTURE: A WAY FORWARD FOR NATURAL RESOURCE MANAGEMENT AND SUSTAINABLE AGRICULTURE**ANURAG UPADHYAY***Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, 221005*

Conservation agriculture (CA) technologies involve minimum soil disturbance, permanent need based soil cover through crop residues or cover crops, and sensible diversification/crop rotations for achieving higher productivity. The technologies of CA provide opportunities to reduce the cost of production, save water and nutrients, increase yields, increase crop diversification, improve efficient use of resources, and benefit the environment. CA is developed as a technically viable, sustainable and economic alternative for current crop production practices. Current crop production systems have resulted in soil degradation, desertification, higher cost, poor soil health and unstable crop production. The adoption of no tillage has been found to enhance soil biological process, conserve soil and water, resource use efficiency, better soil condition, stable and higher yield. CA being recognized as holistic crop management for sustainable farming and it should be adopted the areas where CA adoption is low. The main barrier to its adoption is less skill/knowledge, mindset (tradition, prejudice), inadequate policies for the promotion of CA, availability of appropriate machines. Various report are

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available on improved yield, profit, soil and water conservation, better soil health due to adoption of CA based practices. Soil organic carbon percentage increases and bulk density of soil decreases by the mulching (Ram *et al.*, 2013). Effective tiller number, grain yield and B:C ratio of wheat is significantly higher in zero tillage and minimum tillage compare to conventional tillage (Kumar *et al.*, 2013). Soil and water loss is less under the conservation tillage compare to conventional tillage (Ghosh *et al.*, May 2015). Grain yield, cost of cultivation, and net return of rice and wheat are more under conservation agriculture practices compare to conventional practices (Singh *et al.*, 2012). CA based practices can help in achieving stable high yield/profitability, better environment quality with higher resource use efficiency which leads to sustainable agriculture.

ADVANCES IN TOMATO IMPROVEMENT THROUGH BIOTECHNOLOGICAL APPROACH

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Tomato is called Love of Apple in England, Poor man's orange in India, it is the protective food which provides almost all types of vitamins and minerals in quite fair amount and is the number one processed vegetable in the world. Improvement in tomato is very much needed to produce elite varieties having desirable attributes like high yield, resistance to biotic stress (insect, pest and diseases) and abiotic stress (drought, salt, frost and heat), slow ripening, varieties suitable for processing and long distant transport. Biotechnology is emerging branch of science involving tools of biology and engineering through the application of which varieties can be produced in short duration with higher quality and assurance. Various biotechnological approaches are being used in tomato improvement like molecular marker, MAS (Marker Assisted Selection), transgenic, genomics etc. Achievements in tomato breeding using biotechnological tools are 1. Flavr Saur variety having antisense gene polygalacturonase (PG) delays ripening. 2. Resistance to tomato leaf curl using coat protein. 3. Transgenics having insecticidal proteins like delta-endotoxin of *Bacillus thuringiensis* (Bt) proteinase inhibitor, lectins or enzyme (tobacco anionic peroxidase). 4. Resistance to fruit borer (*Helicoverpa armigera*) using Bt gene cry AC. 5. Transgenes chitinase and glucanase are used to generate resistance to bacterial and fungal diseases. 6. Transgenes ctx-B and tcp antigens of *Vibrio cholera* are used to develop edible vaccine.

RECENT TRENDS IN AGRICULTURE SCIENCES AND TECHNOLOGY

ARCHAR

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Landscape implications of bio energy feedstock choices are significant and depend on land use practices and their environmental impacts. Although land use changes and carbon emissions associated with bio energy feedstock production are dynamic and complicated, ligno cellulosic feed stocks may offer opportunities that enhance sustainability when compared to other transportation fuel alternatives. For bio energy sustainability, major drivers and concerns revolve around energy security, food production, land productivity, soil carbon and erosion, greenhouse gas emissions, biodiversity, air quality, and water quantity and quality. The many implications of bio energy feedstock choices require several indicators at multiple scales to provide a more complete accounting of effects. Ultimately, the long term sustainability of bio energy feedstock resources (as well as food supplies) throughout the world depends on land use practices and landscape dynamics. Land management decisions often invoke trade offs among potential environmental effects and social and economic factors as well as future opportunities for resource use. The hypothesis being addressed in this paper is that sustainability of bio energy feedstock production can be achieved via appropriately designed crop residue and perennial ligno cellulosic systems. We find that decision makers need scientific advancements and adequate data that both provide quantitative and qualitative measures of the effects of bio energy feedstock choices at different spatial and temporal scales and allow fair comparisons among available options for renewable liquid fuels.

KEYWORDS : Landscape, carbon emission, sustainability, feedstock, land management.

RECENT DEVELOPMENT OF FERTILIZERS AND THEIR ROLE IN PRECISION FARMING

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Aim of fertilizer application is to provide nutrients to plants and to increase or sustain optimal crop yield. Proper use of fertilizer is beneficial to both crop production and the environment. The fertilizer industry faces a new challenge to improve its products by increasing the efficiency of their use, particularly of nitrogenous fertilizers and to minimize any possible adverse environmental impact. This can be done either through improvement of fertilizers already in use, or through development of new specific fertilizer types. The

current trends show that the marginal productivity of soil in relation to the application of fertilizers is declining. Fertilizer use efficiency in Indian agriculture is quite low even with good management practices. Efficiency of N fertilizer use seldom exceeds 40%. P and micronutrients the efficiency is only 20% and 2%, respectively and for K the efficiency is about 50%. This lead to the development of Ideal fertilizer which release nutrients in a sigmoidal pattern for optimal plant nutrition and reduction in nutrient losses. In EEF concept, the fertilizer formulations are capable of minimizing the various losses and enhance the use efficiency of the nutrients by providing the continuous availability of the plant nutrients throughout the plant growth. Precision agriculture practices using high-tech equipment has the ability to reduce agricultural inputs by site-specific applications as it better target inputs to spatial and temporal needs of the fields, which can result in lower greenhouse gas emissions. All Enhanced Efficiency Fertilizers (EEF) fertilizers are economically quite expensive but that can be compensated through higher efficiency and because of higher nutrient use efficiency and environmental impacts due to fertilizers pollution can be effectively managed. Research and development shall continue to pursue new alternative like precision nutrient management and other innovative technology in terms of fertilizer production and use efficiency to sustain crop production with minimum environmental hazards.

PROTECTED CULTIVATION IN HORTICULTURE CROPS

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In the present scenario of perpetual demand of horticultural produces and shrinking land holding drastically, protected cultivation is best alternative and drudgery less approach for using land and other resources more efficiently. In protected environment (greenhouse, glass house, polyhouse), the natural environment is modified to suitable condition for optimum plant growth which ultimately provides quality horticultural produces. Demand for horticulture commodities is increasing over a period of time. The production of quality fruits, vegetables, flowers and other horticultural crop can be enhanced either by increasing productivity, use of improved cultivars/hybrids and effective production system, bringing additional land under horticultural crops or by promotion of protected cultivation which supports production in adverse climatic condition, and during off season. Greenhouse cultivation is useful and is in practice in all kinds of climatic conditions, may be it be severe and extreme cold, intolerant summer, excessive rains etc. Nursery production of horticultural crops under protected conditions is highly economically viable. Greenhouse for vegetable production encompasses glass house, polyhouse, and insect proof net house. Use of techniques like soilless culture, hydroponics, aeroponics, production of hybrid seed of important vegetable crops and grafting of promising varieties on desirable root stock can be made more efficiently under protected environment.

EVALUATION OF MANGO (*MANGIFERA INDICA* L.) CULTIVARS ON THE BASIS OF QUALITY CHARACTERS OF FRUIT UNDER FAIZABAD CONDITION

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The experiment was carried out at Main Experimental Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) The experiment on mango was conducted in Randomized Block Design (RBD) with twelve treatments were Each variety was replicated thrice and spaced at a distance of 10 × 10 m. Plants were of uniform in age (22 years) and received same cultural practices during the course of investigation. The Selected varieties were Dashehari, Banarasi Langra, Langra Kukori, Bombay Green, Nisar Pasand, Gulab Khas, Himsagar, Lucknow Safeda, Rataul, Gaurjeet, Samarbahist Chausa and Zardalu and used as treatments T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ respectively. The observations were recorded on physico-chemical characters of mango fruits. The maximum fruit length (9.37cm) was recorded in Samarbehist Chausa, whereas the highest fruit breadth (6.57cm) was recorded in Bombay Green. The maximum fruit weight (186.67gm), fruit volume (179 cm³), pulp weight (135.50 gm) and pulp: stone ratio (6.66) and minimum stone weight (20.33 gm) were recorded in Banarasi Langra. Better quality fruits with respect to highest total soluble solids (20.78 Brix^o), reducing sugars (3.98%) and lowest acidity percentage (0.24%) were recorded in samarbahist Chausa. The highest ascorbic acid (74.28 mg/100gm) and total sugars (15.54%) were recorded in Banarasi Langra. While, the maximum non-reducing sugar (13.08%) was recorded in Rataul. Overall it can be concluded on the basis of quality of fruits, Bombay Green and Gulab Khas were observed as early variety whereas Dashehari, Banarasi Langra and Langra Kukori as mid season variety and Samabahist Chausa as a late variety to be found best under Faizabad condition. These varieties posses good quality characters and superior overall the varieties under this study.

Key words: Mango, Cultivars, Peel, Fruit, Sugar

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**EFFECT OF INM ON GROWTH AND YIELD OF SPROUTING BROCCOLI {*BRASSICA OLERACEA* (L.) VAR. *ITALIC PLANCK*}****ARJUN LALOLA*, L. N. BAIRWA, MALEE RAM JHAJHRA AND RAJ KUMAR JAKHAR***Dept. of Horticulture, S.K.N. College of Agriculture, Jobner (Jaipur)*

The field experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Jaipur) during *Rabi* season 2016-17 and 2017-18. The experiment consisted of seven treatment of INM i.e (1) 100 % RDF through inorganic fertilizer, (2) 75% RDF through inorganic fertilizer + 25 % through FYM, (3) 50% RDF through inorganic fertilizer + 50% through FYM, (4) 100 % RDF through FYM, (5) 75 % RDF through inorganic fertilizer + 25% through VC, (6) 50 % RDF through inorganic fertilizer + 50% through VC and (7) 100 % RDF through vermicompost with three replications. The application of 50 % RDF through inorganic fertilizer and 50 % through vermicompost was found significant effective and recorded maximum plant height, number of leaves per plant, leaf area, chlorophyll content in leaves (2.96mg/g), leaf area duration, weight of primary curd (222.51g), number of secondary curds per plant (6.58), weight of secondary curd (154.05 g), volume of curd (119.78 cc), diameter of curd (13.10 cm), yield per plant (384.56g), yield per plot (7.69 kg), yield per ha (189.90 q), biological yield per ha (1081.85 q). This treatment was also recorded minimum days taken to curd formation. It was statistically at par with 75 % RDF applied through inorganic fertilizer with 25 % through vermicompost.

Key Words: Growth, Yield, Organic, Inorganic, Vermicompost and Sprouting broccoli.

TO STUDY THE MANGO HOPPERS *AMARITODUS ATKINSONI* (L)**ARUN KUMAR*, SUCHARU SINGH*, MOHD. YAMEEN* AND RAJENDRA SINGH,***Department of Entomology**

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Mango Hopper is a serious pest of mango crop and three species of mango hoppers are causing considerable yield loss up to 60 per cent and failure of good crop. Hoppers lay egg singly on floral shoots, buds and tender leaves which hatch in a week. After hatching Large number of nymphs is pale yellow and adults vary in size from small to large depending on the species. Adults may be dark with wavy lines on wings and three spots on scutellum, or light brown with dark spots on the vertex. Nymphs and adults damaging both as puncture and suck the sap of tender parts of panicles, inflorescence, leaves and fruit. It results into weakening of inflorescence and affects fruit set and their drop. They also damage the crop by excreting sweet sticky substances which facilitates the development of sooty mold, a fungus, which affects photosynthesis activity of leaf. Based on the Studies If the timely interventions are not taken, the quality of the fruit is affected and may cause considerable yield loss.

EFFECT OF DIFFERENT HERBICIDE COMBINATION ON NUTRIENT STUDIES AND NET RETURN OF TRANSPLANTED RICE IN WESTERN UTTAR PRADESH**ARUN KUMAR***Department Of Agronomy, PAU Ludhiana-141004*

A field experiment was conducted with the aim to know effects of different weed management on nutrient studies and net return of transplanted rice in western Uttar Pradesh during *Kharif* 2016 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U. P. (India). The experimental site was sandy loam in texture, low in organic carbon and available N, medium in available P and K and slightly alkaline in reaction. The experiment was laid out in randomized complete block design with three replications comprising twelve weed management treatments. The results indicated that the lowest N,P&K content in weeds at harvest stage found with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha⁻¹PE fb 25g a.i ha⁻¹POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha⁻¹PE fb 30 g a.i ha⁻¹POE) and the highest were found in weedy check. The highest rice grain N,P&K content found with the application of Pyrazosulfuron fb Bispyribac Sodium was at par with Pyrazosulfuron fb Azimsulfuron. Among weed control treatments significantly highest N,P&K uptake 112.51, 34.94 & 135.01 kg ha⁻¹ respectively was observed in the application of Pyrazosulfuron fb Bispyribac Sodium was at par with Pyrazosulfuron fb Azimsulfuron 104.89 kg ha⁻¹ and significantly higher than the remaining treatments. The net return of rice was highest in application of Pyrazosulfuron fb Bispyribac Sodium treatment in comparison to weedy check treatment. Pyrazosulfuron fb Bispyribac Sodium recorded 59.05 % higher net return B: C ratio over weedy check. This shows that Pyrazosulfuron fb Bispyribac Sodium can be applied in transplanted rice for effective weed control, highest nutrient content in grain & straw, higher net return and B:C ratio.

Key words: Nutrient content, herbicide, net return, and weed management.

BREEDING FOR SUSTAINABLE VARIETIES: NEED OF THE HOUR**ARUN THAKUR***Department of Crop Improvement, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.) 176062*

By 2050, the world population will increase from recent 7.6 billion to 10 billion. This 30% increase in population will increase the need for food. With the current trends in growing food crops all around the world, agriculture often places significant pressure on natural resources and the environment without leaving a window large enough for these resources to replenish. Current demand for food and other agriculturally derived products by ever increasing population of the world doesn't leave an option for food growers. Furthermore, the amount of arable land for crop cultivation is limited and decreasing due to urbanization, salinization, desertification and environmental degradation. So, sustainable agriculture is the need of the hour. Plant varieties currently grown by farmers in India and abroad tend to be of narrow genetic base, with landraces decreasing significantly year after year leading to loss of biodiversity. This leads to farmer changing their varieties more often than before leading to more stress on land. In the recent era of GMOs dominating the agriculture, many studies have shown that these transgenic crops tend to consume considerably more nutrition than the regular non-GM crop. Plant breeding strategies for sustainability aim to develop crops which entail rationalization between yield and quality. Plant breeding methods that involve sustainability tend to put less stress on existing diversity and more on exploiting the existing variability. Generation of new variability would include tapping into new plant genetic resources to bring forth new genes for yield, stability and adaptability, resistance to diseases, pests and drought. The farmer would possess varieties that would have incorporated and mixed the genetic diversity from wild relatives. The created crops would have more variability available to farmer and breeder than before. This would lead to consistent performance in agriculture yield and quality resulting in growing food in an ecologically and ethically responsible manner that does not harm the environment and sustains communities.

Keywords: biodiversity, environment, landraces, sustainability, quality and yield

EFFECT OF DIFFERENT PH AND TEMPERATURE LEVELS ON MYCELIAL GROWTH OF *PLEUROTUS CORNUCOPIAE* (BRANCHED OYSTER MUSHROOM)**ARUNESH KUMAR^{1*}, R.S JARIAL², KUMUD JARIAL³ AND SAVITA JANDAIAK⁴**

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Pleurotus cornucopiae, the branched oyster mushroom is one of the *Pleurotus* species whose cultivation is not common in India. The physiological/cultural studies were conducted to evaluating different pH and temperature levels for the mycelial growth of *P. cornucopiae*. The test fungus was evaluated for its tolerance to low and high Ph levels. Out of different pH regimes ranging from 4.0 to 8.0 tested and pH 7.0 was found to support maximum average diametric growth (83.25mm) and minimum growth (53.91mm) was observed at pH 4.0. In all the treatments, type of growth ranged between sparse, fluffy to thick strandy. Six different temperature regimes ranging from 10 to 35°C were evaluated, the maximum average diametric growth (85.00 mm) was observed at temperature 25°C and minimum (39.16mm) was observed at 10°C. The type of growth at different pH & temperature's ranged between strandy, sparse, fluffy and thick strandy. Data were recorded after 7 days of inoculation of test fungus in both that is pH and temperature.

Keywords: temperature, pH, *Pleurotus cornucopiae*, diametric growth, average biomass, colour of mycelium and type of growth.

WHEAT PRODUCTION STRATEGIES UNDER THE CLIMATE CHANGE SCENARIO TO IMPROVING THE CROP PRODUCTIVITY**ARVIND KUMAR***G.B. Pant University of agriculture and technology, Pantnagar, US Nagar, Uttarakhand 263145.*

Over the past decade experienced suggest that climate will be even more variable in the future. Both rainfall pattern and temperature are more variable due to climatic aberrations which have much affected the agriculture. Wheat crop require an optimal conditions for their growth and production but alteration in growing environment directly influences the wheat development and production. It may causes; Wheat rapid development, Early Flowering and fasten the maturation due to increasing temperature and growing degree days. Photosynthetic rate, dry matter accumulation and water uptake are enhanced due to increased atmospheric CO₂ which resulting more demand of soil nutrients and yield reduction of wheat under current nutrients application rates. Accurate estimation of climate change impact on wheat is not possible due to many interactions within planting date, water availability, nutrients and crop variety. Therefore to achieve the potential yield target, Wheat growers need to focus on various short, medium and long-term management options that involving knowledge and input intensive systems of cultivar selection, nutrient and water management. In case of short term options, combination with strategic nutrient management and Irrigation has much potential to significantly improve the yields. Growers can also

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use such varieties which are better suitable for warmer climate, late seasonal rainfall and shorter durations. Whereas, in Medium to Long-term options, Growers are need to focus on closely match the nutrient application with crop demand to maintain of the current yield levels. However, Delaying the nutrient applications or leaching in wet conditions may cause some nutrient deficiency. The use of slow release fertilisers to assist in preventing nitrogen deficit may be used. However, Early Flowering and maturation in wheat will likely influence future cultivar selection and sowing window. So, the future wheat production can be improved by using different crop management options.

ORGANIC MULCH: BETTER TECHNIQUE TO CROPPRODUCTION FOR SUSTAINABLE AGRICULTURE

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Indian Agriculture is mostly depending on the heavy application of fertilizer, pesticides, irrigation and several other agricultural inputs. They are constantly degrading and polluting the quality of soil, water and our environment. The farmers are using excess doses of fertilizers and pesticides to increase the yield of the crop, but these over doses are hazardous for our soil health. Use of organic mulching is one of the suitable methods which could help the growers to increase the production with good quality of produce. Organic mulches are those natural origin materials which can decompose naturally. It includes bark chips, grass clippings, wheat or paddy straw, plant leaves, compost, rice hulls, and sawdust, etc. It decays very rapidly and increases the water holding capacity of soil. It also restricts the weed growth by obstructing light penetration to the soil surface. Organic mulch also reduces erosion by protecting the soil surface and reduces nutrient loss by runoff and leaching. The total production of organic waste by human, livestock and crops are approximately 38 trillion metric tons worldwide, and about 600 to 700 million metric tons of agricultural wastes (as well as 272 million metric tons of crop residues) are existing every year in India. A seven-year organic mulch study in India showed that the superiority of organic mulching compared to black or transparent polythene mulch resulted in improved flowering, pod production and yield of groundnut. With proper planning, good management, attention to details, and dedication to all aspects of the cropping sequence, earlier and higher yields are possible through use of mulch. Mulching is a good practice for virus-vector management. Farmer can adopt this technique to sustain the agriculture.

EFFECT OF PHOSPHORUS AND SULPHUR NUTRITION ON SUMMER MUNGBEAN (*VIGNA RADIATA* L. WILCZEK) UNDER IRRIGATED CONDITIONS OF WESTERN UTTAR PRADESH

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A field experiment was conducted during the *summer* season of 2017 at Crop Research Centre (located at a latitude of 29° 40' North and longitude of 77° 42' East with an elevation of 237 metre above mean sea level.) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to study the Response of *Summer* Mungbean (*Vigna radiata* L. Wilczek) to Phosphorus and Sulphur Nutrition. The soil of the experimental field was well drained, sandy loam in texture and slightly alkaline in reaction. It was low in organic carbon and available nitrogen, medium in available phosphorus, potassium and sulphur with an electrical conductivity (1:2.5, soil: water suspension) of 1.7 dS/m. The total amount of rainfall during crop period was 83.8 mm out of this 64.4 % was received during May to June. Four phosphorus levels (0, 20, 40 and 60 kg P₂O₅/ha) and three sulphur levels (control, 20 and 40 kg/ha) were tested in factorial randomized block design with 3 replications.

Results revealed that the growth parameters and yield attributing characters of mung bean viz., pods/plant, grains/pod, test weight and grain yield/plant were significantly higher at highest levels of P (60 kg/ha) or S (40 kg/ha) over their lower levels. The phosphorus @ 60 and 40 kg P₂O₅/ha over control outyielded 86.6 and 54.5%, respectively. Similarly, the per cent increment with 20 and 40 kg S/ha over control was 35.3 and 19.0, respectively. Mung bean fertilized with 60 kg P₂O₅/ha accumulated 63.7, 64.5 and 93.4 % more total N, P and S/ha over control. The respective improvement with 40 kg S/ha over control was 20.8, 2.11 and 2.62 kg/ha. However, the 40 kg S/ha registered 5.3 and 2.5 per cent higher available nitrogen over control and 20 kg S/ha, respectively. The application of 60 kg P₂O₅/ha fetched significantly highest gross returns (Rs 59863/ha), net returns and Benefit: cost ratio (2.5). However, the net benefit over and above 20 and 40 kg P₂O₅/ha was Rs 14457 and Rs 8774/ha, respectively. Among the sulphur levels, the significantly maximum gross returns (Rs 53085/ha), net returns and B:C ratio was noticed with the application of 40 kg S/ha as compared to rest of the treatments.

INNOVATIVE TECHNOLOGIES FOR HORTICULTURAL DEVELOPMENT IN INDIA**ASHISH PANWAR***Horticulture Assistant, Aga khan foundation Nizamuddin, New Delhi*

Agriculture is the back bone of Indian economy as it supplies raw material for many of the industries and it is the source of livelihood for majority of the rural population in India. There are myriad innovations that have been part of agricultural transformation in India. This paper discusses various innovative technologies for horticulture development in India. Scientists with the Horticulture Innovation Lab are testing and adapting a range of technologies aimed at significantly improving the profitability of fruit and vegetable production throughout the world. Given the complexity of horticulture, technologies such as these can reduce constraints that limit the ability of smallholder farmers to achieve maximum profitability with high-value horticultural products. Our goal is to develop and test technologies that can overcome common limitations in land, labor, capital and infrastructure.

Keywords: Innovation technologies, Institutional Dynamics, Agriculture, Horticulture development.

INHERITANCE STUDY OF RED KERNEL COLOUR IN RICE (*ORYZA SATIVA* L.) USING MICROSATELLITE MARKERS**ASHISH S. JONDHALE*, S. G. BHAVE¹, S. V. SAWARDEKAR², D. B. PATIL³**

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The investigation comprised of one red kernel and one white kernel fine grained rice cultivars. Crosses between White rice x Red rice cultivars and their reciprocal were made during *Kharif* 2013. The F_1 s were evaluated during *Rabi* 2013-14 and F_2 seeds of each cross were obtained. The BC_1 and BC_2 i.e. back crosses of F_1 with both the parents were effected during *Rabi* 2013-14. The parents, F_1 s, F_2 s, BC_1 s and BC_2 s were evaluated during *Kharif* 2014. The F_1 progenies of both crosses under study were examined for the kernel colour and it was observed that all the F_1 progenies were having red coloured kernels. This indicates the dominance of red kernel colour over white kernel colour in rice in F_1 generation. For these studies molecular markers linked to the red kernel were used for parental polymorphism and for foreground selection. The parental validation using SSR markers were also studied. Marker RM 206 was found as the best marker in screening F_2 population for red kernel colour followed by RM 251 as the distance between two fragments are more. The F_2 population of both crosses was screened using selected two SSR markers i.e. RM 206 and RM 251. A representative 100 individuals derived from the crosses Karjat-2 x Munga and their reciprocal was estimated for white and red kernel colour. Out of 100 individual plants 81 and 19 were found to exhibit red and white kernel colour respectively and these individuals were segregated in 3:1 chi square ratio for kernel colour trait.

A REVIEW ON ABIOTIC STRESS TOLERANCE IN BANANA**ASHOK KUMAR MEENA, FRANCIS DUTTA, BHUJBAL SINGH AND PRAVEEN KUMAR***Department of Horticulture, Assam Agricultural University, Jorhat*

In India, bananas are grown in the regions of humid tropics, humid subtropics and semiarid tropics, and some banana genotypes can grow up to an elevation of 2000 MSL. Deep, well-drained loamy soil with adequate organic matter is ideal for its cultivation. Bananas (referring to banana, plantain and cooking bananas) are economically important high-value commercial as well as subsistence food crop. The most suitable climate is with warm moist weather without strong winds throughout the year. The major abiotic factors which influence the banana growth and productions are water, temperature, wind and mineral nutrients. The major constraints for banana production are largely dominated by biotic and abiotic stresses. Though research on biotic stresses in banana has drawn sufficient attention worldwide, abiotic stresses are not. The successful cultivation of water-loving Cavendish clones, in drought-prone areas with protected irrigation, has provided the sufficient momentum to research on drought in bananas. Banana plants, especially the Cavendish clones, are sensitive to abiotic stresses like soil moisture deficit, salinity, extreme temperatures and strong winds. As bananas are recalcitrant to conventional breeding approaches, clonal selection and tolerant genotype selections from germplasm are the major sources to address the abiotic stresses. Stress resistance mechanism are avoidance (preventing exposure of plant to the stress), tolerance (allowing the plant to withstand against the stress) and acclimation (altering the physiology in response to the stress).

Keywords: Banana, Abiotic stress, nutrients, salinity

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**WATERPROOFING CROPS****ASHOK SINGAMSETTI^{*1}, SWATHI REKHA NANDIGAM², KRISHNAVENI VARALA³***Department of Genetics and Plant Breeding, Banaras Hindu University, Varanasi, U.P., Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand., Department of Plant Pathology, Birsa Agricultural University, Ranchi, Jharkhand.*

In farming regions all over the world, in past 50 years, the extremes in water availability like drought and flood had increased its frequency. These two abiotic stresses are accounting to a loss of many US billion dollars all over the world. The crops which are mostly affected by these abiotic stresses include Rice, Maize, Soybean, Wheat and Cotton. Among these, the most flood-threatened crop is Rice. At present, over 35% of world's rice acreage is flood prone and much of this is in regions of Asia and Africa which are characterized as food insecure continents. This problem is considered as a major one and became a major international goal for the rice breeders to meet the anticipated needs of growing hunger mouths. To achieve this, adopting and developing a germplasm that can bear these abiotic assaults is essential. For this, development of rice varieties that survive transient submergence and their non-commercial dissemination to farmers cultivating flood prone paddies. For this content, through the initiatives of IRRI, robust submergence tolerance was transferred by MAS from farmer's landrace to modern varieties. For translation of flooding survival strategies to additional crops for stabilizing yields of food, feed, fiber and fuel, an entire knowledge on developmental, morphological, physiological and molecular mechanisms that underlie flood tolerance should be known.

DETECTION OF SUGAR BEET VARIETIES HAVING HIGH SUCROSE CONTENT AND YIELD FOR SUB-TROPICAL CONDITIONS OF INDIA**ASHUTOSH KUMAR MALL, VARUCHA MISRA, A. D. PATHAK***ICAR-Indian Institute of Sugarcane Research, Lucknow*

Sugarbeet is a renowned crop standing second position for contributing to sugar production in the world after sugarcane. It is now gaining attraction for production of ethanol due to high potential content of 7000 litre/ha in it. It is a water saving crop where water can be saved up to 30-40 % and its leaves are useful as a good fodder material. The problem of high consumption of sugar due to high population rate and climate change is making this crop an important one. To manage this problem there is a need for developing high sucrose content and yield sugarbeet varieties especially for the sub-tropical regions of India. Thus, the present study highlights on detecting such high sucrose content and high yield sugarbeet germplasm. In respect to control (LS 6), thirteen varieties have been assessed under this study. Study revealed that Shubra had highest population survival capability amongst all varieties tested against check. In respect to sucrose content and commercial beet sugars per cent and root yield, Shubra again bagged the first position. Contrastingly in root diameter aspect, it owes the second position followed by L 33 AND LKC 2007 whereas the first position was attained by R 06 against check variety. The study concluded that amongst all the varieties tested for high sucrose content and yield, Shubra is one of the promising varieties for sub-tropical conditions of India.

Keywords: Germination, LS 6, Sucrose, Shubra, Sugarbeet, Yield

RECENT HEADWAY IN SEED PRODUCTION OF ROOT CROPS**ASHUTOSH KUMAR, ¹MAHENDRA KUMAR TAL, ²ABHIVYAKTI AND ¹R. B. VERMA***Deptt. of Horticulture (Veg. & Flori.), BAU, Sabour-813210, Deptt. Of Agricultural Meteorology, BAU, Kanke- 834006*

Root crops consider carrot, radish, turnip, beetroot and parsnip etc. and are extraordinarily imparting to the vegetable production basket in India. Due to the advancement of varieties for round the year production off-season production and storage facilities, radish and carrot stay in the market most of the year. At national level National Seed Corporation (NSC) and at state level State Seed Corporations (SSCs) are accountable for quality seed production. There is an ample disparity between the quest of quality seed and circulation. This space is bridge up to some extent either by the private sector companies or from the own farm save seed by the farmers. To improve use of quality seed, there is a demand of production of quality seeds and also need for the development of seed production practices of root crops in order to potentiate the accessibility of quality seed for commercial production in these crops. Although, root crops are well naturalizing to cool season but their seed production are being done in plain & hills during winter or after overwintering. The Asiatic/tropical varieties produce their seeds freely in the plain without chilling requirement (for bolting). The temperate/European types need chilling/vernalization stimulus of 4-5°C temperature for 40-60 days' duration for bolting depending upon the range of temperature. Due to limited activity of honeybee at the high temperature i.e. 32°C or above the seed setting hampered in radish as well as turnip. Similarly, high temperature at flowering in carrot also causes desiccation of tertiary umbels due to reduced availability of pollen supply for secondary umbels and reduced the seed setting resulting in lower seed yield.

BOTANICAL MANAGEMENT DOWNY MILDEW OF OPIUM POPPY**NARENDRA DEV UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

Department of Plant Pathology Faizabad, Ashwani Kumar Patel, M.Sc. Ag & Pawan Singh,, Satyendra Vishwakarma

Opium poppy (*Papaver somniferum L.*) is the most important medicinal plant. It has its importance as a plant based natural reliever from the time dating back to early civilization till today. It is an important crop of India because it produces capsules that contains milk from which opium is prepared. Opium possess various types of alkaloids which are used for preparing medicines for the use of human and cattle. There are 25 alkaloids identified in raw opium; of them, morphine, narcotine, codeine phosphate, narcein, thebaine, papaverin, etc are important. Opium poppy is susceptible to a number of diseases which affect the opium yield, most of which can be classified as fungal diseases and other diseases are bacterial, viral etc. Among fungal disease of opium poppy Downy mildew is most common disease present on opium plant. Downy mildew of opium poppy caused by *Peronospora arborescens* (Berk) de Barry was first reported from India by Butler in 1918. During late of December and starting of January mid, symptom of downy mildew were observed on 2 month old plant at Medicinal and Aromatics plant Experiment Station of Horticulture farm Narendra Dev University of Agriculture and Technology Kumarganj faizabad. The leaves symptoms were collected in morning from farm of MAP Experiment of Horticulture faizabad and brought to laboratory and cottony growth on downy region of leaves is isolated and Slide is prepared and it is observed under light compound microscope. It reveals the large number of short lived sporangia and Sporangiospores. The Sporangiospores were hyaline and upper portion is dichotomously branched, the sporangia were pale/ light brown, sub globose, ellipsoidal. Its sizes measure were as follows Sporangiospore branches measure 75 to 240µm long × 2.5 to 8 µm wide. The size of Sporangia is measured 20 to 34 µm long × 18 to 20 µm wide. The Botanical management of Downy mildew was done at field experiment station at trial of Opium poppy crop using Neem seed kernel extract's, and Neem cake, and Naturally available Buttermilk and Garlic extracts and one treatment with control. Observation after treatment with Botanical agent on opium crop reveals that botanical management are satisfactory for control of downy mildew disease.

GROUNDWATER STORAGE ANALYSIS IN CHANGING LAND USE IN AGRICULTURE**ATIN KUMAR¹, SATENDRA KUMAR¹, ASHOK KUMAR¹, ROHIT KUMAR² AND SHRIMAN KUMAR PATEL³**

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Groundwater is a major source of drinking water across the world and plays a vital role in maintaining the ecological value of many areas. However, the quantity and quality of groundwater are changing due to human activity. Assessing the impact on the groundwater system and predicting the magnitude of change in the future is therefore a major scientific challenge. Land-use and land-cover changes are one of the main human induced activities altering the groundwater system. Nevertheless, the impact of future land-use changes on the groundwater system has not been investigated extensively. Throughout the entire history of mankind, intense human utilization of land resources has resulted in significant changes of the land-use and land-cover. Since the era of industrialization and rapid population growth, land-use change phenomena have strongly accelerated in many regions. The impact of land use and land cover changes on the regional water balance is the most vigorous research in the international hydrological fields, and lots of research indicate that large-scale land use and land cover changes are the important factors resulting in the regional climate and hydrological cycle changes. Over the last century, major changes in land use have occurred locally, regionally and globally. These will continue in the future too. The impact of urbanization on groundwater has a major concern over past few decades, and in particular, to those involved in groundwater quantity and qualitative studies. Increased impervious area due to urbanization results in decreased infiltration, and finally affecting the groundwater storage. Thus, land use changes have to be assessed with spatial data technologies; especially the application of remotely sensed data and geographical information systems (GIS) has been used. During the last five decades there has been sharp increase in water consumption owing to the population explosion, unprecedented rise in standard of living and enormous development. The problem is caused not only by natural factors, but also due to mismanagement and lack of knowledge about existing water resources. Therefore, a proper management plan can only be adopted by knowing the balance of different hydrologic components of hydrological unit.

Key Words: Groundwater, water, land-use, climate, GIS etc.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**NUTRIENT CONTENT OF IMPORTANT FRUIT TREES FROM DRY AREA OF RAJASTHAN****ATMARAM MEENA¹, BHAGWATI BARANDA² PUSHPENDRA SINGH³***1, 2, College of Agriculture, S.K.R.A.U-Bikaner, Rajasthan -334 006 (India), 3, Rajasthan College of agriculture, MPUAT-Udaipur, Rajasthan*

Forests have provided food and shelter to man since ages. About 20% of the plants occurring in the forests are reported to have direct utility to mankind. Around 600 plant species in Indian forests are enumerated to have food value. Arid zone vegetation comprises a wide range of edible fruit bearing and food producing species viz. *Capparis decidua* (Ker), *Cordia dichotoma* (lasora), *Ziziphus mauritiana* (ber), *Ziziphus nummularia* (Bordi), *Salvadora oleoides* (Jal), *Balanites aegyptiaca* (Hingota), *Prosopis cineraria* (Khejri) etc. which play an important role in the nutrition of children in rural and urban areas alike and are relished by them. Most of these fruits are rich sources of protein and energy. Ker is a rich source of fibre, vitamin A and vitamin C. Ber is richer than apple in protein, phosphorous, calcium, carotene and vitamin C. However they are often undervalued and underutilized as more exotic fruits become accessible. Also most of these are not cultivated and there is only scant and dispersed knowledge about them. Their production and consumption provides a dietary supplement as well as commercial opportunity. Potential fruit species from arid region are reviewed in context with their nutrient contents.

Key words: Fruits, nutrition, protein, vitamin A, energy.

CHARACTER ASSOCIATION STUDIES IN OATS (*AVENA SATIVA* L.)**ATMAN POONIA & D S PHOGAT***Department of Genetics and Plant Breeding, CCSHAU, Hisar*

Oat (*Avena sativa* L.) is a cereal crop of global importance, belonging to the family. Oat (*Avena* spp.) has a taxonomic pattern similar to that of wheat, consisting of a polyploid series of species with seven basic ($x=7$) chromosomes, i.e., diploid, tetraploid and hexaploid. The multifunctional uses of oats include forage, fodder, straw for bedding, hay, haylage, silage chaff, human food; most commonly, they are rolled or crushed into oatmeal, or ground into fine oat flour. The present investigation was carried out in Forage Section Department of Genetics & Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar during *rabi* 2015-16 to estimate the magnitude of correlation among fodder yield and seed yield. Positive and significant correlations of dry matter yield per meter row length were recorded for seed yield per meter row length and green fodder yield per meter row length. Hence, it would be rewarding to lay stress on characters viz. green fodder yield and seed yield per meter row length for the improvement of dry matter yield.

Key Words: correlation, *Avena sativa* L., selection, fodder

SOIL HEALTH MANAGEMENT: A QUALITATIVE APPROACH**ATUL DHANSIL¹ BHAWANI SINGH PRAJAPAT² AND KAMLESH YADAV³***¹Deptt. of Agril. Chem. and Soil Science, College of Agriculture, JAU, Junagadh, Gujarat, ²Deptt. of Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, ³Deptt. of Agril. Chem. and Soil Science, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan*

India is a predominantly agricultural country in which major part of GDP depends on agricultural commodity. The soil health is one of the most important factors in deciding production potential of particular soil in relation with present situation as well as future use. Soil health is the 'fitness' or 'condition of soil' to sustainably support specific uses (e.g. crop growth) in relation to its potential, as dictated by the inherent quality of the soil. The soil health is basically the integration of the soil physical, chemical and biological processes and functions. A healthy soil will be balanced for all the three components. In order to make interpretation of the health of a soil, the various processes and functions need to be assessed through meaningful indicators (on the basis of cumulative rating of all indicator). Soil health is an assessment of ability of a soil to meet its range of ecosystem functions as appropriate to its environment. The term of soil health is used to assess the ability of a soil to sustain plant and animal productivity and diversity, maintain or enhance water and air quality, and support human health and habitation. Soil health deals with both inherent and dynamic quality. Inherent quality relates to the genetic characteristics while dynamic soil quality is affected by management practices. The inherent and dynamic soil quality components do interact.

Key word: Soil health, indicator, inherent and dynamic quality, production

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**“TECHNOLOGICAL GAP OF FARMER IN WHEAT CROP CULTIVATION”****ATUL KUMAR^{*1}, R.K. DOHAREY², KAUSHIK PRASAD³, KAMAL KISHORE⁴, ARVIND PRATAP SINGH⁵, AND MANOJ KUMAR⁶**^{1,2,3,4,5,6} *Department of Extension Education, College of Agriculture, N.D.U.A &T., Narendra Nagar (Kumarganj), Faizabad (U.P.) 224229, India*

The study was conducted in Harpalpur and Madhoganj block of Hardoi district (UP) selected purposively, because block area has more popular for area and production of wheat as criteria. A total number of hundreds wheat growers were selected through random sampling from five selected villages panchayats on the basis of twenty respondents from each selected villages panchayats. The technological gap with result of Wheat cultivation ranged from to (7.5 to 42.5 per cent). The highest gap was found in farmer about knowing of the plant protection. The second major technological gap of 28.75 per cent was noticed in harvesting and 28.33 percent of seed treatment and their characteristics. A gap of 28.33 per cent was found in weed management and 18.75 per cent was found in land preparation, 18.00 per cent was found in sowing method. I remaining practices such as seed rate, variety, method of application, intercultural operation, manure and fertilizers, selection of soil, irrigation and variety the gap were reducing from 16.66 per cent to 7.50 per cent.

Keywords: Technological Gap, knowledge, *adoption*, scientific cultivation, etc.

EFFECT OF SITE SPECIFIC NUTRIENT MANAGEMENT IN RICE**ATUL KUMAR*, VIPUL KUMAR MISHRA*****Dept. of soil science, RAU, Pusa- 848125, **Msc Research Scholar, Dept. of soil science, RAU, Pusa- 848125*

Rice (*Oryza sativa* (L.)) is one of the most important staple food crop in the world. In Asia, more than two billion people are getting 60-70 per cent of their energy requirement from rice and its derived products. In India, rice occupies an area of 44 million hectare with an average production of 90 million tonnes with productivity of 2.0 tonnes per hectare. Nutrient management is a major component of a soil and crop management system. Site specific crop and soil management is basically taking a systematic approach to applying sound agronomic management to small area of a field that can be identified as needing special treatment. At present the site specific nutrient management for rice crop is developed and adopted by the farmer all over the world. Many of nutrients required by rice plants come from soil. But the supply of nutrients is typically insufficient to meet the nutrient requirements for high rice yields. The use of fertilizer is consequently essential to fill the gap between the crop needs for nutrients and the supply of nutrient from soil and available organic inputs. Site Specific Nutrient Management (SSNM) is an approach to feeding rice with nutrients as and when needed. The application and management of nutrients are dynamically adjusted to crop needs of the location and season. The SSNM approach aims to increase farmers profit through, increased yield of rice per unit of applied fertilizer, higher rice yields, and reduced disease and insect damage. Site Specific Nutrient Management (SSNM) provides an approach for feeding rice with nutrients as and when needed. SSNM eliminates wastage of fertilizer by preventing excessive rates of fertilizer and by avoiding fertilizer application when the crop does not require nutrient inputs. It also ensures that N, P, K are applied in the ratio required by the rice crop. Site specific nutrient management is a concept that can be applied to any field or any crop, while most often use of computer and satellite technology in the site specific nutrient management does not require special equipment and does not require a large farming operation. The technology tools certainly expand the capabilities for using site specific management.

Key words: Rice, Site Specific Nutrient Management (SSNM), N, P, K, yield.

PROSPECTS OF DOUBLED HAPLOID BREEDING IN MAIZE (ZEAMAYS L.)***ATUL LOYAL¹, SAWAN KUMAR¹ AND SIDHANT CHAUDHARY²**¹*Department of Crop Improvement, CSK Himachal Pradesh Agricultural University, Palampur, H.P. (India) 176062, ²Institute of Plant Breeding, University of Hohenheim, Stuttgart (Germany) 70599*

Maize (*Zea mays* L.) is an important food crop after rice and wheat. Successful hybrid production requires the development of true breeding homozygous inbred lines. In conventional methods, inbreeding of maize required repeated self-pollination for six to eight generations to get enough homozygosity in inbred lines. The key to the accelerated development of hybrids is reducing the time required for inbred development. The doubled haploid (DH) technology is an alternative approach which shortens the breeding cycle significantly by the rapid development of completely homozygous inbred lines within 2-3 generations. To our knowledge, all present commercial DH-line breeding programs are based on *in vivo* induction of maternal haploids. Other techniques have proven to be less effective or too genotype specific. Because of the genetic, methodological and logistic advantages, further progress in maize breeding is expected to increase considerably with the development of DH lines. Yet, the success of employing DH lines depends on a robust and efficient haploid induction technology as well as breeding strategies that make optimum use of the breeder's genetic, technical and

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monetary resources. An important aspect of the DH approach is to limit the loss of genetic variance due to random drift and selection by maintaining a minimum effective population size. To comply with this requirement, considerable numbers of DH parent lines need to be inter-crossed for starting a new selection cycle. In maize, *in vivo* induction of haploids is done by crossing source material with various maize inducer lines. Haploids are screened using various morphological (seed color, seedling root coloration) or biochemical (herbicide resistance, kernel oil content) markers. Generally, Colchicine is used as a chromosome doubling agent (or mitotic inhibitor) in DH production in maize. The seeds from the colchicine treated plants represent the newly developed, completely homozygous DH line. Implementation of DH technology requires new skills on the part of breeding programs, for both DH line production and integrating DH lines efficiently in the breeding pipeline, such as i) Optimization of DH production protocols, ii) New haploid seed identification markers and iii) Develop alternative chromosome doubling agents.

Keywords: Doubled haploid, Homozygosity, *in vivo*, Maize, Morphological markers

ANALYSIS OF GENETIC DIVERGENCE IN CHRYSANTHEMUM (*DENDRANTHEMA GRANDIFLORA* TZVELEV)
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The investigation was carried out with twenty chrysanthemum genotypes at Horticultural Research Centre (HRC) of SVPUAT, Meerut, UP during 2016-17 to study the genetic diversity among the genotypes. The maximum days to flower bud initiation (43.53 days) and days to flowering (69.53 days) was observed in the cultivar of Ajay while cultivar White Star produced larger size flower (9.97 cm). The maximum flowering duration (57.53 days) was observed with the cultivar of Haldighati and maximum plant height at flower bud initiation stage (28.27 cm) and plant height at full bloom (57.53 cm) was observed with the cultivar of Sunny. Cultivar of Basanthi produced maximum number of primary branches (7.93), plant spread (70.73 cm) and maximum number of flowers (218.67). D2 analysis grouped among the genotypes into five clusters showing the existence of considerable amount of variation among the genotypes. Cluster pattern revealed that, cluster V had largest number of 6 cultivars, followed by cluster III (5 cultivars), cluster II (4 cultivars), cluster IV (3 cultivars) and cluster I had only (2 cultivars). Highest intra-cluster distances were found for cluster III ($D_2 = 2.117$) whereas, highest inter-cluster distance was observed between clusters V and IV ($D_2 = 4.402$). The cluster means revealed the best cluster for various growths and flowering traits depending upon the aim of breeding programme and potential line can be selected from different clusters as parents.

POSTHARVEST HANDLING OF MANGO
ATUL YADAV AND ABHINAV KUMAR

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Post-harvest management means the handling of an agricultural product after harvest to prolong storage life, freshness and an attractive appearance. In order to deliver a quality product to the market and ultimately to the consumer to command buyer attention and gives the grower a competitive edge, proper post-harvest management is the need of the hour. Nearly, 20-25 per cent of fruits are wasted due to faulty Post-harvest practices during harvesting packaging, storage, grading etc. This wastage can be reduced to some extent through proper and scientific methods. The pre-harvest cultural practices like use of fertilizers, pest control, growth regulators, climatic conditions like wet and windy weather and tree conditions influence the fruit potentiality for storage by modifying physiology, chemical composition and morphology of fruits. The spray of calcium is found useful in delay in ripening of Mangoes improves the storage life and increased the marketability. Similarly, pre-harvest spray of fungicide like Dithane M-45 (0.2%), Bavistin 0.1%, Topsin-M (0.1%) and Captan (0.2%) is effective in controlling storage disease due to anthracnose and stem end rot in Mango varieties. Harvesting is the most important factor, governing the post-harvest management. The harvesting of the fruit is done, either by hand picking, or plucking with a harvester at green mature stage. When the Mangoes are fully-grown and ready for picking, the stem will snap easily with a slight pull. If a strong pull is to be applied, then fruit is still somewhat immature and should not be harvested. A long-poled picking bag, which can hold nearly four fruits, is also used for plucking of the fruits.

Keywords- management, increased the marketability, harvesting, morphology of fruits etc.

EFFECT OF SPACING AND NUTRIENTS MANAGEMENT ON GROWTH, YIELD, YIELD ATTRIBUTES, QUALITY CHARACTERS AND ECONOMICS IN *HIRSUTUM* COTTON IN CENTRAL PLAIN ZONE OF U.P.
AVINASH KUMAR SINGH, JAGDISH KUMAR, RAJEEV KUMAR, SUNIL KUMAR, AJEET KUMAR

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A field experiment was conducted, with *hirsutum* cotton genotype H-1300 during *Kharif* season 2015 at the Oil Seed Farm of C. S. Azad

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University of Agriculture and Technology, Kanpur. The treatments were evaluated in Randomized Block Design with three replications. Crop was fertilized as per respective treatments where half of nitrogen and full dose of phosphorus and potassium was applied at the time of sowing and remaining half of nitrogen was applied in two equal installment one at 30 days after sowing and second at 60 days after sowing. Harvesting was done on the basis of picking when boll was fully open. Application of 125% RDF + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP produced significantly highest growth characters viz., plant height at 30, 60, 90 and 150 days after sowing, number of monopodial and sympodial, fresh and dry weight/plant, yield attributes viz., number of bolls/m², number of bolls/plant and boll weight, yield viz., seed cotton, lint, seed and stick, quality characters viz., ginning out turn, span length, micronaire value, uniformity ratio and fibre strength and economics, it was closely followed by 125% RDF + 25% less than normal spacing + foliar spray of MgSO₄ and ZnSO₄. On the basis of above results, it may be concluded that *hirsutum* cotton genotype H-1300 along with application of 125% recommended dose of fertilizers (60:30:20 kg NPK/ha) + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP was most productive and remunerative for cotton under Central Plain Zone of U.P.

IMPORTANCE OF SPIDERS ON THE SUSTAINABILITY OF AGRICULTURE AND ENVIRONMENT

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The use of pesticide has grown over past 20 years to 3.5 billion kg/year, amounting to a global market worth \$45 billion. The external costs of pesticides are \$4\$19 (€315) per kg of active ingredient applied. Who's giving a great result to knock down the pest population but side by side also providing the adverse effect to our agriculture and environment. This leads to us a silent unsustainability. So, to break this unsustainability from agriculture and environment several agents (predator, parasitoid and bio agent) are used now a day. Among all these agents "spiders" are very unique and important. Spiders eat lots of insects, mostly those smaller than themselves. Taken as a whole and given the diversity of species assemblages in most ecosystems, spiders' primary niche in nearly every ecosystem is controlling insect populations. Spiders are most eerie arthropods in nature which is carnivorous in nature. They consume a large number of harmful insects. About 19 species in rice ecosystem, 13 species in maize, 16 species in soybean, 18 species in oil seeds, 21 species in cotton, 57 species in sugarcane, 13 species in vegetables, 11 species in fruit crops and 26 species in coconut has recorded. Species abundance of spider communities in agricultural ecosystem can be as high as in undisturbed natural agro-ecosystem. On the other hand spider web is also play a vital role to clean the environment. Spider web have capability to fish out the heavy metals eg. Pb, Zn from the environment, which has adverse effect on environment as well as human health. Moreover, in the winter season when frost drop down from the sky, they holds the frost particle and protect "lower and side" tillers of crops. Later these frost particles are converted in to the droplets of water through the abiotic factors and dripped by the spider webs as a natural "light drip irrigation" on the crops.

Key words- Spider, Spider web, Environment

SOIL QUALITY AND SUSTAINABLE AGRICULTURE

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Soil is the world's most vital component for food and fiber production: preservation of this critical natural resource is paramount for protecting the environment, and ensuring that current and future populations are healthy and well-fed. Soil quality is the critical component of sustainable agriculture. Soil quality can be conceptualized as a three-legged stool, the function and balance of which requires an integration of three major components sustained biological productivity, environmental quality, and plant and animal health. The concept attempts to balance multiple soil uses (e.g., for agricultural production, remediation of wastes, urban development, forest, range, or recreation) with goals for environmental quality. Many decades of research have consistently shown that the best means of improving and restoring soil quality and productivity is by proper and regular additions of organic materials mainly through the use of crop rotations, cover crops, crop residues, animal manures, composts, and reduced tillage. Soil organic carbon (SOC) is the most often reported as the most important indicator of soil quality and agronomic sustainability because of its impact on other physical, chemical and biological indicators of soil quality. Often the topsoil is lost at a rate that far exceeds the capacity of natural processes to regenerate it. With soil degradation, there is a concomitant decline in soil quality, i.e., the soil's capacity to produce healthy and nutritious crops, resist erosion, and reduce the impact of environmental stresses on plants. Society is demanding solutions from science. Simply measuring and reporting the response of an individual soil parameter to a given perturbation or management practice is no longer sufficient. The soil resource must be recognized as a dynamic living system that emerges through a unique balance and interaction of its biological, chemical, and physical components.

Key words: Agricultural sustainability, soil organic carbon, environment quality.

BIOENERGY SIMPLER WAY TO ENERGIZE AGRICULTURE**AYUSHRI CHAUHAN, GIRISH TIWARI***Department Of Agriculture, Shri Guru Ram Rai University, Dehradun, 248001.*

Bioenergy is renewable energy made available from material derived from biomass which include animal, plant and their by-product. Biomass is any organic material that store sunlight in the form of chemical energy. Biomass, when burned produces heat that is directly turned into biofuel. Biofuel when compared to fossil fuel does not release CO₂ and are present in abundant sources. Biofuel are converted into biodiesel and bioethanol which are alternates for diesel and petrol. Many Bioenergy routes can be used to convert a range of biomass sustainable seed bags such as wood, straw and waste into a final energy product. The Bioenergy industry now represents a major market not only for established crop but for novel crop and a variety of waste product. Bioenergy cuts down the transportation cost and in addition to this, fuel cells have a power generating application that is available for electricity. Heat producing biofuel with a blend of biodiesel will reduce the emissions of both nitrogen and sulphur dioxide. Currently, 6% of the good energy supply is bio methane and 19% of the electricity we supply is generated from Bioenergy. Biofuels can help to clean up oil spills and grease. Biofuel as Bioenergy are seen as the alternate which can replace all human energy sources. Bioenergy is already making a substantial contribution to meeting global energy demand.

BIO-EFFICACY OF VARIOUS HERBICIDES AGAINST MIXED WEED FLORA OF WHEAT CROP.**B.K MISHRA,¹ A.K SINGH², MITHLESH KUMAR PANDEY³ AND ARVIND SINGH⁴**

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A Field experiment was conducted during rabi season of 2015-16 on sandy loam soil at Agricultural Research Farm (Pili Kothi) of Agronomy Department, Tilakdhari Post Graduate College, Jaunpur (U.P) to evaluate the effect of different herbicides (alone and mixtures) against complex weed flora in wheat crop. The experimental field was mainly infested with *Chenopodium album*, *Anagallis arvensis*, *Parthenium hysterophorus*, *Cynodon dactylon* and *Cyperus rotundus* during the study period. The experimental result indicated that the post-em application of clodinafop + metsulfuron at 0.04 + 0.005 kg a.i/ha was most effective herbicides and recorded minimum density and dry weight of total weeds, without any phytotoxicity symptoms on the crop. Significantly higher values of wheat yield, yield attributes and growth parameters was recorded in clodinafop + metsulfuron at 0.04 + 0.005 kg a.i/ha treated plot at 33 DAS when compared with unweeded control. Weed growth suppression effect of clodinafop + metsulfuron at 0.04 + 0.005 kg a.i/ha resulted 80.8 per cent higher economic yield of wheat over unweeded control and remain statistically similar with weed-free condition in respect to grain yield of wheat crop.

Keywords:- Herbicide, wheat, weed management

USE OF PLANT HEALTH CLINIC LABORATORY IN IDENTIFYING AND SOLVE PESTS AND DISEASES PROBLEMS OF MAJOR CROPS**¹B.L. MEENA, ²R.R. MEENA, ¹K.C. MEENA, ³C.B. MEENA AND ¹RAMASREY**

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The main objective of Krishi Vigyan Kendra (KVK,s) is to help the farmers in the field of agriculture and allied sectors. Jhalawar district is mainly mandarin, coriander, garlic, soybean, wheat, fenugreek growing area. During the last 3 years i.e. from 2013-14, 2014-15 and 2015-16, a record of all the visiting farmers was maintained in the Plant Health Clinic Laboratory (PHCL) at the KVK, in which complete details of the farmer with address and contact number was maintained. Similarly, the purpose of visiting KVK was recorded date wise by the KVK and at the end of each month, a summary was prepared and analysed for severity of the attack of insect pest and diseases. During these three years, total 2657 problems related different pests and diseases of crops were recorded. Farmers belong to various agro-ecological situations of the district. It is clearly indicate that most of the problems such black fly, fruit fly, sooty mould, bark eating caterpillar was related to mandarin (27.17%) during the whole year mainly July month followed by coriander' stem gall disease (18.86%) during winter season after mid December to last week of January. Most of the farmers (22.00%) started contact to KVK about the management of black fly and fruit fly in mandarin during pre monsoon in the month of June followed by August, December, April, respectively. Frequently visit of the farmers in the KVK campus in each month indicates that this crop is being attacked by insect pests and diseases during the round of year. Regarding coriander crop, 98.00 per cent farmers visited KVK during the month of January and

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February for the management only stem gall disease. Weather condition during this period was favorable for the disease i.e. continuous low temperature and high humidity. During 2014-15, in the month of January, continuous rainfall, high humidity and cloudy weather are most favorable condition for the severity the stem gall disease. Although vegetable crops like tomato, chilli, brinjal, bhindi, cucurbits, cauliflower, cabbage were more prone to the attack of insect pest rather than disease as the 25.40 per cent farmers visited to know about the management of insect pest and diseases. Other crops like garlic (4.97%), onion (2.82%), soybean (3.88%), blackgram & greengram (2.22%), gram (2.15%), mustard (0.83%), other fruits (6.89%) and other medicinal plants (2.97%) were also taken samples and solved their problems. It was also revealed that the crop was prone both to the attack of insect and diseases. Electronic microscope attached laptop-LED programme, posters, charts, photographs, insect disease specimen collection, various modern plant protection equipments, botanicals and bioagent products like pheromone traps, low cost bottle fruit fly trap, light trap, NPV, *Trichoderma*, *Trichogramma* card, NSKE, neem oil, *Beauveria* are helpful to diagnosis and solve the pest and disease problems in the laboratory. As krishi Vigyan Kendra imparts short duration trainings, diagnostic visit alone & allied departments, timely survey of pest and disease to manage and awareness among the farmers, It can be concluded that KVK staff and other line departments should provide trainings related to the above mentioned technological problem in a particular month.

DETECTION OF ANTIFUNGAL EFFICACY OF WEED EXTRACTS AGAINST *COLLETOTRICHUM CAPSICI* CAUSING ANTHRACNOSE OF CHILLI

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The pathogenic ability of *Colletotrichum capsici* was proved under detached chilli fruit. Among all the solvent extracts, methanolic extract of *Psoralea corylifolia* had potential antifungal activity against *Colletotrichum capsici*. *P. fluorescens* and *T. viride* were found compatible with each other and also with methanolic extract of *Psoralea corylifolia*. Different solvents viz., acetone, ethanol, methanol and chloroform were tested to compare the maximum extraction yield from four different plants. Methanol was found useful for getting highest per cent extraction yield. Methanolic extracts of *Psoralea corylifolia*, *Datura* sp. and *Lantana camera* were selected for chromatographic analysis on the basis of *in vitro* growth inhibition assay against tested pathogen. This method was used to study the preliminary phytochemicals present in methanolic extract of three different plant extract, while thin layer chromatography was used for separation of different compounds present in crude methanolic extract of *Psoralea corylifolia*, *Datura* sp. and *Lantana camera*. All the plants methanolic extracts showed presence of saponins, fixed oils, flavonoids, tannins and phenolic compounds. Among 31 different combinations of solvent systems used under experiment, Toluene : ethyl acetate : methanol (24:5:1.5), Toluene : ethyl acetate : water (10:10:2) and Toluene : ethyl acetate : water (12:4:2) were effective for good separation of methanolic extract of *Psoralea corylifolia*, *Datura* sp. and *Lantana camera* respectively by thin layer chromatography. In detached chilli fruit bioassay treatment with *P. fluorescens* (culture filtrate @ 0.5%) + *T. viride* (culture filtrate @ 0.5%) + methanolic extract of *Psoralea corylifolia* 2% was proved effective to reduce intensity of anthracnose of chilli caused by *Colletotrichum capsici*.

ECOFRIENDLY OPTIONS FOR SUSTAINABLE AGRICULTURE

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Sustainable agriculture is a system of agriculture that is ecologically, economically, and socially viable, in the short as well as long term. There are many reasons (droughts, challenges in energy demand, decreasing soil productivity) why we need to change from a conventional agricultural system to one that is sustainable. In addition, the success of high yielding varieties of wheat and rice that ushered in the "green revolution" to feed the increasing population was partially under the protection umbrella of pesticides. But, the over-reliance on the use of synthetic pesticides in crop protection programs around the world has resulted in disturbances to the environment, pest resurgence, pesticide resistance, and lethal and sub-lethal effects on non-target organisms. These side effects have raised public concern about the routine use and safety of pesticides thus, leading to the development of an alternative Ecofriendly Pest Management approach which is based on an understanding of pest ecology and relies on a range of preventive tactics and biological control to keep pest populations within acceptable limits. Ecofriendly Pest Management options may be considered proactive or reactive. Proactive options, such as crop rotations and creation of habitat for beneficial organisms, permanently lower the carrying capacity of the farm for the pest. The carrying capacity is determined by factors like food, shelter, natural enemy complex, and weather, which affect the reproduction and survival of a species. Proactive strategies involve cultural control (manipulations of the

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agroecosystem that make the cropping system less friendly to the establishment and proliferation of pest populations). The second set of options is more reactive (involve all the measures that are taken after the emergence of the pests in the field). This simply means that the grower responds to an economically damaging population of pests, with some type of suppressive action. Reactive methods generally include inundative releases of biological control, mechanical and physical control, and chemical control (use of reduced risk pesticides). The population now demands the organic food or the residue free food which is possible by limiting use of high risk pesticides. Long term pest management solution to pest problem can only be sought by re-structuring and managing ecosystem in such a way that enhances the ability of inbuilt mechanisms of plants to resist insect damage. This will reduce the pesticide usage; will improve the soil productivity thus, leading to sustainable agriculture and the sustainable planet as a whole.

Keywords: Ecofriendly, Options, Sustainable, Agriculture

ECO-FRIENDLY MANAGEMENT OF ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*) IN SUSTAINABLE AGRICULTURE

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The need for alternatives to nematicides has stimulated research focusing on sustainable and eco-friendly management of plant parasitic nematodes. Root-knot nematode, *Meloidogyne* spp., are the major plant parasitic nematodes attacking most of the crops. Nematicides are very much effective but their unsafe use may result in acute poisoning and deaths are a problem especially in developing countries. The nematocidal activity of neem could be due to any of the several known biologically active principles it contains, such as nimbin, nimbidin, thionemone, kemferol, azadirachtin, etc., which are nematocidal in nature. The culture of *M. incognita* was maintained on okra plants in infested soil pots inside the screen house. All the concentrations of the aqueous extracts from fresh leaves of *Eucalyptus globulus* (20% w/v) caused the mortality of second stage juveniles of *Meloidogyne incognita* whereas the more mortality occurred in 1:5 concentration and the least in 1:80 concentration. Juvenile mortality decreased with an increase in the dilution of all the extracts. As an increase in exposure time, juvenile mortality was also increased. This study also revealed that *Azadirachta indica* leaves @ 30 g/kg of soil in pots when incorporated, improves the plant growth and reduced the *M. incognita* infestation in okra. Moreover, *E. globulus* and *A. indica* can be used as an alternative in eco-friendly management of root-knot nematode.

Keywords: *Meloidogyne incognita*, *Azadirachta indica*, *Eucalyptus globules*, Eco-friendly management.

AN ECONOMICS REVIEW ON SUSTAINABLE AGRICULTURE DEVELOPMENT

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World population continues to grow, much more effort and innovation will be urgently needed in order to sustainably increase agricultural production, improve the global supply chain, decrease food losses and waste, and ensure that all who are suffering from hunger and malnutrition have access to nutritious food. Many in the international community believe that it is possible to eradicate hunger within the next generation, and are working together to achieve this goal. Extreme poverty and hunger are predominantly rural, with smallholder farmers and their families making up a very significant proportion of the poor and hungry. Thus, eradicating poverty and hunger are integrally linked to boosting food production, agricultural productivity and rural incomes.

Land, healthy soils, water and plant genetic resources are key inputs into food production, and their growing scarcity in many parts of the world makes it imperative to use and manage them sustainably. Boosting yields on existing agricultural lands, including restoration of degraded lands, through sustainable agricultural practices would also relieve pressure to clear forests for agricultural production. Wise management of scarce water through improved irrigation and storage technologies, combined with development of new drought-resistant crop varieties, can contribute to sustaining dry lands productivity. An increase in integrated decision-making processes at national and regional levels are needed to achieve synergies and adequately address trade-offs among agriculture, water, energy, land and climate change. Given expected changes in temperatures, precipitation and pests associated with climate change, the global community is called upon to increase investment in research, development and demonstration of technologies to improve the sustainability of food systems everywhere. Building resilience of local food systems will be critical to averting large scale future shortages and to ensuring food security and good nutrition for all.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**STUDIES ON VEGETATIVE PROPAGATION TECHNIQUES IN CITRUS (*CITRUS LIMON* BURM.)****BABLOO PATEL*, SATYA PRAKASH*, PUSHKAR DIXIT*, SHARDULYA SHUKLA* AND SONU KATIYAR*****Department of Horticulture* and Department of Plant Pathology**, SVP University of Agriculture and Technology, Meerut, 250 110 (UP).*

Various propagation studies have been carried out in different species of citrus. The effect of different concentrations of Indolebutyric acid (IBA) and growing conditions on adventitious root formation in stem cutting of Kagzi-lime. Properly prepared cuttings of about 22-24 cm length in the month of June were treated with different concentrations of IBA viz., 500, 1000, 1500 ppm and planted in 3 different conditions, namely, open area, under partial shade and under low cost polyhouse. The cuttings treated with IBA 500 ppm performed best in all aspects, i.e., root formation, root length, root thickness and leaf sprouting in shoot. Among the growing conditions, open area growing condition was found effective in increasing the success rate of the cuttings. The performance of all the rooting parameters was found better under polyhouse condition. Effect of different growing media, hormonal treatments and growing seasons on shoot and root characters and survival percentage of cuttings of lemon cv. Plant Lemon-1. Pooled data of two season (rainy and spring) has shown that soil + sand + FYM growing medium resulted maximum length of sprouts and average number of leaves per cutting, whereas maximum diameter of shoot and length of longest roots were recorded with soil + coco peat based medium. The result of the study also revealed that average diameter of root was higher in soil + coco peat and soil + FYM medium. Maximum survival percentage of cuttings was noted with soil + sand + FYM. IBA (500 ppm) was found superior in respect of all growth parameters except for root diameter which was found to be highest with IBA + NAA (500 ppm each). In respect of season of planting of cutting, rainy season was found superior over spring season for all shoot and root characteristics.

Keywords: citrus, propagation, indole butyric acid, polyhouse, survival percentage, growing media and growing season.

EMERGING DRONE TECHNOLOGY IN SUSTAINABLE AGRICULTURE AND SMART CROP FARMING**BABULAL CHOUDHARY, UNDER SUPERVISION OF PROF. PRIYANKER RAHA***Soil science & agricultural chemistry at Institute of Agricultural sciences, BHU VARANASI*

The use of Drone system in sustainable Agriculture becoming most effective and popular. The continuous growth of the population together with the decreasing of resources at disposal poses the problem of smart usage of resources. It is important especially in the field of food production & soil exploitation. The common methods used in agriculture to analyses and assess the correct production and usage of resources employs optical and multispectral techniques applied to photos captured from satellites. These techniques allow to assess the light absorption from the leaf displays the presence of chlorophyll. This is a critical and important things since the results of these phase will affect the decisions of interventions on the feeding of the soils, the protection from insects/fungi. In remote sensing for surveying and mapping of the soil and plant DRONE becoming most effectively used. It can be use in irrigation application, assessing crop health by determining crop stress, protecting wild life by tracking. For this, draw field borders for flight pattern. This map is the key to boosting yields, cutting costs, and driving your business forwards. It highlights exactly which areas of crop need closer examination. It most effectively using in crop monitoring, soil & water analysis, planting & spraying. Drones are however becoming much more affordable as the technology advances and key components become commonplace in other devices such as Smartphone.

Key words: 1. Assess the correct production of crops, 2. Uses multispectral techniques, 3. Crop stage and soil mapping and surveying, 4. Soil and water analysis

CLOUD SEEDING**BAL MANOHAR* AND SUSHMITA***Bihar Agricultural College, B.A. U Sabour, Bhagalpur, Bihar*

Natural disaster have a worse impact on the society linked sectors like agriculture, animal husbandry, fisheries, forestry, biodiversity (both land and ocean), water resources and health. In order to minimize the losses due to weather hazards, weather modification strategies can be adopted. There are several methods to modify the existing weather. The most popular method among them is cloud seeding. Cloud seeding is defined as the introduction of a seeding agent into suitable clouds to encourage the formation and growth of ice crystals or raindrops, which in turn enhance the precipitation from the clouds (Denholm, 2010). Cloud seeding provides condensation nuclei for the initiation of collision-coalescence process in warm cloud and ice crystal process in cold clouds (Hess, 1974). Based on the seeding material used, cloud seeding is classified into glaciogenic and hygroscopic. Glaciogenic seeding is done in cold clouds using ice forming substances like silver iodide and dry ice. Hygroscopic materials like sodium chloride and calcium chloride are used as seeding agents in warm clouds. These materials are released through ground based or airborne systems. There are two types of seeding done by aircraft viz., base seeding and top seeding. For delivering the agents, burn-in-place or ejectable flares are used (Sharma, 2009). The

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principle of cloud seeding was discovered by Vincent J. Schaefer and Irving Langmuir in 1946 at General Electric Laboratories, New York. Cloud seeding operations in India were started in 1951. At global level, China is the leading country in cloud seeding operations, followed by Russia and Israel. Cloud seeding is also intended for dissipation of fog, hail damage suppression, snowfall augmentation, cyclone modification and lightning suppression (Mahi and Kingra, 2007). However, majority of operational projects are focused on rainfall enhancement. According to Venkataraman and Krishnan (1992), cloud seeding cannot be done in all types of clouds. Best suited clouds for cloud seeding operations are identified using ground based radar and aircraft systems. Precipitation monitoring is also done by radar, which is supplemented by ground level rain gauge measurements. The frequency of weather hazards like occurrence of droughts is likely to increase under the projected climate change scenario. Therefore, there is a need to strength then experiments on cloud seeding as a proactive measure to combat ill effects of drought and to enhance water resources.

FOLIAR SPRAY OF MICRONUTRIENTS IN OILSEEDS CROP**BANDANA BHATT, AJAY KUMAR, ANUPAMA RAWAT****Department of Agronomy, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar*

In the agricultural economy of India, oilseeds are important next to food grains in terms of area, production and value. The demand of vegetable oil in India is very high due to which there is a need to increase the home production of oilseeds crops. One of the reasons for low yield is nutrient deficiencies. Availability of nutrients in optimum amount is an important factor which influence crop growth yield. Micronutrients serve as a best alternative to increase the oilseed production. Micronutrients are elements that are essential for plant growth but are required in much smaller amount. Micronutrients are involved in metabolic and cellular functions. Micronutrient plays a vital role in Oilseeds crops which includes protein synthesis, involved in nitrogen assimilation, sulphur metabolism, phytohormone biosynthesis, and stress reactions, transport of sugars, respiration, RNA and carbohydrate metabolism, and the metabolism of plant hormones. Recently, foliar application of nutrient has become an important practice in crop production. Nourishment of plant through leaves is considered as more efficient than root absorbance during later stages. However, the wastage of nutrients can be minimised by foliar applications of dilute solution of nutrients to supplement the basal applications which have been shown to be effective and economical in some crops.

Keywords: foliar spray, micronutrient, deficiencies

SOIL ENZYMES: MAJOR COMPONENT IN MAINTAINING SUSTAINABILITY OF CROPPING SYSTEM.**BANDANARANI BARIK, MONALISA SAHOO, RESEARCH SCHOLAR, DEPARTMENT OF AGRONOMY***Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttarpradesh-221005*

Soil enzymes play important role in sustainable agriculture. Soil enzymes are the chemicals which are obtained from microbial activity, plant residues, protozoa, termites and other invertebrates. These enzymes take their role in nutrient recycling like carbon, nitrogen, phosphorus and Sulphur recycling. They act as catalysts in starch, lignin, cellulose, chitin and ester degradation which helps in maintenance of soil health and increase in bioavailability of different nutrient. But there are different factors affecting soil enzyme activity such as soil temperature, soil water content, soil type, agronomic management practices, pesticide and fungicide content. Farm yard manures and other organic manures enhance the activity and availability soil enzymes. Soil under legume based cropping system enhances nitrogen availability to the succeeding crop by biological nitrogen fixation and enhanced enzymatic activity due higher microbial count. it can also reduce toxic material or toxic plant exudates which will increase the soil fertility by maintaining proper soil health. Assays based on substrate-induced respiration have been developed to measure enzyme activity. In this method, a substrate is added to soil, and production of CO₂ or consumption of O₂ is measured. Temporal and special studies on soil enzymes activities will be helpful to know the factors controlling enzymes activities so that optimal conditions for the soil enzymes activities can be determined. Soil enzyme profiling under different cropping systems and management practices can help in understanding correlations between soil enzymes activities and productivity and soil health of the ecosystem.

Key words-soil enzymes, microbial count, nutrient recycling, cropping system.

COMBINING ABILITY ANALYSIS FOR SEED COTTON YIELD AND ITS ATTRIBUTING TRAITS IN UPLAND COTTON (GOSSYPIUM HIRSUTUM L.)**BANKARA. H.*, MADANKAR K. S., K. S. NIRANIA AND SAGAR***Department of Genetics and Plant Breeding, CCSHAU, Hisar-125004*

The present investigation aims to estimate the general combining ability of the parents and specific combining ability of Gossypium hirsutum hybrids for seed cotton yield and its attributes viz., days to first flower (earliness), number of bolls per plant, boll weight, plant

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height, number of monopodia and number of sympods per plant. Five females crossed with ten testers in line x tester mating fashion resulting 50 hybrids were obtained. Fifty hybrids along with their 15 parents and one standard check were raised during kharif 2016-17 in a randomized block design with three replications at CCS HAU, Cotton Research Station, Sirsa. The study revealed that Gregg 45, MESR-17 and SR-38 among the males while, the H1300 and H1098i among females were found to be good general combiner with highest per se performance for all the traits studied. Among the crosses, H1117 X LRA 5166 (poor x poor GCA), H1226 X SR-38 (good x good GCA), H1098i X PUSA 31 (good x good GCA) and H1300 X AVB SM-277 (good x poor GCA) were recorded high heterosis with good SCA effects for seed cotton yield and its yield attributes in desirable direction. The magnitude of sca variance was greater than gca variance for all the traits except plant height, indicating that the both additive as well as non-additive gene action responsible for SCA effects with the preponderance of non-additive genetic variance for inheritance of these characters.

Key words: *Gossypium hirsutum*, Line X Tester analysis, GCA and SCA variance, seed cotton yield.

USE OF BIOCHAR IN AGRICULTURE**BARKHA**

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Soil organic carbon is an extremely valuable natural resource. Considering the global climate change, the SOC stock must be restored, enhanced, and improved. Soil C sequestration is the process of transferring CO₂ from the atmosphere into the soil through plants, plant residues and other organic solids, which are stored or retained in the soil as a part of the soil organic matter. The application of biochar to the soil is proposed as a novel approach to establish a significant long-term sink for atmospheric carbon dioxide in terrestrial ecosystems. The term 'biochar' denotes black carbon formed by the pyrolysis of biomass, *i.e.*, by heating biomass under oxygen-free or stress environment, so that it is not subjected to complete combustion. Biochar, due to its aromatic structure and long mean residue time in the soil (more than 100 years) has the potential for long-term carbon sequestration in the soil. Biochar decomposition rate is slow in the soil, which indicates that it could be the possible answer to mitigation of elevated atmospheric CO₂. It has been found that addition of biochar along with chemical fertilizers produced significant increase in crop yield. Other potential benefits listed in literature include carbon sequestration by the natural process of photosynthesis, reduction of CO₂, N₂O and CH₄ emissions from soils, net production of energy in form of bio-energy, increase in soil fertility and microbial activity in the soil, improvement of water retention capacity in the soil, improvement of cation exchange capacity of the soil, improvement of durability of soil aggregates and reduction of erosion and nutrient leaching, reduction in need of fertilization and decreased dissipation rate of herbicides in the soil. Thus, use of biochar in agriculture can mitigate the increasing CO₂ concentration in the environment provided its rate of application and mechanism of action are fully understood.

GENETIC ENGINEERING OF TOMATO (*LYCOPERSICON ESCULENTUM*) PLANT USING ANNEXIN GENE THROUGH AGROBACTERIUM MEDIATED TRANSFORMATION**BASANT KUMAR SHARMA¹ AND M. SHAMSUL ISLAM²**

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Drought and high salinity are two major abiotic stresses that significantly affect agricultural crop productivity worldwide. Annexins are multigene family that plays an essential role in plant stress responses and various cellular processes. The present study involves the development of genetically engineered tomato, (*Lycopersicon esculentum*) plant with annexin gene. *E. coli* bacteria (resistant to kanamycin) carrying pGPTV/ annexin, *E. coli* carrying helper plasmid pRK2013 and *A. tumefaciens* (MTCC431 strain) carrying disarmed Ti plasmid (resistant to Streptomycin) were used for tri-parental mating. The annexin gene construct was transferred into plant genomic DNA by using leaf disc preparation, co-cultivation and selection media transfer. The selection media consists of Kanamycin, Augmentin and Cefatoxime. Leaf disc containing gene construct survives on selection media and were allowed to grow in the form of callus that is regenerated into transgenic plantlets, indicating the presence of gene of interest, which was further confirmed by extraction of genomic DNA and PCR analysis. Study revealed that Agrobacterium-mediated transformation in tomato was successful method for transfer of annexin gene. The methodology may be used for the commercial production of transformed tomato plant with salt and Drought tolerance character.

Key words: *A. tumefaciens*, *Lycopersicon esculentum*, Annexin gene, *E. coli* DH5α, pUC119, pGPTV,

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**DOUBLING FARMERS' INCOME: WAY FORWARD****BHAGWATI BARANDA * SMARTISHREESAHO * PRIYANKAADLAN ****Department of Plant Breeding and Genetics, *College of Agriculture, S.K.R.A.U-Bikaner, Rajasthan -334 006(India), **GBPUAT, Pantnagar, Uttarakhand -263145 (India)*

The will of the present Government to double the incomes of farmers by 2022 as announced by the Honorable Finance Minister during his Budget Speech on 29 February 2016 has been greeted with less of optimism and more of skepticism by economists and other columnists. Do we have evidence of income growth in past decades and if so what does it tell us about the possibility of doubling incomes? Is the 7-pronged strategy to achieve the doubling as announced by the honorable Prime Minister enough? If not, what other initiatives are needed? This issue of Rural Pulse discusses some of these questions. Pulses as a candidate crop, contributes immensely towards doubling farmers' income through better package of practices, diminishing cost of production, efficient marketing networks and successful technology delivery mechanisms by giving emphasis on scientific evidences suggest that existing vast gap grain yield of pulses can be bridged with site-specific technological modules including appropriate varieties as climate resilient production technologies backed with strong research outputs in pulses can contribute towards doubling the farmers' income.

Key word: pulse, innovation tech., rural development, innovation achievement,

PRECISION NITROGEN MANAGEMENT IN RICEBASED CROPPING SYSTEM**BHAGYASHREE PHOGAT¹, AKSHAY KUMAR YOGI²***¹ICAR-Indian Agriculture Research Institute, Jharkhand, India, ²ICAR-Indian Agriculture Research Institute, Assam, India*

The blanket recommendation of nitrogen (N) in ricebased cropping system leads to low yield, N use efficiency (NUE) and green house gases emission. It has been reported that N recovery by irrigated rice in onfarm experiments is only 31% with farmer fertilizer practices (FFP) in South Asia. Therefore, there is need to synchronise N management considering fieldtofield N variability in soil supply and demand. The precision N management could be one of the strategies to enhance productivity and resourceuse efficiency in rice based system. It considers N deficiency or excessiveness exists within the field at particular time, and makes adjustment in N application to match these locations differences. This strive to enable farmers to adjust fertilizer use dynamically to make up the deficit in N needs between that required by a crop and nutrient supply from naturally occurring indigenous sources. The sitespecific N management (SSNM) approach could be one of the approach which reported to enhance system productivity (15-35%) and response to yield increased (12-20%) in ricewheat cropping system. Leaf color chart (LCC), soil plant analysis development (SPAD) meter, Green Seeker and Nutrient expert/manager are the most important tools available for tailoring the N in rice crop. N application through LCC saved 21.6% of applied N compared to FFP in 461 on-farm experiments in Punjab. N application through field specific N management could enhance the N recovery up to 40% in South Asia. Besides, higher yield and NUE, annual N losses also get reduced by using nutrient expert based split N application in ricewheat cropping system. It can be concluded that precision N management can provide new possibilities for achieving higher NUE and yields in ricebased systems besides addressing the environmental problems in near future.

Key Word: Green Seeker, Leaf color chart, Nitrogen, Nutrient Use Efficiency, Productivity, SPAD, SSNM

AGRICULTURAL MECHANIZATION IN INDIA: WITH REFERENCE TO SMALL AND MARGINAL FARMER.**BHARAT D.V., SAKET KUSHWAHA, SARTHAK GHIMIRE, PRABIN KARKI***Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, India*

Mechanization is must for the agricultural growth in the country. Food and fiber production in the country like India depends upon the small and marginal farmers. 67% of farmers own land holding less than 1.0 ha. But these farmers merely own agricultural machinery like spade and hoe making their agricultural activities labor intensive and costlier. It is reported that during 2003-13, small farmers with up to 1 ha of landholding were able to increase their income by 50%, whereas the farmer with more than 10 ha was able to double income. This has led to the income inequality among the farming community. With the increase in mechanization in agriculture, we can have decreased production cost and, also these farmers can have increased income by involving in off-farm activities. A recent survey by NABARD shows that only 5.2 % of farmers own a tractor and 1.8 % owns power tiller. Similarly, access to drip irrigation and sprinkler was limited to 1.6 % and 0.8% of farming households respectively. Although there are various developments in the design and commercialization of technologies for small farmers, reports from India is not satisfying in the light of government's plan of doubling farmer's income. So, it is must for the related stakeholder to revise policies for agricultural machinery with special focus to the farmers with less farm holding. This paper examines the status of agriculture mechanization in India with the special focus on small and marginal farmers, and makes necessary recommendations.

Key words: Agricultural Mechanization, Indian Agriculture, Small and marginal farmer, Farm income

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON ECONOMICS OF WHEAT (*TRITICUM AESTIVUM* L.)-PEARL MILLET CROPPING SYSTEM**BHAWANA SAHARAN¹, R.S. YADAV², JITENDRA KUMAR VERMA³, RAKESH KUMAR⁴, SOMA DEVI⁵ AND HANSRAJ SHIVRAN⁶***Based on part of Ph.D thesis of first author, submitted to S.K.R.A.U., Bikaner. 2-HOD, Department of Agronomy, 3,5,6- Dept. of Agronomy, S.K.R.A.U., Bikaner (Raj.) and 4- GBPUAT, Pant Nagar (Uttarakhand)*

A field experiment was conducted at Bikaner to evaluate the effect of integrated nutrient management on wheat (*Triticum aestivum* L.)-pearl millet cropping system during *rabi* and *kharif* seasons of 2014-15 and 2015-16. Experiment was laid out in a split plot design with three replications comprising different treatment combinations *i.e.* control, 50%, 75% and 100% RDF, 50% RDF + FYM (5 t ha⁻¹), 75% RDF + FYM (5 t ha⁻¹), 100% RDF + FYM (5 t ha⁻¹), 50% RDF + FYM (5 t ha⁻¹) + *Azotobacter* + PSB, 75% RDF + FYM (5 t ha⁻¹) + *Azotobacter* + PSB and 100% RDF + FYM (5 t ha⁻¹) + *Azotobacter* + PSB, applied in wheat as main plots and 3 fertility levels (control, 50% and 75% RDF) as sub plot in succeeding pearl millet comprising a total of 30 treatment combinations. Incorporation of INM treatments mainly as 75% RDF + 5 t FYM ha⁻¹ + *Azotobacter* + PSB in wheat and direct incorporation of fertilizers (*i.e.* 75% RDF) to pearl millet significantly increased the yield attributes, yield and monetary returns of wheat- pearl millet cropping system. It was revealed that combined application of different nutrient management treatments in wheat-pearl millet cropping system will help in improving farmer's income rather than single application of nutrient sources. Significantly highest net returns during individual years 2015, 2016 and in pooled mean analysis 56682, 68662 and ` 62672 ha<sup>-1</sup> with B:C ratios 2.02, 2.22 and 2.12, respectively were fetched under 75% RDF + 5t FYM + *Azotobacter* + PSB applied in wheat followed by 100% RDF + 5t FYM + *Azotobacter* + PSB and net returns under 75 % RDF in pearl millet were 47449, 57652 and ` 52551 ha⁻¹ and B:C ratios 1.87, 2.05 and 1.96, respectively were obtained under wheatpearl millet cropping system.

Keywords: INM, RDF, FYM, Nutrient sources and Monetary returns.

EVALUATION OF SENSORY QUALITIES OF ENCAPSULATED HYDROLYZED VEGETABLE PROTEIN**BHAWNABISHT¹, U.C LOHAN²***Department of Post-Harvest & Food Engineering, G. B. Pant University of Agriculture and Technology, Pantnagar- 263145, Uttarakhand*

Hydrolyzed Vegetable Proteins (HVP) have been well known to elevate the flavor of foods. However, most of the research has remained concentrated on soybean proteins, in spite of its allergenicity and high cost. Moreover, its flavor have never been attempted to be captured using the encapsulation technique. Corn and barley flour were hence selected as substrates for acid and enzymatic hydrolysis to produce acid-HVP (a-HVP) and enzyme-HVP (e-HVP) for the production of flavor enhancer, for their high nutritional content, low cost, non-allergenicity and underutilization in India. Acid hydrolysis was performed followed by neutralization and decolorization with activated charcoal, whereas enzymatic hydrolysis was performed using Trypsin enzyme followed by vacuum filtration. Encapsulation of the a-HVPs and e-HVPs were performed using sodium alginate (2%) as a gel matrix and calcium chloride (2M) as a hardening bath. The encapsulated HVPs, after being incorporated in a commercial peanut dip, were sensorially analyzed by panelists in comparison with a control sample. Physicochemical tests were performed of the developed HVPs (corn, barley) and evaluated for the following factors: pH, specific gravity, sodium chloride content, reducing sugar, α -amino acid content and protein content. Significant results ($p < 0.05$) were obtained (in case of reducing sugar, sodium chloride content and sensory analysis) differentiating the two hydrolysis methods subjected on the substrates. Statistical analysis of the panelists test data showed that the barley flour encapsulated produced a-HVP and e-HVP have been preferred by the panelists due to its low salt content, and had an overall mellow flavor profile as compared to the corn flour encapsulated a-HVP and e-HVP. Hence, Barley flour HVP has the potential to be used as a food additive for flavor enhancement in foods commercially.

Keywords: Hydrolyzed Vegetable Protein, acid hydrolysis, enzymatic hydrolysis, encapsulation, flavor enhancer, food additive.

EVALUATION OF CHRYSANTHEMUM (*CHRYSANTHEMUM MORIFOLIUM* RAMAT.) GENOTYPES FOR FLOWER YIELD AND COMPONENT TRAITS**BHUPENDER SINGH DALAL****Department of Horticulture, CCS Haryana Agricultural University, Hisar-125004*

A field experiment was carried out in the experimental orchard, Department of Horticulture, CCS Haryana Agricultural University in winter season on 30 genotypes of chrysanthemum to estimate the genetic variability, heritability, genetic advance and varietal

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characterization. The experiment was laid out in Randomized Block Design with three replications. The observations were recorded for plant and floral parameters. The mean performances showed that maximum number of flowers and buds per plant were observed in Anmol. Maximum plant height was observed in Winter Queen, maximum duration of flowering and days to first flower was observed in Autumn Joy. Maximum number of flowers per plant were recorded in Anmol, whereas, minimum in S-30. The highest size of flower and stalk length was exhibited by genotype-149. The maximum fresh weight of ten flowers was recorded in genotype- 26 while dry weight of ten flowers was maximum in Double-1. The genotype Anmol produced highest flower yield per plant followed by genotype 24 while lowest in genotype S-30. It can therefore, be concluded from the present study that there was a significant genetic variability in the chrysanthemum genotypes for various characters and the estimates of genetic variability, heritability, genetic advance and path analysis suggested that for the improvement and development of high flower yielding chrysanthemum genotypes, the characters like number of buds per plant, number of flowers per plant and plant spread should be considered in breeding methodology.

Key words: Chrysanthemum, genetic variability, heritability and flower yield

INTEGRATED EFFECT OF BIO - INOCULANTS, ORGANIC AND CHEMICAL FERTILIZERS ON GROWTH, YIELD AND QUALITY OF OKRA [*ABELMOSCHUS ESCULENTUS* (L.) MOENCH]

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Okra is an important vegetable crop of family Malvaceae, which valued especially for its tender and green fruit. To meet out the demand of increasing population the growers use inorganic nutrient indiscriminately. This left the challenges towards scientists to increase the production of quality food in a sustainable manner. Organic manures and biofertilizers either alone or in integration are the option to improve the soil fertility and productivity in a sustainable manner. The bio-fertilizers are cost effective and produce plant growth promoting hormones, vitamins and amino acids and help to fix atmospheric nitrogen, solubilizing and mobilize phosphorus and translocate the minor elements like zinc, copper etc, to the plants. Keeping these all facts in to consideration, an investigation entitled 'Integrated effect of bio-inoculants, organic and chemical fertilizers on growth, yield and quality of Okra [*Abelmoschus esculentus* (L.) Moench]' was conducted at Vegetable Research Farm, BAU, Sabour to explore the possibilities of best integrated nutrient management option for better growth, yield and quality of okra. The sixteen treatments viz. T₁ (RDF @ 120:60:60 kg NPK ha⁻¹), T₂ (75% of recommended dose of N through chemical fertilizer + 25% N through Vermicompost), T₃ (50% of recommended dose of N through chemical fertilizer + 50% N through Vermicompost), T₄ (25% of recommended dose of N through chemical fertilizer + 75% N through Vermicompost), T₅ (T₁ + *Azotobacter*), T₆ (T₂ + *Azotobacter*), T₇ (T₃ + *Azotobacter*), T₈ (T₄ + *Azotobacter*), T₉ (T₁ + PSB), T₁₀ (T₂ + PSB), T₁₁ (T₃ + PSB), T₁₂ (T₄ + PSB), T₁₃ (T₁ + PSB + *Azotobacter*), T₁₄ (T₂ + PSB + *Azotobacter*), T₁₅ (T₃ + PSB + *Azotobacter*), T₁₆ (T₄ + PSB + *Azotobacter*) were arranged in a randomized block design replicated thrice. Okra variety VNR Super Green was sown in July, 2017 and all the recommended cultural package and practices were followed as per need for healthy crop. Results revealed that the application of 75 % RDN through chemical fertilizer + 25 % N through vermicompost + *Azotobacter* @ 20 g kg⁻¹ of seed + PSB @ 20 g kg⁻¹ of seed (T₁₄) influenced most of the characteristics significantly and recorded the highest values of plant height, number of branches, fruit length, average fruit weight, number of fruits per plant, yield per hectare and B: C ratio (1.62) except number of nodes to first flower appearance, days taken to 50 % flowering and days to first picking, which were minimum however, the microbial load was maximum in T₁₆ treatment, which was statistically at par with T₁₄ and T₁₅. Therefore, the use of 75 % RDN through chemical fertilizer + 25 % nitrogen through vermicompost + *Azotobacter* + PSB is a cost effective and sound integrated nutrient management option for higher growth, yield and quality produce of okra and to improve the fertility status of the soil.

Key words: Integrated, bio-inoculants, inorganic, vermicompost, yield

MICROBIAL CONSORTIA FOR BETTER SOIL HEALTH UNDER NON-LEGUMINOUS PRODUCTION SYSTEM BISWARANJAN BEHERA AND T.K. DAS

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Soil fertility restoration through the use of chemical fertilizers alone often has negative impact on the complex system of the biogeochemical cycles. Non-leguminous production systems, which contribute maximum to the national food basket, are particularly facing the problem of soil health deterioration owing to mono-cropping and imbalance fertilization. Microbial consortia consisting of two or more microbes, enhances the nutrient availability when inoculated in soil, besides secretion of various plant growth promoting hormones improves soil health. However, major focus earlier remained on single microbe biofertilizer and work on microbial consortia got late moment. Microbial consortia includes plant growth promoting rhizobacteria (PGPR) consortia, biofilm biofertilizer and NPK

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biofertilizer. It has been observed that seed treatment with *Trichoderma viridae*-*Pseudomonas* biofilm increased germination percentage in cotton (Triveni *et al.*, 2012). Inoculation of blue green algae (BGA) with plant growth promoting rhizobacteria (PGPR) increased nitrogenase activity by 31.4% over sole BGA application in rice (Shahane *et al.*, 2015). *Anabaena-Providencia* inoculation as PGPR increased grain yield of rice by 9% and 14% over sole application of *Anabaena* and *Providencia*, respectively (Meena *et al.*, 2015). Swarnalaxmi *et al.* (2013) observed an increase of 8% and 15% in N uptake and yield in wheat due to the use of cyanobacterial-*Rhizobium* biofilm. PGPR consortium of *Bacillus* sp, *Providencia* sp, *Brevundimonas* sp along with 2/3rd of recommended dose of fertilizer increased Fe, Cu, Mn, and Zn content in wheat grain by 45-143% over the full dose of chemical fertilizer (Rana *et al.*, 2012). Hettiarachchi *et al.* (2014) reported a 19% reduction in nitrate leaching due to application of biofilm biofertilizer. Application of NPK biofertilizer significantly increased total N and available P content in soil over control (Wu *et al.*, 2004). Microbial consortia proved better over single microbe based biofertilizer in improving crop productivity, profitability and soil health. However, its success depends on compatibility of different microbes used. Microbial consortia as a source of nutrient management can combat ill-effects of intensive fertilizer use by reducing environmental trade-offs.

EFFECT OF NITROGEN ON GROWTH PARAMETERS OF FODDER OAT '(*AVENASATIVA* L.)'

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Plant height of Oat is increased with advancement of crop age and nitrogen level. Plant height was increased significantly upto 160 kg N kg ha⁻¹ at all the growth stages. The increase in plant height with nitrogen level might be related to the availability of more nitrogen for early establishment of enzymes, pigments, and other compounds needed for photosynthesis and other beneficial effects of nitrogen in cell elongation and cell division in meristematic activity as well as inter-nodal expansion. The number of tillers per unit row length increased with crop age only upto 1st cut (60 DAS), and thereafter, decreased progressively under all levels of nitrogen. LAI increased significantly with increasing in nitrogen level from N1 to N5. At 50 % flowering stage LAI increased significantly with increase in levels of nitrogen. In general, dry matter accumulation in plant increased with advancement of crop age and with increasing levels of nitrogen from 0 to 160 kg ha⁻¹. In present study, the increase in dry matter accumulation with nitrogen could be due to increase in specific leaf weight and thickness of young growing leaves with higher crude protein content, higher plant height and more number of tillers. Green forage and dry matter yield significantly with successive increase in nitrogen levels from N1 to N5. Significant increase was observed upto 160 kg N ha⁻¹. Nitrogen application showed the linear influence on green forage yield from 0 to 160 kg ha⁻¹. Plant height, LAI and dry matter accumulation increased with increasing in nitrogen levels. These things directly related with production of green matter.

Key words: Nitrogen and growth

DOUBLING FARMERS' INCOME BY 2022: A CRITICAL APPROACHES

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The programme of Doubling Farmers' Income was announced by the Finance Minister, Mr. Arun Jaitley during his budget speech on February 29, 2016. The targeted year that has been set by the govt. for doubling the farmers income is 2022 i.e. from 2015-16 to 2021-22 (Six years) with the objective to double the real income of farmers, not output or value added or the GDP of the agriculture sector. Targeted income includes income from agricultural as well as allied activities. Doubling rural income in nominal terms is possible by increasing agriculture output & minimum support prices (while keeping inflation below 5%), doubling rural income in real terms would be a daunting task considering increasing agriculture output by 12% every year with no additional land likely to be utilized for agricultural activity. However, a long term solution remains faster execution of policies that could develop infrastructure to support irrigation system and reduce the dependency on rains. There is every possibility not only to double the income of farmers through enhancement in productivity, changes in cropping pattern, inspire additional income through many supplementary activities but also provide stability in farmers income. There is need to think beyond food security and give our farmers a sense of income security. It will also attract youth towards farming profession and ease the pressure on non-farm jobs.

Keywords: Income, Innovation, Productivity, MSP, e-platform

AREVIEW- IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON SOIL HEALTH AND CROP IMPROVEMENT**C.K. DOTANIYA¹, SANDEEP MOHBE¹ AND R.K. DOUTANIYA², H.P. SINGH³**¹Dept. of Soil Science and Agricultural Chemistry, ICAR-Indian Institute of Soil Science Bhopal M.P. 462038, ²Department of Agronomy O.P.J.S. University Churu Rajasthan, ³Sales Officer- EFFCO eBAZAR Anarad Dhar, M.P.

Integrated nutrient management (INM) is not a new concept. It is an age-old practice when almost all the nutrient needs were met through organic sources to supply secondary and micronutrients besides primary nutrients. This may be achieved through combined use of all possible sources of nutrients and their scientific management for optimum growth, yield and quality of different crops and cropping systems. The organic residues that are added to the soil undergo microbial decomposition and in this process, various organic products of decay like polysaccharides are released which act as strong binding agents in the formation of large and stable aggregates which helps to improve the physical properties of the soil (Divya *et al.*, 2013). INM practice was found beneficial for sustaining soil health in terms of build up of organic carbon, macro and micronutrient and enhancing the crop equivalent yield (Vidyavathi *et al.*, 2012). Organic manures acted as nutrient reservoir and upon decomposition produced organic acids thereby absorbed irons are released slowly for the entire crop growth leading to higher plant height. FYM worked as soil conditioner in addition to supplying plant nutrients and resulted in improvement in plant height at different stages of plant growth (Prasad, 1994).

Keyword- Integrated Nutrient Management, Soil Health, Cropping Systems

INFLUENCES OF PHOSPHORUS AND SULPHUR ON YIELD ATTRIBUTES OF SUMMER GREEN GRAM (*VIGNA RADIATA* L.) BUNDELKHAND PLATEAU**DS. DHARWE¹, HC. DIXIT¹, CK. DOTANIYA², SANDEEP MOHBE³, RK. DOUTANIYA³**¹Department of Soil Science and agricultural chemistry, Bundelkhand University Jhansi (U.P.) , ³Department of Agronomy, OPJS University Churu, Rajasthan, ²ICAR-Indian Institute of Soil Science Bhopal M.P. 462038

A Pot experiment was conducted to see the Effect of Phosphorus of green gram. Four levels of phosphorus (P) with four levels of sulphur (S) were applied at Agriculture experimental field, Nehru PG collage Lalitpur (U.P.) during 2014-15. Results revealed that application of 40 kg sulphur ha⁻¹ and Phosphorus 90kg ha⁻¹ to the summer green gram crop significantly increased the sulphur and Phosphorus content in seed and straw yield. The interaction effect of P×S on seed and straw production of summer green gram was found also significant and yield was improved by the application of both of these two 90kg P₂O₅ ha⁻¹ and 40kg S ha⁻¹ nutrients as compared to control and but statistically at par with 40 kg sulphur ha⁻¹. The percent enhancement were 6.74, 15.92 and 19.48 in seed and 31.60, 54.50 and 69.71 in straw of green gram due to 10, 20 and 40kg S ha⁻¹ over control respectively.

Keywords: Phosphorus and Sulphur, Seed, Straw, Summer Yield, Green Gram

BIO-EFFICACY AND DISSIPATION PATTERN OF DIFFERENT INSECTICIDES AGAINST DIAMONDBACK MOTH (*PLUTELLA XYLOSTELLA* L.) IN CABBAGE**C.G. SAWANT* AND C.S. PATIL**

All India Network Project on Pesticide Residue, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Maharashtra, India

Field studies were conducted at farmer's field (at Nandur Madhyameshwar, Tq. Niphad, Dist. Nashik and at Khandgaon, Tq. Sangamner, Dist. Ahmednagar), Instructional Farm, P.G.I, M.P.K.V., Rahuri and laboratory studies were carried out at A.I.N.P. on Pesticide Residue, Department of Agril. Entomology, M.P.K.V., Rahuri. Studies on bio-efficacy revealed that, chlorantraniliprole @ 10 g a.i. ha⁻¹ was found to be the most effective with 91.30 per cent reduction in larval population of *P. xylostella* followed by spinosad @ 17.5 g a.i. ha⁻¹ (87.55%) and flubendiamide @ 18.24 g a.i. ha⁻¹ (86.61%). The maximum marketable yield of cabbage heads (238.15 q ha⁻¹ with 129.23 % increase over control) was obtained from the plots treated with chlorantraniliprole @ 10 g a.i. ha⁻¹ followed by spinosad @ 17.5 g a.i. ha⁻¹ (233.83 q ha⁻¹ with 125.07 % increase over control) and flubendiamide @ 18.24 g a.i. ha⁻¹ (224.98 q ha⁻¹ with 116.56 % increase over control). The highest cost:benefit ratio was registered in the treatment of chlorantraniliprole @ 10 g a.i. ha⁻¹ (1:16.40) followed by flubendiamide @ 18.24 g a.i. ha⁻¹ (1:14.98) and spinosad @ 17.5 g a.i. ha⁻¹ (1:12.22). Studies on dissipation showed that, residues of triazophos persisted in cabbage up to 7th and 10th day with half-life of 2.66 and 2.87 days at recommended and double the recommended dose, respectively. Residues of quinalphos persisted in cabbage up to 5th and 7th day with half-life of 2.10 and 1.97 days at recommended and double the recommended dose, respectively. As regards bifenthrin residues persisted in cabbage up to 7th and 10th day with half-life of 2.30 and 2.52 days at recommended and double the recommended dose, respectively.

EFFECT OF DIFFERENT HOUSEHOLD PROCESSES ON PESTICIDES RESIDUES IN CABBAGE**C.G. SAWANT* AND C.S. PATIL***All India Network Project on Pesticide Residue, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Maharashtra, India*

The investigations were carried out on 'Bio-efficacy of newer insecticides against diamondback moth (*Plutella xylostella* L.) and their residues in cabbage' during the year 2015-16 and 2016-2017 at M.P.K.V., Rahuri, Maharashtra. Field studies carried at Instructional Farm, P.G.I, M.P.K.V., Rahuri and laboratory studies were carried out at A.I.N.P. on Pesticide Residue, Department of Agril. Entomology, M.P.K.V., Rahuri. Among the various decontamination methods evaluated, cooking in close pan was found to be the most effective method in removing triazophos, quinalphos and bifenthrin residues from chopped cabbage samples (85.18, 85.42 and 86.27 %, respectively). Boiling was the next effective treatment which removed the triazophos, quinalphos and bifenthrin residues to the extent of 74.07, 81.25 and 80.39 per cent from chopped cabbage samples, respectively. Dipping of cabbage heads in 2 per cent salt solution reduced triazophos, quinalphos and bifenthrin residues to the extent of 51.85, 56.25 and 64.70 per cent, respectively. Reduction of residues due to dipping in 2 per cent tamarind solution was to the extent of 42.59, 41.67 and 56.86 per cent for triazophos, quinalphos and bifenthrin residues, respectively from cabbage heads. Washing of cabbage heads with tap water was observed to be the least effective in removing the residues of triazophos, quinalphos and bifenthrin residues (up to 25 %).

INVESTIGATION ON USAGE PATTERN, BIO-EFFICACY, DISSIPATION PATTERN AND DECONTAMINATION OF DIFFERENT INSECTICIDES AGAINST DIAMONDBACK MOTH (*PLUTELLA XYLOSTELLA* L.) IN CABBAGE**C.G. SAWANT* AND C.S. PATIL***All India Network Project on Pesticide Residue, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Maharashtra, India*

The investigations were carried out on 'Bio-efficacy of newer insecticides against diamondback moth (*Plutella xylostella* L.) and their residues in cabbage' during the year 2015-16 and 2016-2017 at M.P.K.V., Rahuri, Maharashtra. Investigations comprised studies on pesticide use pattern, bio-efficacy of newer insecticides against *P. xylostella*, dissipation of triazophos, quinalphos and bifenthrin in cabbage and decontamination of residues in cabbage. Field studies were conducted at farmer's field (at Nandur Madhyameshwar, Tq. Niphad, Dist. Nashik and at Khandgaon, Tq. Sangamner, Dist. Ahmednagar), Instructional Farm, P.G.I, M.P.K.V., Rahuri and laboratory studies were carried out at A.I.N.P. on Pesticide Residue, Department of Agril. Entomology, M.P.K.V., Rahuri. Insecticide usage pattern of selected farmers from Ahmednagar, Pune and Nashik district of western Maharashtra indicated that, farmers relied mostly on chemical pesticides to control the insect pests of cabbage. Irrespective of location, farmers from these locations used conventional insecticides. Among three cabbage growing areas, the use of conventional insecticides was maximum by the farmers from Pune districts (1.43 kg a.i. ha⁻¹ season⁻¹) followed by Ahmednagar (1.22 kg a.i. ha⁻¹ season⁻¹) and Nashik districts (1.07 kg a.i. ha⁻¹ season⁻¹). As regards, use of novel insecticides, farmers from Nashik district used 0.38 kg a.i. ha⁻¹ season⁻¹ followed by Pune (0.24 kg a.i. ha⁻¹ season⁻¹) and Ahmednagar district (0.20 kg a.i. ha⁻¹ season⁻¹). Very few farmers from above locations used biopesticides i.e. Mycoinsecticides and neem based formulations. The most commonly used conventional insecticides were triazophos, quinalphos, dimethoate, dichlorvos, cypermethrin, profenophos and chlorpyrifos. About 50 per cent farmers were aware of natural enemies. Nearly 60 per cent farmers knew about the recommended insecticides and their doses on cabbage. Majority of the farmers indicated that they were aware of the residual effects of insecticides, but they did not follow any precautions to avoid harmful effects. It was also found that majority of the farmers did not know about safe waiting period for harvesting of cabbage after application of insecticides. Majority of the farmers sprayed at an interval of 7-10 days giving 5-7 rounds of spraying during cropping season of cabbage. Studies on bio-efficacy revealed that, chlorantraniliprole @ 10 g a.i. ha⁻¹ was found to be the most effective with 91.30 per cent reduction in larval population of *P. xylostella* followed by spinosad @ 17.5 g a.i. ha⁻¹ (87.55%) and flubendiamide @ 18.24 g a.i. ha⁻¹ (86.61%). The maximum marketable yield of cabbage heads (238.15 q ha⁻¹ with 129.23 % increase over control) was obtained from the plots treated with chlorantraniliprole @ 10 g a.i. ha⁻¹ followed by spinosad @ 17.5 g a.i. ha⁻¹ (233.83 q ha⁻¹ with 125.07 % increase over control) and flubendiamide @ 18.24 g a.i. ha⁻¹ (224.98 q ha⁻¹ with 116.56 % increase over control). The highest cost:benefit ratio was registered in the treatment of chlorantraniliprole @ 10 g a.i. ha⁻¹ (1:16.40) followed by flubendiamide @ 18.24 g a.i. ha⁻¹ (1:14.98) and spinosad @ 17.5 g a.i. ha⁻¹ (1:12.22). Studies on dissipation showed that, residues of triazophos persisted in cabbage up to 7th and 10th day with half-life of 2.66 and 2.87 days at recommended and double the recommended dose, respectively. Residues of quinalphos persisted in cabbage up to 5th and 7th day with half-life of 2.10 and 1.97 days at recommended and double the recommended dose, respectively. As regards bifenthrin residues persisted in cabbage up to 7th and 10th day with half-life of 2.30 and 2.52 days at recommended and double the recommended dose, respectively. Among the various decontamination methods evaluated, cooking in close pan was found to be the most effective method in removing triazophos, quinalphos and bifenthrin residues from chopped cabbage samples (85.18, 85.42 and 86.27 %, respectively).

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Boiling was the next effective treatment which removed the triazophos, quinalphos and bifenthrin residues to the extent of 74.07, 81.25 and 80.39 per cent from chopped cabbage samples, respectively. Dipping of cabbage heads in 2 per cent salt solution reduced triazophos, quinalphos and bifenthrin residues to the extent of 51.85, 56.25 and 64.70 per cent, respectively. Reduction of residues due to dipping in 2 per cent tamarind solution was to the extent of 42.59, 41.67 and 56.86 per cent for triazophos, quinalphos and bifenthrin residues, respectively from cabbage heads. Washing of cabbage heads with tap water was observed to be the least effective in removing the residues of triazophos, quinalphos and bifenthrin residues (up to 25 %).

USAGE PATTERN OF DIFFERENT INSECTICIDES AGAINST DIAMONDBACK MOTH (*PLUTELLA XYLOSTELLA* L.) IN CABBAGE**C.G. SAWANT* AND C.S. PATIL**

All India Network Project on Pesticide Residue, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Maharashtra, India

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CREATING AWARENESS ON ORGANIC FARMING AMONG FARMERS FOR SUSTAINABLE AGRICULTURE**CHALLA SATISH REDDY¹ AND JHUNILATA BHUYAN²**

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According to the Food and Agriculture Organization (FAO), sustainable agriculture "is the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of environment and conserving natural resources". Organic farming is one of the several approaches found to meet the objectives of sustainable agriculture. Many techniques used in organic farming like inter-cropping, mulching and integration of crops and livestock are not alien to various agriculture systems including the traditional agriculture practiced in old countries like India. The most important constraint felt in the progress of organic farming is the inability of the government policy making level to take a firm decision to promote organic agriculture. In addition, Organic Farming has vast opportunity for rural employment and livelihood security. Awareness of Organic Farming has a range of strengths in various areas including agriculture and food production, international relations, direct marketing and process auditing. Hence, there is a need for a comprehensive framework that integrates organic farming with bottom up responses, technology diffusion with reciprocal knowledge flow from farmers' institution and their local resources and innovation for sustainability in agriculture which will help generating large-scale farmers' acceptance to solve ecological crisis in context to climate change and to address the health and livelihood security of large rural masses of India.

Keywords: Organic Farming, soil and sustainable agriculture.

IMPRESSION OF WHEAT GENOTYPES UNDER NORMAL SOWN CONDITION ON YIELD AND ITS ASPECT**CHANDAN KUMAR UPADHYAY¹, SHASHANK SRIVASTAV¹, PAWAN KUMAR SINGH²**

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The study entitled "Impression of wheat genotypes under normal sown condition on yield and its aspect" was conducted at the Department of Crop Physiology, College of Agriculture Chandra Shekhar Azad University of Agriculture and Technology, Kanpur

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during rabi season 2017. Twenty wheat varieties viz. K1006, K 8434, K 9423, K 8027, K 9351, K 607, K 307, K 9644, K 424, K 7903, K 9533, K9006, K 9465, K 906, K 402, K 9162, K 9107, K8962, PBW 343, HD 2733 were grown in field. Under control condition plots were irrigated at all growth stages. The condition plots were maintained under rain fed condition. Different physiological growth parameters were recorded at tillering, jointing, flowering and pod formation stages whereas yield and yield contributing parameters were recorded at maturity stage and after harvesting. The results showed that different physiological parameters such as relative growth rate (RGR), Net assimilation rate (NAR), and specific leaf weight (SLW). The wheat varieties K 9107, K 1006, K 9006 and PBW343 showed a good varieties maintained higher seed yield along with number of tillers per plant, seeds per ears test weight, seed yield, biological yield, harvest index and under normal condition. All these traits of the varieties helped them to maintain economic yield. The wheat varieties K 9107, and K 1006, K 9006 and PBW 343 varieties maintained higher seed yield along with number of leaves per plant, total dry matter, test weight, seed yield, biological yield, harvest index and yield under normal condition.

ECONOMICS OF HYBRID MAIZE PRODUCTION AS INFLUENCED BY DIFFERENT APPROACHES AND FORMS OF FERTILIZERS APPLICATION

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A field experiment was conducted at Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bangalore to study the economics of hybrid maize as influenced by different forms of fertilizers through different approaches in eastern dry zone of Karnataka. The experiment was laid out in RCBD with ten treatments and replicated thrice. The results revealed that soil test crop response (STCR) dose through soluble fertilizer with 3 splits and 3 sprays recorded higher yield parameters like grain yield (98.22 q ha⁻¹) and stover yield (130.96 q ha⁻¹). Similarly, Higher gross returns were recorded (Rs.150279.54) in 100 per cent STCR dose applied through soluble fertilizers in three splits along with three sprays of 19:19:19 @ 1% concentration. Whereas, higher net returns were recorded (Rs.104447.97) in 100 per cent RDF applied plot through conventional fertilizers. However, higher Benefit:Cost (B:C) ratio was observed in recommended dose of fertilizer (RDF) through conventional fertilizer (4.20) followed by STCR dose through conventional fertilizers (3.62) and lower B:C ratio recorded in treatment receiving soluble fertilizers irrespective of the forms and approaches of fertilizer application was mainly due to higher cost for soluble fertilizers compared to conventional fertilizers which were subsidized under government policy.

BIOFORTIFICATION; A MAJOR CHALLENGE IN HORTICULTURE INDUSTRY IN INDIA

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Biofortification is the process of breeding for improved nutrient content in a crop and is considered a sustainable and cost effective strategy to address malnutrition to rural peoples in developing countries because it targets staple foods that are consumed daily. *About 800 million people suffer from hunger, but even more suffer from micronutrient malnutrition particularly iodine, vitamin A, iron, and zinc malnutrition are major concerns. Presently, agronomic, conventional and transgenic are three common approaches are in limited scale in use. Agronomic Practices used to enhance concentration of phytonutrients. Stresses such as water stress, cold and ultraviolet light can significantly enhance production of phytonutrients such as flavonoids and glucosinolates. In conventional plant breeding, parent lines with high vitamin or mineral levels can be crossed over several generations to produce plants that have the desired nutrients. Recent progress in conventional plant breeding has given emphasis on fortification of important vitamins, antioxidants and micronutrients. Transgenic approaches are advantageous when the nutrient does not naturally exist in a crop (example, provitamin A in sweet potato and cassava). Recently, there have been more focusing on development of transgenic crops to enhance levels pro-vitamin A content in several horticultural crops like tomato, potato, banana, cassava, sweet potato, carrot etc. Biofortification provides a feasible means of reaching malnourished populations in relatively remote rural areas, delivering naturally fortified foods to people with limited access to commercially-marketed fortified foods, which are more readily available in urban areas. Thus, the best and final solution to eliminating under nutrition as a public health problem in developing countries is to provide increased consumption of a range of non-staple foods. Plant breeders need to be aware of both the major influence that horticulture research may have had on nutrient utilisation in the past and the potential of plant breeding for future improvements in nutrition and health.*

Key words: Biofortification, Approaches, Horticultural crops.

EFFICACY OF EDIBLE COATING AND CHEMICALS ON THE SHELF LIFE QUALITY OF FRUITS AND VEGETABLES

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Post harvest losses of fruits and vegetables are serious problem because of rapid deterioration during handling, transport and storage in tropical regions. The Indian fruits and vegetable market is one of the largest in the world. It has certain unique characteristics viz., high wastage in value chain, weak transportation and storage infrastructure, low tech harvestings, low usage in food processing and relatively low exports. The post-harvest losses between 35 and 40% and valued at about \$800 million annually, affect the livelihoods of nearly one-third of the population, the majority of whom are smallholder farmers. In order to limit the post-harvest changes in a commodity, an environmental friendly technology i.e. edible coating can be applied. In this, a commodity is enrobed using natural polymers. This technology offers various advantages like maintaining food quality and increasing shelf life by delaying the ripening process, colour changes, maintaining texture, reducing weight loss and decay. This coating can be done in various ways like dipping the product into, or by spraying it or brushing with a solution containing film ingredients. Edible coatings are usually made from materials such as polysaccharides, proteins and lipids. Edible coatings have high potential to control browning, discolour activity, off flavour, microbial activity of fruits and vegetables and to extend shelf life. Several new formulations have been developed which serve as a best alternative. These are made from herbs or combination of other edible coatings and the most common herbs used in edible coatings are such as *Aloe vera* gel, neem, lemon grass, rosemary, oregano and turmeric etc. Therefore, prospects of studies pertaining to improve coating adhesion and durability on the surface of fruits and vegetables and investigations on sensory quality and consumer acceptance of coated products are needed.

Key words: Post harvest loss, edible coating, vegetable and fruit crops

YIELD AND ECONOMIC OF SUMMER PEARL MILLET AS INFLUENCED BY INTEGRATED NITROGEN MANAGEMENT

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A field experiment was conducted during summer, 2015 at Agronomy Instructional Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, to study the "Integrated nitrogen management in summer pearl millet under South Gujarat condition". Total nine integrated nitrogen treatments of chemical fertilizers with organic manures with three replications in randomized block design. The results revealed that pearl millet GHB-558 performed better by combined application of 50% RDN from chemical fertilizers + 25% nitrogen from vermicompost + 25% nitrogen from neemcake recorded higher value for plant height, dry matter accumulation per plant, total tillers per plant, earhead length, earhead girth, effective tillers, test weight, grain yield per earhead as well as grain (2057 kg/ha) and straw yield (5347 kg/ha) over other combinations. Maximum net realization (18773 Rs./ha) along with higher BCR value (0.71) were recorded with 50% RDN from chemical + 25% nitrogen from vermicompost + 25% nitrogen from neemcake.

RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON THE PERFORMANCE OF FENUGREEK (*TRIGONELLA FOENUM-GRACUML.*) IN CLAY LOAMY SOIL

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A Pot experiment was conducted to study Response of Integrated Nutrient Management on the performance of Fenugreek at Agriculture experimental field, Bundelkhand University Jhansi (U.P.) during 2014-15. The experimental design use RBD with consisting four levels of such vermicompost - (0, 100, 200, 300 gm) FYM - (0, 100, 200, 300 gm) and rhizobium - (0, 10, 20, 30 kg/ha) respectively. The results reflected that application of integrated nutrient management increased the seed yield (kg/ha) as compared to control. Seed yield obtained at different levels of vermicompost 14.25, 14.27 and 14.33 followed by Farm Yard Manure 14.27, 14.25 and 14.27 and rhizobium 13.07, 13.08 and 13.12 q/ha.

Key words- Integrated Nutrient Management, Vermicompost, FYM, Rhizobium, Fenugreek

COMBINING ABILITY ANALYSIS OF INTRA HIRSUTUM CROSSES FOR SEED COTTON YIELD AND ITS ATTRIBUTES IN COTTON**CHHAVIKANT¹, K.S. NIRANIA¹, S.R. PUNDIR¹**¹*Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar-125004*

Present investigation was carried out to evaluate forty intra hirsutum hybrids, produced through crossing of 5 hirsutum lines (H1300, H1098i, H1117, H1226 and H1236) with 8 hirsutum testers (GN 67-1, HS-2, LH 1960, P 729-37, RS 875, Mahalaxmi, RST-9 and PIL-18) by Line x Tester method for general combining ability of the parents and specific combining ability of hybrids in respect of seed cotton yield, its attributing traits viz., boll number, boll weight, morphological traits viz., plant height, number of monopods, number of sympods and for important economic parameters viz., ginning out turn, seed index and lint index. The 40 F₁ intra hirsutum hybrids were sown during Kharif 2015-16 in a randomized block design with three replications at CCS Haryana Agricultural University, Cotton Research Station Sirsa. From the estimates of additive and dominance variance, it was observed that SCA variance was greater than GCA variance for all the characters except boll weight, ginning out turn and lint index, indicating the involvement of both additive and non-additive gene effects with the preponderance of non-additive gene effect for genetic control of these characters. Among all the studied hybrids, cross combinations H1226 x RS 875, H1300 x P 729-37, H1300 x PIL-18, H1300 x HS-2 and H1098i x Mahalaxmi were found to be best specific combiners, while best general combiner were male parents LH 1960 & P 729-37 and female parent H1098i.

Keywords: Combining ability, hirsutum, Line x tester analysis.

FERNS DIVERSITY IN SWAMPY HABITAT OF DOON VALLEY**CHHAYASINGH*, NEHA CHAUHAN*, SHAGUN GUPTA****SGRRU, Dehradun*

Wetlands are special type of habitat which have received great attention for their conservation and management by UNESCO, IUCN, IBP etc. Kanjilal (1901) focused attention towards the great botanical potential of the swamp forest in Doon valley. He described Mothronwala, Nakraunda, and Golatapar swamp forest in his work for their great botanical interest. Ferns are found in varied habitat but sometimes they are found in unusual habitat. The ravine and gorges are popularly known as "fern centers". The vegetation and botanical value of swamps were first observed by Kanjilal (1901). The Mothronwala swamp of study area is a well known as "Hot Spot" of biodiversity due to topographic and edaphic variations. The fern species of such areas include *Ampelopteris prolifera* (Retz.) Copel., *Christella arida* (D. Don) Holtt., *Christella dentate* (Forssk.) Brown., *Coniogramma fraxinea* (D. Don) Fee ex Diels (*moist habitats*), *Woodwardia ungiemmata* C. Presl. (Shady ravines along water side). Increase in Anthropogenic activities such as cutting of trees, overgrazing of swamp by the local people, there is decline in swamp species. It requires urgent conservation and protection of the area. The present paper focuses on various conservation measures to protect biodiversity of ferns of these swamps.

Keywords: Swamps, Wetlands, fern centers, Anthropogenic activities

MULCHING: EFFECTIVE PRACTICE FOR REDUCING SOIL WATER EROSION**CHOLLANGI PRASANTH KUMAR¹ AND DEEPAK KUMAR MOHANTY²***M S Swaminathan School of Agriculture, Centurion University, Paralakhemundi, Gajapati, Odisha, Senior Scientist and Head, Dept. of Ag. Engineering, Krishi Vigyan Kendra Mayurbhanj-II, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha*

Mulching is referred to as the soil water conservation practice of leaving mulch on the soil surface for soil and water conservation and to favour plant growth. In these contexts, soil erosion by water is a serious problem, especially in semi-arid and semi-humid areas of the world. The term 'mulch' refers to any material other than soil or living vegetation that performs the function of a permanent or semi-permanent protective cover over the soil surface. Different materials can be used, such as vegetative residues, biological geo textiles, gravel and crushed stones. Mulching has been shown several beneficial effects. It protects the soil against raindrop impact, thereby reducing the water and soil loss rates in different environments, such as agricultural lands, rangelands, fire affected and anthropic sites. It also reduces both the overland flow generation rates and velocity by increasing roughness and it cuts the sediment and nutrient concentrations in runoff. Mulching has been shown to confer several beneficial effects. Furthermore, mulching allows improved infiltration capacity and increases water intake and storage. It enhances the activity of some species of earthworms as well as crop performance, interactions with, the soil structure and the organic matter content with in soil. Hence, Mulching act effectively in reduce soil and water losses in different environments.

Keywords: Mulching, soil and water.

A COMPREHENSIVE STUDY ON KARNAL BUNT DISEASE OF WHEAT IN EASTERN UTTAR PRADESH**D.N.SHUKLA,* J.P.SRIVASTAVA AND AMIT MAURYA***Department of Plant Pathology, Narendra Deva University of Agriculture & Technology Kumarganj Faizabad (UP)*

Karnal bunt caused by *Tilletia indica* Mitra (*Neovossia indica* Mitra (Mundkur) was first recorded in April, 1930 from Botanical Research Station, Karnal (Haryana) on wheat cultivar, foundation and Punjab A. The disease was prevalent in the sub-continent since long, infecting native wheats grown over North Western India but it never caused serious yield reduction. In the absence of strict domestic quarantine regulation, it spreaded to new areas in North Western Wheat belt. However, Madhya Pradesh, southern Rajasthan, Maharashtra and Peninsular India are free from Karnal bunt due to high temperatures. Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad has a well-equipped notified Seed Testing Laboratory under the Department of Seed Science & Technology. Samples of different release and notified varieties meant for quality seed production purposes i.e. nucleus, breeder, foundation and certified seed at different seed production farms/KVK of the University established at different location in Eastern Uttar Pradesh are collected and analysed for testing against seed quality traits like germination, physical purity, genetic purity, seed vigour, seed health etc. Total 26 seeds samples comprising 11 released and notified varieties under university seed production chain were available in the seed testing lab from the produce of Rabi 2011-12. A part from the said seed samples were obtained and analysed for Karnal bunt of wheat. Maximum average infection percentage was found in variety of PBW-343(0.15%) of Faizabad Produced and minimum average was found in the variety of UP-262(0.10%), the varieties were DBW-17, K-307, NW-1012 and K-9423 found free from Karnal bunt. Studies indicated that varieties like Raj-3077, HD-2733, NW-1012, K-307, K-9423 and DBW-17 are safer against the disease. Due to very low disease incidence the results regarding the suitability of sowing date and fertilizer levels found inconclusive and fungicides namely carboxin (Vitavax 75WP), Carbendazim (Bavistin 50WP), Subeej (Bavistin 25SD), Propiconazole (Tilt 20EC), Vitavax power (Crompton. Uni. Royal) along with one untreated control. All these five fungicides were tested at three concentrations i.e. 0.1%, 1.0% and 2.5%. The radial growth was measured after 15 days and per cent inhibition radial growth was calculated and propiconazole (Tilt 20EC) was found most inhibitory against the radial growth.

CHARACTERIZATION AND CLASSIFICATION OF ELITE GENOTYPES OF CHICKPEA (*CICER ARIETINUM* L.) FOR MORPHOLOGICAL CHARACTERS USING DUS DESCRIPTORS**D.K. JANGHEL*, KRISHAN KUMAR, S.S. VERMA AND A.K. CHHABRA***Department of Genetics and Plant Breeding, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, (125 004), India.*

In this present investigation, the 60 chickpea genotypes were characterized and grouped into different classes as per the guidelines for the conduct of test for Distinctiveness, Uniformity and Stability (DUS) on chickpea (*Cicer arietinum* L.) approved by the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) in 2007, Government of India. Among the 13 morphological characters observed, seven characters were found trimorphic viz., plant growth habit, leaflet size, flower colour, peduncle length, pod size, seed shape and seed testa texture, four characters dimorphic viz., anthocyanin pigmentation on stem, number of flowers per peduncle, stripes on flower and seed type, and two characters polymorphic viz., foliage colour and seed colour among all the 60 chickpea genotypes indicating great potential for varietal identification and characterization. A substantial level of genetic diversity was also observed based on morphological descriptors for all the chickpea genotypes. From the above 13 morphological DUS descriptors a unique morphological profiles could be established for the each chickpea genotype. Thus two important conclusions emerged out from the present investigation, (i) there exists remarkable variability among the present chickpea genotypes and (ii) 13 DUS parameters were adequate to assign a distinctive profile (combination of traits) to each chickpea genotype qualifying them to be fit for registration as a diverse genotype. Moreover, diverse but complementary genotypes may be selected for inclusion in the breeding programmes to develop elite breeding material for the development of improved chickpea varieties.

Keywords: Chickpea, DUS, PPV&FRA, unique profile and Genetic diversity.

EFFECT OF PHOSPHORUS AND ZINC ON YIELD AND QUALITY OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) IN INCEPTISOL.**D. V. KADAM, B.S. INDULKAR, V. S. KADAM, L. S. JADHAV, P. N. SONUNE***Department of Soil Science and Agriculture Chemistry, College of Agriculture, Latur Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani 431402, (M.S.), India.*

The experiment was laid out in FRBD with 16 treatments along with 3 replication. It was carried out during the Kharif season 2018, at farm of oilseed research station, College of Agriculture, Latur. The results of field trial on response of various levels of Phosphorus and zinc showed significant effect on yield and quality parameter of groundnut. The pod, kernel and haulm yield was significantly affected at

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P_2 - 50 kg P_2O_5 ha⁻¹ and zinc level at Zn_2 -30 kg $ZnSO_4$ ha⁻¹ as compare to all other levels of phosphorus and zinc. The quality parameter like oil content, protein content and oil and protein yield showed maximum increases due to application of phosphorus at P_2 - 50 kg P_2O_5 ha⁻¹ and zinc Zn_2 -30 kg $ZnSO_4$ ha⁻¹ in kernel of groundnut. Thus, it can be concluded that balanced fertilizer application of phosphorus at level of P_2 - 50 kg P_2O_5 ha⁻¹ and zinc Zn_2 -30 kg $ZnSO_4$ ha⁻¹ showed superiority over all other levels of P and Zn. However, further increment of P, P_3 -60 kg P_2O_5 ha⁻¹ and Zn, Zn_3 - 40 kg $ZnSO_4$ ha⁻¹ was found be better when compared with P_1 (40 kg P_2O_5 ha⁻¹) and Zn_1 (20 kg $ZnSO_4$ ha⁻¹). Thus application of P_2 (50 kg P_2O_5 ha⁻¹) along with zinc level at Zn_2 (30 kg $ZnSO_4$ ha⁻¹) was found to be beneficial in increasing yield and quality of groundnut on low phosphorus and zinc containing ineceptisol soil.

PUSH AND PULL STRATEGY FOR CONTROL OF MAIZE STEMBORERS**D. VAMSI CHANDRASEKHAR REDDY, ABHISHEK YADAV AND M. SREEDHAR***Department of Entomology, SVPUA&T, Meerut-250 110*

The lepidopteran stemborers cause major yield losses in maize production. A habitat management strategy for minimizing damage due to stemborers has been developed in maize-based farming systems was push and pull strategy. For stemborers, this strategy involves use of trap crops to attract stemborer colonization away from the maize plants (pull) and intercrops to repel the pests (push). The two most successful trap crop plants Napier grass, *Pennisetum purpureum*, and Sudan grass, *Sorghum vulgare sudanensis*, attracted greater oviposition by stemborers, than cultivated maize. The intercrops giving maximum repellent effect were molasses grass, *Melinis minutiflora* and a legume species, silverleaf, *Desmodium uncinatum*. These trap crops produces volatile chemicals, such as octanal, nonanal, naphthalene, 4-allylanisole, eugenol and linalool, attract female moths (pull) to lay eggs. While those volatile chemicals released by intercrops, such as (E)- β -ocimene and (E)-4,8-dimethyl-1,3,7-nonatriene, which repel the stemborer moths from the maize (push). The volatile chemicals emitted by inter crops not only repelled female stemborer moths but also attracted parasitoids, principally foraging female *Cotesia sesamiae*. Push-pull is one of the most successful examples of conservation biological control, which holds great promise for maize growing regions. In addition to enhancing maize yields, the strategy increased small livestock production, conserved soil resources, controlled important weeds, enhanced functional biodiversity and increased incomes. Push-pull is an appropriate technology for poor farmers because it is based on locally available renewable inputs and can thus be easily integrated into traditional poly-culture cropping systems. On a larger scale, principles of push-pull can be applied to low-inputs and organic agriculture systems worldwide.

CHARACTERIZATION AND CLASSIFICATION OF ELITE GENOTYPES OF CHICKPEA (*CICER ARIETINUM* L.) FOR MORPHOLOGICAL CHARACTERS USING DUS DESCRIPTORS**D.K. JANGHEL*, KRISHAN KUMAR, S.S. VERMA AND A.K. CHHABRA***Department of Genetics and Plant Breeding, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, (125 004), India.*

In this present investigation, the 60 chickpea genotypes were characterized and grouped into different classes as per the guidelines for the conduct of test for Distinctiveness, Uniformity and Stability (DUS) on chickpea (*Cicer arietinum* L.) approved by the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) in 2007, Government of India. Among the 13 morphological characters observed, seven characters were found trimorphic viz., plant growth habit, leaflet size, flower colour, peduncle length, pod size, seed shape and seed testa texture, four characters dimorphic viz., anthocyanin pigmentation on stem, number of flowers per peduncle, stripes on flower and seed type, and two characters polymorphic viz., foliage colour and seed colour among all the 60 chickpea genotypes indicating great potential for varietal identification and characterization. A substantial level of genetic diversity was also observed based on morphological descriptors for all the chickpea genotypes. From the above 13 morphological DUS descriptors a unique morphological profiles could be established for the each chickpea genotype. Thus two important conclusions emerged out from the present investigation, (i) there exists remarkable variability among the present chickpea genotypes and (ii) 13 DUS parameters were adequate to assign a distinctive profile (combination of traits) to each chickpea genotype qualifying them to be fit for registration as a diverse genotype. Moreover, diverse but complementary genotypes may be selected for inclusion in the breeding programmes to develop elite breeding material for the development of improved chickpea varieties.

Keywords: Chickpea, DUS, PPV&FRA, unique profile and Genetic diversity.

IMPACT OF DEMONSTRATIONS ON YIELD AND ECONOMICS OF MAJOR VEGETABLE CROPS**DAN SINGH¹, R.N.YADAV², D.K.SINGH³ AND H.L.SINGH³***Department of Agricultural Extension and Communication, S.V.P.U.A.&T., Meerut, Professor, Department of Agricultural Extension and Communication, S.V.P.U.A.&T., Meerut, Professor, Department of Agricultural Economics and Management, S.V.P.U.A. & T., Meerut*

The present study was conducted in four blocks of Hapur and Saharanpur district of Western Uttar Pradesh. The total sample size was of 160 vegetable growers for the investigation. During the research study it was observed that increase the yield of vegetable crops from 16.66 to 22.45 percent under demonstrations in compare to farmers practice in summer and kharif season (2014-15). The highest cost of cultivation was found in tomato crop i.e. Rs.2,50,000/ha., lowest in sponge gourd i.e. Rs.77,413/ha., highest net return received in tomato crop i.e. Rs. 1,75,000/ha., lowest in bitter gourd crop i.e. Rs. 17,379/ha. and benefit cost ration was higher in chilli crop i.e. 1:1.82 and lowest in bitter gourd crop i.e. 1:1.16. In Rabi season 2015-16 increase yield of demonstrations from 25.39 to 33.92 percent over the farmers practice. The highest cost of cultivation was found in tomato crop i.e. Rs.2,43,000/ha., lowest in bottle gourd i.e. Rs. 1,01,000/ha., highest net return received in cabbage crop i.e. Rs. 1,33,695/ha., lowest in chilli crop i.e. Rs. 47,200/ha. and benefit cost ration was higher in brinjal crop i.e. 1:1.77 and lowest in tomato crop i.e. 1:1.42. Increase yield of demonstrations from 25.00 to 36.90 percent over the farmers practice. The highest cost of cultivation was found in okra crop i.e. Rs.2,17,312/ha., lowest in sponge gourd i.e. Rs.80,000/ha., highest net return received in brinjal crop i.e. Rs. 1,95,000/ha., lowest in bitter gourd crop i.e. Rs. 55,625/ha. and benefit cost ratio was higher in cucumber i.e. 1:1.97 and lowest in bitter gourd i.e. 1:1.30 in summer and kharif season 2015-16. The highest yield gap was found in brinjal and cabbage.

CLIMATE SMART AGRICULTURE: NEED OF HOUR**DANISHTAAZIZ***Department/Subject- Entomology, SKUAST-KASHMIR, FAO, WADURA*

Multiple climate changes have occurred over the past several decades across the world, including increasing temperatures, changes in water availability and precipitation, and increasing instances of floods. These changing climatic conditions, especially over the last twenty years, have presented multiple risks to the country's agricultural sector, affecting the productivity and quality of crops. Marked changes in rainfall dynamics, with more frequent and intense precipitation events, and more frequent and pronounced drought events that disrupt farming and other economic activities, have presented new challenges for farmers. Farmers are now forced to respond to these adverse changes that affect the way they are familiar to farming and threaten to destabilize the economic viability of many farming communities. These changes, along with increasing climate variability, have influenced soil fertility, crop selection, and harvesting times. The emerging challenges have prompted a need for change in agricultural practices and technologies on the islands. Innovators in the community of farmers in world have realized that to tackle these issues, both mitigation and adaptation measures need to be implemented, and have thus committed to working towards creating more resilient agricultural systems.

Key Words: Climate, Smart, Agriculture, Floods, rainfall, soil fertility

ROLE OF IPM IN SUSTAINABLE AGRICULTURE**DAVARKARAM***Entomology and Agricultural Zoology Institute of Ag. sciences BHU VARANASI)*

IPM is a holistic approach (cultural, physical, biological, chemical & genetic methods) to sustainable agriculture that focuses on managing insects, weeds & diseases. They are cost effective, environment friendly & socially acceptable. This includes the responsible use of crop protection & plant biotech products. The IPM strategies use in sustainable agriculture save the environment and save the soil fertility. IPM also important in increasing crop production. Resistance method is a important key in sustainable agriculture. In resistance method include resistance varieties use against to insects, pests and diseases that can helps farmer in managing the crops. IPM also use in improve soil and water quality, reduced farmer and consumers risks from pesticides poisoning and related hazards. It also manages ecological sustainability by conserving natural enemy species, biodiversity and genetic diversity. It also promotes sound structures and healthy plants. IPM reduces the environmental risk associated with pest management by encouraging the adoption of more ecologically begin control tactics. Biological control can be effective in all types of agriculture systems, including organic, sustainable, and conventional. But certain biological control approaches certainly have the potential to conform to the sustainable agriculture philosophy. In IPM biological control includes parasitoids, predators, natural enemies etc. are effective roll in sustainable agriculture. Also, biological control is often location and management system specific, so requires intense knowledge of relatively unique conditions that may not be applicable on a wide scale basis, again a problem for marketing product.

KEYWORDS: IPM, PESTICIDES, BIOLOGICAL CONTROL, SUSTAINABLE AGRICULTURE, ENVIRONMENT.

PLANT GROWTH AND NUTRIENT UPTAKE BY WHEAT GROWN IN A TYPIC USTOCHREP OF WESTERN U.P. AS AFFECTED BY FERTILIZER-N AND SCHEDULING OF IRRIGATION.

DEVENDRAPAL, TULSARAM AND VIPIN KUMAR*

Krishi Vigyan Kendra, Muradnagar, Ghaziabad & Krishi Vigyan Kendra, G.B.Nagar, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut.*

An investigation on plant growth and nutrient uptake by wheat grown in a Typical Ustochrep of Western U.P. as affected by fertilizer-N and scheduling of irrigation was conducted during Rabi season of 1st, 2nd and 3rd year in randomized block design at Crop Research Centre, Modipuram, Meerut. The experiment comprising three replications of 20 treatment combinations of four irrigation levels (2, 3, 4 & 5) and five nitrogen levels (0, 60, 90, 120 and 150 Kg. ha⁻¹). The results showed that higher irrigation decreased available nitrogen in soil whereas no effect was observed on available P, K and Zn. However, it increased plant height, number of effective tillers m⁻¹, grain and straw yield. It also had a positive relationship with uptake of N, P, K and Zn, nitrogen use efficiency, apparent nitrogen recovery and physiological efficiency. Nitrogen application upto 150 N Kg ha⁻¹ caused an increase in plant height, effective tillers m⁻¹, grain and straw yield, nutrient (N, P, K and Zn) uptake it caused a decrease in nitrogen use efficiency, apparent nitrogen recovery and physiological efficiency of wheat.

EFFECT OF RATES OF FENOXAPROP-P-ETHYL ALONE AND IN COMBINATION WITH ISOPROTURON ON WHEAT AND ASSOCIATED WEEDS

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An experiment was conducted during Rabi season of two year data from crop research center at Pantnagar to assess the appropriate rate of fenoxaprop-p-ethyl alone and in combination with isoproturon with respect to weed control efficiency, crop growth, yield attributing character, yield and nutrient uptake by crop and weeds in wheat crop. Out of four treatments of fenoxaprop-p-ethyl (40, 60, 80 and 90 g a.i. ha⁻¹) and three in combination with isoproturon (30+500, 40+500 and 50+500 g a.i. ha⁻¹) the maximum wheat control efficiency, crop growth, yield attributing character, yield and NPK uptake by plants and lower dry matter of weeds and NPK uptake by weeds were found in fenoxaprop-p-ethyl at 90 g a.i. ha⁻¹ alone and in tank mixture of fenoxaprop-p-ethyl and isoproturon at 50+500 g a.i. ha⁻¹ during both the years. Results revealed that higher rates of fenoxaprop-p-ethyl alone or in combination with isoproturon were more effective in reducing density and dry matter of *P. minor* and *A. ludoviciana* as well as total weeds. It may be due to excellent weed control efficiency at this of herbicides. The highest yield (5056 kg ha⁻¹) was recorded under weed-free condition. Fenoxaprop-p-ethyl at 90 g a.i. ha⁻¹ and a tank mixture of fenoxaprop-p-ethyl and isoproturon at 50+500 g a.i. ha⁻¹ produced grain yield at par with weed-free condition during both the years. This may be due to increase in crop dry matter, leaf area index, number of spike (m⁻²), length of spike, number of grains spike⁻¹ and 1000-grain weight. There was increase in the uptake of N, P and K ha⁻¹ by crop at 60 days stage and at harvest by increasing rate of fenoxaprop-p-ethyl either alone or tank mixture with isoproturon at 500 g a.i. ha⁻¹. This may be due to higher level of weed control and lower level of nutrients shaved by weeds.

"TO STUDIES OF EVALUATION OF SINGLE ROW MAIZE PLANTER"

DEVESH KUMAR

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Maize cultivation gets popularity now days in our country because use of maize in human food and especially in the poultry industries. Maize is cultivated manually which is time consuming, labor intensive and costly. A low cost manually operated push type maize planter was designed and the planter consists of two supportive wheels behind the planter, a seed hopper, a vertical plate type seed metering device, a seed tube, a pair of bed former and handle. Power was transmitted from the ground wheels to the metering device through gear. Maize Seeds were used to test the planter. The seed planter was calibrated in the workshop of the department of Farm Machinery and Power Engineers to maintain the desired seed rate and seed rate was calculated as 20 kg/ha. In the field test the effective field capacity, field efficiency, and draft were calculated in three forward speed levels at 1 km/h, 1.5 km/h and 2 km/h as 2 ha/h, 62.51%, 35 kgf; 3.05 ha/h, 67.91%, 25.60 kgf and 4.5 hec/h, 75.49%, 17.5 kgf for area 100 m². The best performance of the maize planter was found at a 2 km/h as a highest effective capacity, field efficiency and lower draft among them. Production of maize in India 147.10 lakh ton and in Uttar Pradesh 10.50 lakh ton as at 2005 -2006 data source from official website of government of India and Uttar Pradesh, jowar Bajra and maize occupies an area of 34830 hectare and in Allahabad district the productivity is 0.92 quintal per hectare. The maize is grown

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throughout the year in all states of the country for various purposes including fodder for animals,

Keywords: Maize cultivation, seed hopper, metering device, field efficiency, field capacity, speed

ROLE OF AGRO-METEOROLOGICAL ADVISORY SERVICES ON RISK MITIGATION IN AGRICULTURE

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One of the major challenges faced by human kind is to provide. In present decades, anomalous weather and climate have drastically impact on agricultural production and increase risk in India. It also impact the quality, if not the absolute production levels, of a crop. Agro-meteorological Advisory Services (AAS) communicated to the farmers on every day, daily weather data and weather forecasting are given to the newspapers on phone call. Agro advisory bulletin (bi-weekly) is prepared and sent to all government bodies, NGO's, Kisan helpline, ETV, All India radio etc. through E-mail and is uploaded on the website working on office day and time. The rising weather risks affect the livelihoods of farmers and GDP growth of the country. Under increasing threat condition, it is becoming increasingly important for farmers to proactively manage the weather and climate risks to agriculture to protect their livelihoods.

Key word: AAS, Agro advisory bulletin, Climate change, Livelihood, Weather forecast

RESPONSE OF SPRING SWEET CORN TO MOISTURE CONSERVATION PRACTICES

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An experiment was conducted during spring season of 2017 and 2018 at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar to investigate the effect of irrigation scheduling, method of establishment and moisture conservation practices in spring season sweet corn. Popularity of sweet corn is increasing amongst the farmers due to short duration and high economic returns. Sweet corn crop besides providing green cobs also produce good quality fodder for milch animals. High ET owing to high temperature during spring season enforces high irrigation frequency which leads to high cost of cultivation. Irrigation was applied at three ratios (IW: CPE of 1.0, 1.2 and 1.4). Sowing was done in flat plots and furrows and moisture conservation practices like biochar @ 3.0 t/ha and mulch @ 6.0 t/ha was adopted. Sweet corn responded significantly upto IW: CPE ratio 1.2 requiring total 8 irrigations. IW: CPE 1.2 and 1.4 were found to be statistically at par with each other but superior to 1.0. Furrow sowing saved 25% irrigation water. Among the moisture conservation practices, biochar and mulch recorded superior value in terms of yield (5.2 % and 5.8 %, respectively) and irrigation water use efficiency than control. Biochar and mulch treatments did not differ significantly for green cob yield.

TECHNOLOGICAL ADVANCEMENT IN PLANT DISEASE DIAGNOSIS

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Plant diseases cause substantial losses in yield of plants, leading to huge economic losses. Accurate identification and diagnosis of plant diseases are very important in the era of climate change and globalization for food security as well as prevention of the spread of invasive pests/pathogens. In addition, for an efficient and economical management of plant diseases accurate, sensitive and specific diagnosis is necessary. Further, traditional methods of scoring disease severity are not reliable for estimating disease in the population due to lack of uniformity and requirement of expertise in the procedure. The science of plant disease diagnosis has evolved from visual inspection and identification of plant diseases to detect with high-throughput serological techniques like enzyme-linked immunosorbent assay (ELISA) and molecular methods such as polymerase chain reaction (PCR) and their variants. Diagnosis technique like the lateral flow-ELISA is applicable at the field or at any part of the production and distribution system; for instance, is widely utilised for *Phytophthora infestans*, *Ralstonia solanacearum*, tomato mosaic virus and many other pathogens. With the applications of bioinformatics in plant pathology, identification of specific motifs, DNA sequences has become possible, which ultimately increase the accuracy of modern techniques in plant disease diagnosis. Though advances have been made in every aspect of diagnosis of plant diseases; increasing sensitivity and specificity have remained the key area for development.

JATROPHA BIODIESEL : FUTURE SUSTAINABLE FUEL**DEEKSHANAROLIA***Institute Of Agricultural Science, Bundelkhand, University, Jhansi*

Jatropha oil is produced from the seeds of the *jatroha curcas*, a plant that can grow in wastelands across India, and the oil is considered to be an excellent source of bio diesel Jatropha cultivation and will provide much needed employment to the rural poor of India . Businesses are also seeing the planting of Jatropha as a good business opportunity. Increased Jatropha oil production delivers economic benefits to India on the macroeconomic or national level as it reduces the nation's fossil fuel import bill for diesel production ,minimising the expenditure of India's foreigncurrency reserves for fuel allowing India to increase its growing foreign currency reserves .The study has revealed that jatropha plantation in India is economically viable Since the cost needed for plantation is relatively lower The plantation activities would become attractive for the grower .The plant has potential to be grown on unused, under-utilized and marginal land and Relatively tolerant to drought and pest.Jatropha meal after oil extraction can be used as fertilizer or for energy production .Significantly detoxified Jatropha kernel meal can be used in production of bio-based industrial products like bio glue therefore it can be said as a FUTURE SUSTAINABLE FUEL

KEYWORDS: *jatropha curcas* , bio diesel, tolerant, sustainable fuel

VERMICULTURE BIOTECHNOLOGY SOCIO ECONOMIC DEVELOPMENT OF HUMAN HEALTH AND ENVIRONMENT BY THE USE OF EARTHWORMS**DEEPA JOSHI, GIRISH CHANDRA***Department of Agriculture , SGRRU, Dehradun, Uttarakhand- 248001*

A revolution is unfolding in 'vermiculture biotechnology' for achieving quicker and cheaper solutions to several environmental , economic and social problems plaguing the human society from sustainable waste management. The recovery of nutrients by modification of wastes like municipal solid waste , industrial solid waste, agricultural residues and animal wastes ,etc. is important for their management and for reducing environmental degradation. Recycling of organic wastes through vermicomposting biotechnology is an emerging trend as an "environmental sustainable" , "economically viable" and "socially acceptable" technology all over the world. Vermicomposting of solid wastes can divert 60-70 % MSW from landfills. Earthworms and their excreta (vermicast) are miracle growth promoters producing highly nutritive and health protective foods while also protecting crop plants from pests and diseases. Sir Charles Darwin wrote that ' no other creature on earth has done so much for mankind ' as the earthworms. Vermicomposting is a sustainable technique for solid waste disposal. Apart from abatement of environmental pollution, such reuse of organic wastes in agriculture helps in the improvement of various physical, chemical and biological properties of soil and thus helps in sustaining soil health. Despite the major advances have been made ,but there is still a need and scope to undertake investigations in this technology and identification of a group of microorganisms which have profound effects on maintaining soil health and increasing crop production. Vermiculture appears to be a novel sustainable technology for waste treatment which has a great future in the field of organic waste management.

TO STUDY THE INFESTATION OF MELOIDOGYNE JAVANICA IN OKRA**DEEPAK KUMAR AND K. K. VERMA***Department of Nematology, CCS Haryana Agricultural University, Hisar-125004*

Okra, *Abelmoschus esculentus* L. (Moench), belongs to the family Malvaceae is one of the warm season crop grown in the tropical and sub tropical regions of the world. Okra contains very high sodium content and is a rich source of vitamin A and B. Root-knot nematodes (*Meloidogyne* spp.) are major constraint in growing of okra crop successfully in tropical and subtropical regions, and infected plants remain stunted, exhibiting signs of nutrient deficiency and characteristics large irregular swellings on both primary and secondary roots. Root-knot nematodes are poikilothermic organisms and their development is usually dependent on temperature. Extensive research has shown that rates of *Meloidogyne javanica* embryonic and post-embryonic development, pathogenic level and life cycle are strongly influenced by temperature and relative humidity. The present investigation was conducted in screen house of Department of Nematology at Chaudhary Charan Singh Haryana Agricultural University, Hisar. Significant reduction in the plant growth parameters and increase of inoculum densities leads to increase in number of root-knots thereby increasing nematode population. The rate of nematode multiplication was reduced with the increase in the inoculum density of *M. javanica*. This might be due to the destruction of root system by the parasitism of root-knot nematode which led the competition for food and nutrition among the developing nematodes within the root system and also due to inability of juveniles to find out new infection sites for subsequent generation.

Keywords: *poikilothermic, inoculum, Meloidogyne* etc.

PROBLEMS OF HERBICIDE RESISTANCE IN WEEDS AND THEIR MANAGEMENT OPTIONS**AUTHOR DEEPAK KUMAR YADAV***Department of agronomy, Institute of agricultural sciences, BHU, Varanasi - 221005*

Weeds play an important role in reducing crop yield, if not managed properly. On an average, almost 1/3 of total crops produce are vanished due to the weed infestation (Rao *et al.*, 2018). Herbicide resistance is the inherited ability of plant or biotype to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type or weed resistance defined and simplified as decreased response the population of a weed species to a herbicide than what an expected or achieved earlier mainly because of long and continued application of the same herbicide. Total crop failure has also been reported due to weeds infestation in upland rice (Reddy and Reddy, 2013). Herbicide use increased more than thirteen-fold (from 16 to 217 million kg) between 1960 and 1981 as more U.S. farmers began to treat their fields with these chemicals. By 1980, more than 90-99% of the U.S. corn, cotton, and soybean area was treated with herbicides as compared to 5-10% of area planted in 1952 (Fernandez-Cornejo *et al.*, 2014). Over reliance on herbicides for weed control has led to rapid evolution of herbicide-resistant (HR) weeds. At present, the use of pesticides in India is quite low and estimated at 0.6 kg/ha as compared to global average of 3 kg/ha (Bhullar *et al.*, 2016). The most common cause of evolution of resistant weeds is by exerting selection pressure on weeds with the use of same herbicide (or herbicides with the same target site of action) year after year (Reddy and Jha, 2016). The resistance against herbicide was reported as early as 1957 against 2,4-D by *Commelinadiffusa* from Hawaii (Hilton, 1957). The first confirmed report was against triazine herbicide in groundsel (*Senecio vulgaris*), was reported in 1968 from U.S.A. In India, *Phalaris minor* developed resistance to Isoproturon during 1992-93 (Malik and Singh 1992-93). This is the most serious case of herbicide resistance in the world with total crop failure particularly under heavy infestation (2000-3000 plants/m²) (Kaur *et al.*, 2016). The herbicide resistance cases reported as follows in different countries - U.S.A. rank first followed by Australia and Canada, India stands at 34th position in case of number of resistant weed flora occurrence. There are currently 491 unique cases (species x site of action) of herbicide resistant weeds globally, with 254 species (148 dicots and 106 monocots). Weeds have evolved resistance to 23 of 26 known herbicide sites of action and to 163 different herbicides. Herbicide resistant weeds have been reported in 92 crops in 70 countries. There are more resistance reported from ALS inhibitor group, total 160 sp. (98 dicots and 62 monocots) followed by Photo system II inhibitors, total 51 sp. (51 dicots and 23 monocots) (<http://www.weedscience.org>, 2018). Accurate and timely diagnosis of the nature and level of herbicide resistance in a weed population and knowledge about the inherent resistance mechanism involved will greatly strengthen the efforts towards devising sound herbicide resistant weed management strategies. New technologies, especially, molecular tools revolutionizing herbicide resistance research. (Nandula, 2016). HR management cannot be attained by single method of approach but can be achieved as combination of weed management like prevention, cultural and mechanical practices with herbicide application with proper dose, method and time of application like IWM practices.

OPTIMIZATION OF FERTILIZER DOSES IN CITRONELLA (CYMBOPOGON WINTERIANUS L.) BASED INTERCROPPING SYSTEMS WITH KHARIF MAIZE AND BAJRA**DEEPAK KUMAR*, A.K. SHRIVASTAVA AND ADESH SINGH¹***Department of Agronomy, College of Agriculture, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.) India*

The field experiment was conducted at CSAUA&T, Kanpur with 09 treatment of cropping systems in different combinations viz., sole citronella, sole maize, sole bajra, citronella + Maize (100% RDF), citronella + Maize (75% RDF), citronella + Maize (50% RDF), citronella + bajra (100% RDF), citronella + bajra (75% RDF), citronella + bajra (50% RDF) in randomized block design with 3 replications. The soil of experimental field was sandy loam in texture with good irrigation and drainage facilities. Sole treatments were fertilized with recommended doses (100% RDF) for these crops and treated as control. The citronella crop (cv. Bio-13) was transplanted on 30 July, 2010 at 60 x 60 cm spacing. The *kharif* Maize cv. P-3441 (Hybrid) and Bajra (86M84) was planted on 10 July 2015 at 60 x 20 cm and 40 x 15 cm geometry, respectively. The *kharif* crops (Maize and Bajra) were harvested on 08 and 12 October 2015, respectively while, the citronella herbs were harvested during the experimental period on 16 September 2015. After harvesting of citronella herbs, distillation was done for oil extraction.

The results revealed that after harvest, organic matter and available nitrogen in the soil was highest in sole maize and intercropping of citronella+maize with 100% RDF and 75% RDF followed by Bajra sole and citronella+bajra intercropping with all the three fertilizer doses i.e 100%, 75% and 50% RDF, respectively. The available phosphorus (P₂O₅) was highest in citronella + maize intercropping system with 100% and 75% RDF fertility level, respectively. The available potash was decreased year by year but the highest potash was found in citronella sole followed by C+M 75% RDF followed by bajra sole (177.5 kg/ha) and C+M 50% RDF. Cultivation of citronella sole crop was superior over sole maize and sole bajra cropping system. In intercropping system, the highest citronella equivalent oil yield was found in citronella + maize 100% RDF followed by 75% and 50% RDF system, respectively. The highest net return was found in citronella + maize 100% RDF and B:C ratio highest is sole citronella 3.79 followed by C+M with 50% RDF intercrop system with B:C ratio 3.75.

STUDIES ON GENETIC DIVERGENCE IN BITTER GOURD (*MOMORDICA CHARANTIAL*.)**DEEPAK MAURYA*, V.B. SINGH, G. C. YADAV AND VEERENDRA KUMAR***Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad- 224 229, (U.P.), India*

The experiment was conducted during spring summer season, 2017 in Eastern Uttar Pradesh, to evaluate the nature and magnitude of genetic divergence among the thirty genotypes of bitter gourd were carried out by using Mahalanobis D² statistics. Thirty genotypes were grouped into 6 different non-overlapping clusters. Cluster III had highest number of genotypes (8) followed by cluster II (7), cluster V (6), cluster IV (5) and cluster I, VI (2) whereas cluster I and VI had only two genotypes.

The highest intra-cluster distance was observed for cluster VI recorded for (123.61) followed by cluster V (91.85), cluster I (69.08) and cluster II (62.75), cluster IV (47.92). The maximum inter-cluster distance observed between cluster III to cluster VI (231.577), which suggested that members of these two clusters are genetically very diverse to each other. The inter cluster values between cluster II to cluster VI (222.683), cluster II to cluster V (220.722), cluster V to cluster VI (205.629), cluster I to cluster VI (187.421), cluster III to cluster V (148.762), cluster II to cluster IV (134.414) and cluster I to cluster V (133.185) were very high.

The minimum inter-cluster distance was recorded in cluster I to IV (91.813) and cluster IV to V (104.356). Highest inter cluster distances, recorded indicated between two cluster pairs greater genetic divergence between the genotypes of those clusters, whereas, lower inter-cluster values between the clusters suggested that the genotypes of the clusters were not much genetically diverse from each other. The intra-cluster means for twelve characters in bitter gourd. Among 12 characters studied, average fruit weight (g) contributed maximum (27.82%) towards genetic divergence followed by fruit yield / plant (18.39%) and fruit length (12.64%) in bitter gourd. Ranking of genotypes based on intra-cluster mean performance for these characters which are major contributors of genetic diversity revealed its usefulness in selecting parents for heterosis breeding.

CANOPY MANAGEMENT IN “KING CHILLI” AT NORTH EASTERN CONDITIONS (*CAPSICUM CHINENSE* JACQ.)**DEEPAK RANJAN PRADHAN^{1*} AND ASHOK KUMAR MEENA²**^{1,2}*Department of Horticulture, Assam Agricultural University, Jorhat-785013*

King chilli (*Capsicum chinense* Jacq.) is wonderful gift of nature as its fruit is one of the hottest chillies in the world and at the same time it possesses a pleasant and palatable aroma. It is also called as “Naga Jolokia” Bih Jolokia, Ghost chilli pepper and *Bhut Jolokia* is extensively cultivated in North Eastern region and cannot be grown in any other parts of India. In 2007, Guinness World Records certified the *Bhut Jolokia* the world's hottest chilli pepper with more than 1 million Scoville Heat Units (SHUs), 401.5 times hotter than classic Tabasco sauce with a hotness of 2,500-5,000 SHUs. Canopy management is a practice that balances the reproductive and vegetative processes of the plant. In an experiment in which King chilli plant was trained to single stem, double stem and multistem by using bamboos. It was found that plants with double stem or multistem plant produced more fruits as compared to untrained and single stem trained plant. The double stem trained plants get more space for the proper growth of the fruits and they bear more number of fruits and also they develop excellent colour of fruit. Also, this system is more effective in case of greenhouse condition as compared to open field condition.

Key words: Canopy management, Training, Growth, Greenhouse

INFORMATION TECHNOLOGY PENETRATION IN AGRICULTURE IN AGRA (UTTAR PRADESH)**DEEPIKA TIWARI¹ JAGADISH ADITYA DINAKAR²***Institute of Agribusiness Management, Bikaner, Keywords: IT Penetration, Smart Phones*

Information and agriculture were considered to be different with each other in previous years but now the scenario has changed. Today information is required in every area of agriculture. In the area of agriculture, the potential of information technology (IT) can be identified broadly under two heads: (a) it contributes directly to agricultural productivity and (b) and indirectly to empower farmers so that they can take information and make decisions based on the information. This will help farmers to face market situations; It acts like decision support system for farmers. In developed countries, the agricultural productivity is very high because of uses of IT information in precision farming. Agriculture output is increasing in developed countries with the use of remote sensing, various kinds of satellite technologies, agronomic practices etc. The farmers having large area of land are using this kind of approach. Farmers are also take up this kind of activity as an corporate approach. Today, in India the benefits of IT in agriculture are exploited and farmers are not using because of awareness. Farmers are still using traditional practices, that is why their production is very less. The Indian farmer urgently requires timely and reliable sources of information inputs for taking decisions. To remain successful in market, farmers should incorporate these

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IT related practices in agriculture. This paper examines the extent of usage of smart phone by farming community, their socio-economic group and also examines what kind of information are disseminated by companies to farmers

EVALUATION FOR COLIFORM CONTAMINATION OF DIFFERENT HILLY SPRING WATER SOURCES IN AND AROUND THE CITY NAINITAL, WESTERN HIMALAYA

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Nainital is an internationally recognized tourism hot spot lying at the elevations ranging from 1938-2611 m above sea level within the state of Uttarakhand in the Western Himalayan region of India. The daily water requirements for the local need depend solely on natural lake in the basin while few other water springs in the hilly regions of the city also provide adequate fresh water sources for drinking purposes. Traditionally, spring water is considered clean and pure due to the natural filtering that occurs during infiltration and its movement through shallow and deep aquifers. However, the possibility of contamination by humans and wildlife is always there. Keeping this in view, the present study aimed to evaluate coliform contamination of fresh water springs and their suitability for drinking and other domestic purposes. Water samples were collected aseptically on a monthly basis in sterilized containers from ten hilly springs in the study area from January to June, 2018. The samples were analyzed for microbial parameters like total plate count (TPC), and presumptive test to detect the presence of coliform bacteria in water samples. Of the total samples evaluated, water samples collected from two water springs exhibited green metallic sheen on EMB indicating the presence of fecal coliform bacteria i.e., *E. coli* rendering the water sample as contaminated. This study provides updated information on the spring water contamination in hilly areas which seeks an immediate action in order to improve the bacteriological quality of these mountainous spring water sources.

Keywords: Spring, drinking water, *E. coli*, Eosin Methylene Blue.

PLANT QUARANTINE IN INDIA

DHARM BEER, RAVINDRANATH NISHAD, SURYA PRATAP SINGH, RAVISHANKER, AJEET KUMAR

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To prevent the entry, establishment and spread of exotic pests in India as per the provisions of The Destructive Insects & Pests Act, 1914. These are documents issued by an official of an exporting country, or country of re-export, attesting to the freedom from pests and admissibility into the destination country for specific plants or plant products. PRA (pest risk analysis) is a process of investigation, evaluation of information and decision making with respect to certain pests, that starts once it is known or determined that this pest is a quarantine pest. 1st Quarantine work started in 1879 in Fiji and in 1900's. The Agricultural Quarantine started again in Fiji. Plant quarantine is a technique for ensuring disease and pest free plants, whereby a plant is isolated while tests are performed to detect the presence of a problem (Plant quarantine Wikipedia). Two new species of whiteflies (Hemiptera: Sternorrhyncha: Aleyrodidae: Aleyrodinae) intercepted in quarantine on plants from Asia. Two new species of whiteflies are described and illustrated based on specimens intercepted at US Ports of entry. *Aleurolobus tomkinsae* Dooley & Smith *sp. nov.* was intercepted on the leaves of *Berbera koenigii* Linnaeus (Rutaceae) from India and Sri Lanka and on *Magnolia* L. (Magnoliaceae) from Thailand. *Asialeurodes lateropapilliformis* Dooley & Smith *sp. nov.* was intercepted on the leaves of *Syzygium*. Browne ex Gaertn (Myrtaceae) from Indonesia. Head Quarter Directorate of Plant Quarantine and storage Faridabad Started in year 1946. Quarantine is an important protocol for International and National food trading. To prevent dumping of low quality goods in the country and protecting the nation from introduction and spread of exotic pests and diseases.

WEEDS THREAT TO AGRICULTURE PRODUCTION AND SOIL HEALTH

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Weeds are a perennial problem with the farmers. They reduce yield and quality of crops substantially. Weeds are identified as a major biological constraint that hinders attainment of optimal productivity in major crops. Weeds were reported to reduce rice yields by 12 to 98%, depending on type method of rice establishment. Weedy rice (*O. sativa*) has become a serious problem in India, and its spread is largely through the use of contaminated rice seeds. In today's scenario single weed control approach may not be able to keep weeds below an economic threshold level. The escalating problems of herbicide persistence and resistance in weeds associated with the herbicide use have led to the emphasis on integrating herbicides with the physical, cultural, and biological weed management practices for reducing the reliance on herbicides alone. Excessive use and incorrect time of herbicides application may lead to soil degradation and

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environmental problems. Herbicide also affecting soil flora and fauna. They not only competing with the desired plants for the resources (sunlight, nutrients, water, and space) but also provides shelter to hosts and vectors for plant pathogens, giving them greater opportunity to infect and degrade the quality of produce apart from significant reduction in yield of field crops. In India, the highest loss (33%) is caused by weeds, followed by pathogens (26%), insects (20%), storage pests (7%), rodents (6%) and others (8%). The data show that weeds reducing the yield saliently to greater extent hence it is today's most urgent requirement to be monitored continuously (weed flora) to assess the emerging weed problems and plan weed management strategies accordingly.

Key Words: Weed, Herbicides, Weed control, Integrated Weed Management etc

RECENT DEVELOPMENT IN POMEGRANATE

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The pomegranate has been grown since ancient times for its delicious fruits and as an ornamental garden plant for its red, orange or occasionally, creamy yellow flowers. The pomegranate (*Punica granatum* L.) belongs to the puniceae family. It is also known as the *Chinese apple* or *Apple of Carthage* or *Apple with many seeds*. Pomegranate is known as a super fruit of next generation and is a native of Iran to Himalayan region and is extensively grown in Iran, Spain, India and USA as well as in most Near and Far East countries. In India, pomegranate is considered as a crop of the arid and semi arid regions because it withstands different soil and climate stresses. It thrives best under hot dry summer and cold winter provided irrigation facilities are available. Pomegranate fruits are irregular round in shape with coriaceous rinds that vary from yellow, green or pink to bright deep red, depending on the variety and stage of ripening. Pomegranate is a very promising and emerging crop for its refreshing arils, juice and its chemo preventive properties having medicinal value. commercial farming of the pomegranates globally, due to the potential health benefits of the fruit such as its high antioxidant, anti-mutagenic, anti-hypertension activities and the ability to reduce liver injury.

Keywords - ancient, semi arid regions, commercial farming, high antioxidant etc

TELOMERASE: A CELLULAR REVERSE TRANSCRIPTASE

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Telomerase, a cellular reverse transcriptase, has been identified as ribonucleoprotein enzyme complex that maintain telomere length in human stem cells, reproductive cells (gametes) and cancer cells by addition of guanine-rich repetitive sequences onto the telomeres. Telomeres are repetitive DNA sequences at the ends of linear chromosomes. Human telomeres are specialized chromosomal end structures composed of TTAGGG repeats. Telomere length represents a balance between the loss of terminal telomeric repeats, which occurs during cell division with incomplete DNA replication, and the addition of telomeric repeats by the unique RNA-dependent DNA polymerase telomerase. Telomerase and telomeres have been shown to be involved in the control of cell proliferation, the regulation of cell senescence and the unlimited proliferation capacity of malignant cells. They function to protect chromosomes from degradation, fusion and recombination. Since the termini of linear molecules are replicated only in the 5'-3' direction by conventional DNA polymerases and require an RNA primer to initiate DNA synthesis, the removal of the RNA primer results in DNA loss (approximately 50 nucleotides) with each cell division. The gradual and progressive telomere shortening at each replicative cycle is associated, through the activation of pRB and p53 pathways and genomic instability, to the replicative senescence, a non-dividing state and widespread cell death. This review aims on the structure and function of the telomerase-telomere complex and its altered behavior leading to disease, mainly cancer and aims to summarize important results in the rapidly moving field of telomeres and telomerase. Although telomerase therapeutics are not approved yet for clinical use, we can assume that based on the promising in vitro and in vivo results and successful clinical trials, it can be predicted that telomerase therapeutics will be utilized soon in the combat against malignancies and degenerative diseases.

Keywords: Telomerase activity; Ribonucleoprotein complex; ageing; cancer; telomeres

INCIDENCES OF REPEAT- BREEDING AT ORGANIZED DAIRY FARMS IN CATTLE.

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The present study was conducted on the animal of Military Dairy and organized farms at Ranchi. The general and breeding history and animals, presented for Gynecological checkup were recorded in respect of age of animal, number of calving, day past from last calving, nature of estrus cycle, number of insemination done without conception it's were noted. Animals observe to be in estrus for the first or

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second time were considered as normal or fresh animal, and those coming to estrus. For third time or more after insemination were taken as repeat breeding animals. A total of 144 cows were selected. Observed, that the highest incidence of repeat breeding (23.52%) was recorded during the month of February and the lowest (11.90%) during the month of June. The overall incidence of repeat breeding out of total number of 483 cases examined was 16.82 percent. The highest incidence of repeat breeding was observed during monsoon (23.80%) and lowest during summer (13.63%) season. The highest incidence of (42.85%) was observed in first calvers.

Key words: Incidences, Repeat breeding, Cattle, infertility and Season

EFFECT OF DIFFERENT SOWING DATE ON WHEAT.

1*DINKLE RAINA 2*GEETAKANDPAL

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Wheat is a dominant crop. Mainly grown in temperate season used for human food and livestock feed. It is an important cereal crop next after rice. Wheat is grown on more land area than any other food crop. Wheat plant has long slender leaves and stem that are hollow in most varieties. The main aim of this research is to test the hypothesis that the impact of different dates of sowing on crop growth and yield of wheat. Best sowing dates provide favorable temperature to obtain maximum yield. Three varieties of wheat HD 3086, PB550 & HD2967 was selected and cultivated in Phagwara belonging to Punjab region. Early and late sowing is done to grow the wheat crop of different varieties at 10 days interval. Early sown crop mature early than those sown later. Early sown crop reduced from the different types of injuries like drought and diseases other environmental factor like rainfall, temperature humidity Dose of fertilizers like UREA AND DAP are used in 18 plots to enhance the yield and growth of wheat. On the behalf of this research work we conclude that the different dates of sowing like early sowing and late sowing give crop growth and yield of wheat.

KEY WORDS: Crop; Wheat; Variety; treatment;

MEDIA ALTERNATIVES FOR PRODUCTION OF BANANA (*MUSA CAVENDISH* L. CV.G-9) THROUGH TISSUE CULTURE

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The present investigation on Media Alternatives for Production of Banana (*Musa cavendish* L. CV.G-9) through Tissue Culture” was carried out during the year 2015-2016 at Plant Tissue Culture Laboratory, Lokamangal College of Agricultural Biotechnology, Solapur. The data was analyzed using Analysis of variance (ANOVA) in Microsoft Excel at 5% significance level.

The low cost alternative components of tissue culture media were evaluated for their potential to supply nutrients and to support growing explant of Banana cultivar in vitro for their cost effectiveness against conventional high cost media. The Murashige and Skoog (MS) salts and sucrose were replaced by vermicompost (50 g/L), table sugar (30 g/L) and coconut water (70 ml/L), and agar was replaced by filter paper, sand and wheat floor. The conventional MS medium supplemented with 30 g/L sucrose and 8 g/L agar was used as control. A banana cultivar was regenerated on control and combinations of alternative components. MS salts in combination with filter paper as solid matrix was found as very efficient for shoot induction, multiplication and root formation with reducing the cost upto 58.13 %. Vermicompost as nutritive source was found to be very effective in reducing cost of media per plantlet. Table sugar reduced the cost of carbon source drastically by 97 %. Use of such alternatives can reduce the cost of media thereby minimizing the production cost of tissue cultured plantlets.

Key words: Media alternatives, banana, tissue culture

EFFECT OF DIFFERENT IRRIGATION SYSTEM ON GROWTH AND DEVELOPMENT OF WHEAT-CHICKPEA INTERCROPPING

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A field experiment was conducted to determine the growth, development and productivity in Wheat-Chickpea inter-cropping under different irrigation conditions. The experiment was done in 2017-2018 on a sandy loam soil of Lovely Professional University, Jalandhar, Punjab. As the experiment was mainly depends on different irrigation quantity of the sole Wheat-Chickpea crop and intercropping of wheat-chickpea showed immensely variations in different treatments. The highest plant height, leaf size and no of tillers found in the T₂

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during the experiment. The best Irrigated treatment was T₂: RDF + Less irrigation which showed different variation on the growth and development parameters.

Key Words- Chickpea, Irrigation, Intercropping, Wheat

PREFERRED MODE OF PRESENTATION: ORAL**BIOLOGICAL MANAGEMENT OF *PHYTOPHTHORA* BLIGHT OF TARO *COLOCASIA ESCULENTA***

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Colocasia roots carry more calories than potato (100gm of root provide 112 calories) and also is much more superior than other tuber crops and potato in many constituents such as protein, minerals, fiber, phosphorus, iron. *Phytophthora colocasiae* cause leaf blight of taro. The genus is of great historical importance as well as of economic importance. The optimum temperature for growth is 20°C, above 29°C temperature, hyphae die. Asexual and sexual reproduction takes place through zoospore and oospore respectively. Colocasia blight causes heavy loss in yield in kharif season especially in moist places. It is primarily a foliar pathogen but also affects petioles and corm. On leaf numerous light to dark brown spots are formed. The disease appears constantly in epidemic form due to ability of pathogen to survive as soil and seed borne, as a result this disease become difficult to manage with cultural, host resistance and chemical means. Thus, biological management has gained importance as *in vitro* screening of antagonistic microorganism and *in vivo* evaluation of bioagents have been done. Fungal and bacterial microorganisms have been isolated from phylloplane or rhizosphere soil of colocasia and tested *in vitro* for antagonism. *In vivo* bacteria like *Streptomyces albidoflavus* and *S. diastaticus* and among fungi, *Botrytis cineria*, *Trichoderma viride*, *T. harzianum*, *Gliocladium virens* have also seen to reduce its incidence. Rhizobacteria isolated from colocasia rhizosphere soil have been reported to have the ability to completely inhibit the growth of *P. colocasiae* *in vitro*. So, biological management of colocasia blight would greatly help in reducing its severe attack which ultimately help to get good yield.

KEYWORD: Phytophthora, Biological management, colocasia, bioagents, antagonistic

EFFECT OF MICRONUTRIENTS ON SOIL PRODUCTIVITY AND CROP GROWTH

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Soil plays a major role in determining the sustainable productivity of an agro-ecosystem. The sustainable productivity of a soil mainly depends upon its ability to supply essential nutrients to the growing plants. The deficiency of micronutrient has become a constraint to productivity, stability and sustainability of soils. The importance of micronutrients has been realized during the past four decades when widespread micronutrient deficiencies were observed in most of soils in our country, intensive AICRP on secondary, micronutrients and polluted elements in soil and plants, Zn deficiency appeared to be widespread with 49%, B deficiency is next to Zn in order is 33%, 7% and 4% respectively. Micronutrient contents of soil and their availability to plant are assessed by the mineral present and weathering processes. Uptake of micronutrient is affected by the presence of major nutrients due to either negative or positive interactions. Different interaction between macro and micronutrients such as positive interaction of N and Fe, P and Mo, Mo and Zn, and negative interaction between Zn and P. thus, indiscriminate use of macronutrients may affect uptake of micronutrients. Plant uptake their nutrients mostly from soil. It is well known that the optimum plant growth and crop yield depends not only on the total amount of nutrients present in the soil properties like: soil texture, organic carbon and calcium carbonate, cation exchange capacity, pH and electrical conductivity of soil. Micronutrients play an important role in increasing crop yield through their effect on the plant itself, nitrogen fixing symbiotic process and effective use of major and secondary nutrients.

Keywords: micronutrients, sustainability, stability, productivity.

MANAGEMENT OF SHOOT AND FRUIT BORER IN BRINJAL (*SOLANUM MELONGENA*) UNDER SOUTH WESTERN SEMI ARID ZONE MATHURA.

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Brinjal is an important vegetable crop grown in Mathura. The high incidence of shoot and fruit borer reduces its yield drastically. Caterpillars of fruit borers feed inside the tender shoots before flowering and cause wilting of the affected shoots. Grown up caterpillars bore into the fruits. KVK conducted field trial in the year 2017 on 6 locations with 11 farmers covering an area of 4 hectares to manage the

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menace of shoot and fruit borer. Cypermethrin 25% EC a systemic pesticide was used/sprayed on crop before flowering i.e. at 45 days followed by another spray after 15 days of 1st spray i.e. 60 days. The pesticide was found highly promising which controlled upto 93% Catterpillars, while under local practice it was found control/manage 66% shoot and fruit borer, thus, recorded an increase in control of this insects by 40.90%. The 18.57 % increase in yield of brinjal was recorded when compared with local check. This also helped to again economically to the farmers.

EFFECTS OF SIMULATED ACID RAIN ON PLANT, GROWTH COMPOENENTS OF GREEN GRAM (*VIGNA RADIATA LINN WILLZECK CVK 851*) AND BANKLA (*VICIA FABA LINN CV ALL GREEN*)

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The present study has been undertaken to study the effects of Simulated Acid Rain on two important food crops grown widely in India. Most of the investigations on the effects of acid precipitation made so far are based on local vegetation. The main objective is to characterize a relative growth and yield response of these leguminous crops to different concentration of simulated acid rain. The legumes are important food crops for human beings as they are good source of protein, carbohydrate and fats. This research studied the effect of Simulated Acid Rain on plants, growth components of Green Gram and Bankla. Green Gram [*Moong Vigna radiata linn willzeck cvk 851* and Bankla *Vicia faba Linn cv all green (Broad bean)*] are belong to Leguminaceae sub family Papilionaceae.

Simulated Acid Rain was prepared with different concentrations of H₂SO₄ and HNO₃ in the ratio 7:3. The plants were exposed to simulated acid rain of pH 2.5, 3.5, 4.5 and 5.5 with control. The morphological changes including plant height, days and time taken in flowering (No, of days), number of leaves were recorded. All the morphological parameters taken in this study showed decrease trend with decrease pH (increase in acidity). The yield of *Moong* and *Bankla* decreased due to acidic rain.

MOLECULAR MARKER-ASSISTED VEGETABLE CROP IMPROVEMENT

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After a prolonged decline, world hunger appears to be on the rise again. The estimated number of undernourished people increased to 815 million in 2016, up from 777 million in 2015. With the continuing detrimental climate change and shrinking agricultural resources, it is a hard time to offer the world not only food security but also nutritional security. To achieve this paramount task, conventional plant breeding cannot be enough on its own. An amalgamation of conventional plant breeding with the marker-aided technology will be capable to sustain the global demand. Vegetables being assigned with the status of protective foods should be given high priority for improvement as it will act as one of the major key factors in achieving this daunting goal. A molecular marker (DNA marker) is a fragment of DNA revealing mutations/ variations, which can be used to detect polymorphism between different genotypes or alleles of a gene for a particular sequence of DNA in a population or gene pool. The integration of molecular markers in plant breeding activities has given rise to the new discipline described as “smart breeding,” “molecular breeding,” or “marker-assisted breeding”. As in a plant breeding program, a lot of plants have to be evaluated for a number of markers within a relatively short period of time. The high cost of marker genotyping is considered as one of the main factors limiting the wide spread adoption of marker technology in routine breeding programs. Therefore, the molecular marker systems should be amenable to high throughput, and their genotyping cost should be reasonably low. In a long run, conventional plant breeding in conjunction with the potentials of marker technology has a bright prospect for improvement of vegetable crops.

Keywords: Vegetables, nutritional security, molecular markers, marker-assisted breeding

ASSESSMENT OF GENETIC VARIABILITY AND DIVERGENCE IN FIELD PEA (*PISUM SATIVUM L. VAR. ARVENSE*) GENOTYPES FOR IDENTIFICATION OF MOST DIVERGENT LINES.

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The present investigation was conducted at Genetics and Plant Breeding Research Farm of Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) in Augmented Block Design during *Rabi* 2016-17, using ninety genotypes with four check varieties viz. Rachna, HUDP-15, HFP-8909 and HFP-4 to estimate extent of genetic divergence, genotypic coefficient of variance and phenotypic coefficient of variance for different traits. For this purpose data on various quantitative characters was taken out. Analysis of

variance revealed highly significant differences among all the genotypes for majority of traits except pod length, this indicates good amount of genetic variation in the experimental material under investigation. Moderate to high level of genotypic and phenotypic coefficient of variance were observed among the genotypes. Phenotypic coefficient of variance was found slightly higher than genotypic coefficient of variance this indicates very less environmental influence on the expression of the characters. Higher estimates of GCV (22.84) was recorded for pod length (cm) followed by number of pods per plant (20.96), number of primary branches per plant (20.78) and plant height (17.40) this indicates that pod length, number of pods per plant, number of primary branches per plant and plant height may be utilized as selection parameters. Analysis of genetic divergence through Non-hierarchical Euclidean cluster analysis includes TOCHER's and WARD methods. Through the WARD's method all the genotypes were grouped into 10 non-overlapping clusters in which cluster number IV and X were found largest including 12 genotypes while cluster IX was found smallest having 2 genotypes namely Pant P 223 and NDP 14-11. The higher inter cluster distance was observed between cluster number II and VIII (84.837) and between cluster II and V (75.302), this indicates that the genotypes belonging to these clusters are more genetically divergent from each other and inter-mating between such genotypes would produce more heterotic F_1 progeny. On the basis of overall investigation genotypes such as KPMR 936, IPLK 112, EC 384275, Prakash, KPF 1036 and Aman were identified as most divergent.

BIOFERTILIZERS: A NON-CHEMICAL SOURCE OF PLANT NUTRIENTS FOR SUSTAINABLE AGRICULTURE

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Biofertilizers are simply selective strain of beneficial soil microorganisms which apply either by seed treatment or soil application and act as a source of plant nutrients at very low cost. Special feature of these microorganisms are sustainability and eco-friendly action. After application, multiplication of microorganisms occurs which further generate plant nutrients in the soil or rhizosphere for plant use. Biofertilizers are help in recycling of nutrients within the components of environment. It provides "eco-friendly" organic agro-input and it can be expected to reduce the use of chemical fertilizers and pesticides, thus promote organic farming for sustainable agriculture. The use of biological inputs such as N and P-fixing bacteria, mycorrhiza or others are also able to maintain the biological, physical and chemical condition of soil. Soil act as a living system only because of microbial population present in it and without this soil unable to produce food. In recent years, biofertilizers have emerged as a promising component of integrating nutrient supply system in agriculture. Bio-fertilizers could be efficient to increase the growth, yield and quality of agricultural products with very less input cost. Soil microbes are also play some important role in many critical ecosystem processes, including nutrient cycling and homeostasis, decomposition of organic matter etc. Thus biofertilizers can be a better option for sustainable production system if we use it according to the proper methods and precautions.

EMERGING CROPS, NEW CULTIVARS AND VARIETIES FOR SUSTAINABILITY MAGNET OUT SNAPPEAS

ESHANEE, 'SHIVANI CHAUHAN, 'HARNOOR KAUR DHILLON, 'SHUBHAM KUMAR, 'SUNIL KUMAR, 'PRIYANKA AND 'BHALLAN SINGH SEKHON

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Magnet out is a French word meaning 'eat all' and edible pod peas are growing popular worldwide as a new crop for its whole eaten pods. This crop is cool season oriental vegetable which shares the cultivation pattern with the garden pea. They consist of snow peas (*Pisum sativum* var. *macrocarpon*) and sugar snaps/ snap peas (*Pisum sativum* var. *saccharatum*) which can be eaten whole as plump pods and seeds usually by removing the strings along the edges. Snap peas lack the pod parchment or fibre which makes their pod edible and easy to use. These peas are mildly flavoured and may be eaten raw, as salads, lightly boiled, steamed, used in 'stir-fry' and other dishes. They can be grown in varied agro climatic conditions but produce best yields and quality in cool and moist growing conditions. Whole pod edible peas are popular in USA, European countries, China, Japan and in South East Asian countries. In India, in the recent years, it is becoming popular and there is a tremendous scope for its spread as it has rich nutritive value especially Vitamin C, processing potential, crop use efficiency as whole pods are eaten and easy cultivation. Also it has great potential for export and is potential crop for India's economy. There are no final figures available for snow pea cultivation in India. Owing to diverse agro climatic conditions in India snap peas have an edge for round the year cultivation. Especially in hilly areas edible pod peas as an additional off season crop which has demand in urban areas can provide profitable returns to the growers.

Keywords: edible pod peas, export, processing, snap pea, snow pea

ROLE OF BIO-FERTILIZER IN ORGANIC VEGETABLE PRODUCTION**F.A. KHAN, S. NARAYAN, AJAZ A MALIK, K. HUSSAIN, ASTHA¹ AND M. AMIR²***Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar 190025, Distt. Srinagar (J&K)*¹CSAUAT, Kanpur; ²NDUAT, Faizabad

The increased crop production for exponentially growing population puts considerable pressure on land and other natural resources of the world causing damage to the ecological base of agriculture and serious socio-economic problems. The replenishment of huge nutrients lost in crop removal through the use of chemical inputs is not a sound advice as their use on a long run has been found to decelerate the biological activities in the soil causing impaired soil health. Consequently, increasing awareness is being created in favors of organic farming which has emerged as an important priority area globally in view of the growing demand for safe and healthy food and long term sustainability and concerns on environmental pollution associated with indiscriminate use of agrochemicals. Biofertilizers or microbial inoculants can be generally defined as preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilising or cellulolytic microorganisms used for application to seed, soil or composting areas with the objective of increasing the extent of the availability of nutrient in a form which can be easily assimilated by plants. Biofertiliser are the low cost source of plant nutrients, eco-friendly and have supplementary role with chemical fertilizers. They are bacteria, algae & fungi and may broadly be classified into two categories viz. Nitrogen fixing like *Rhizobium*, *Azotobacter*, *Azospirillum*, *Acetobacter*, Blue Green Algae & *Azola* and Phosphorous solubilisers/ mobilisers like PSM & Mycorrhizae. Recently, the Potash mobilisers like *Frateruria aurentia*, Zinc & Sulphur solubilisers like *Thiobacillus species* and manganese solubiliser fungal culture like *Pencillium citrinum* have also been identified for commercial operations. These new strains would also address the issue of 'Fertilizer Use Efficiency' and enhance the efficacy of bio-fertilizers. Now bio-fertilizers are considered as essential components of organic farming and play vital role in maintaining long term soil fertility and sustainability by fixing atmospheric dinitrogen (N=N), mobilizing fixed macro and micro nutrients or convert insoluble P in the soil into forms available to plants, there by increases their efficiency and availability. Bio-fertilizers are one of the best modern tools for agriculture. It is a gift of our modern agricultural science. Biofertilizers are applied in the agricultural field as a supplement to our conventional fertilizers like compost, household wastes and green manure as conventional fertilizers are not as effective as chemical fertilizers. Vegetable cultivation is an important area of agriculture which provide a rewarding income to the growers and helpful in mitigating the malnutrition problem. However, they are heavy feeder of nutrients wherein chemical fertilizers need to be replaced or supplemented by organic and biofertilizers. Use of organic farming system in vegetable production is discussed.

NUTRACEUTICAL VALUE OF SPICES***G. CHANDRA MOHAN REDDY, R.K. GOYAL***Department of Horticulture, College of Agriculture, CCS Haryana Agricultural University, Hisar-125004, Haryana, India.*

Spices are mysterious food adjuncts that have been used as flavoring and coloring agents and as preservatives for thousands of years. Spices have also been documented to own medicinal properties and their use in traditional systems of medicine has been on record for a long time. The nutritional, anti-oxidant, anti-microbial and medicinal properties of spices have far-reaching implications. With the advancement in the technology of spices and on knowledge of the chemistry and pharmacology of their active principles, their health benefit effects were investigated more thoroughly in recent decades. Spices used as a Nutraceutical have great scope for improving human health as well as act as pharmaceutical without ant side effects compare to synthetic drugs.

Key words: Spices, Nutraceuticals, Pharmacology, Anti-oxidant.

A REVIEW ON-INFLUENCE OF ANTITRANSPIRANTS (ATS) IN VEGETABLE CROPS**G. KOTESWARARAO^{1*}, M. SURENDRA BABU², V. SRAVANI³, M. SINDHUJA⁴**^{1&2}Dept. of Vegetable Science, ⁴Dept. of Floriculture & Landscape architecture, ASPEE College of Horticulture & Forestry, Navsari Agricultural University, Navsari, Gujarat, 396450, ²Dept. of PSMA, KAU, Thrissur, Kerala, India

Water is the most abundant compound found in nature and is the most limiting factor in agricultural production. More than 98% of water is lost in the form of transpiration and evaporation. Transpiration is the loss of water from aerial parts of plants in the form of vapor, which is also known as 'Necessary Evil'. It takes place through lenticels, cuticle and stomata. Transpiration is affected by both external and internal factors. Water is a scarce commodity and with the expansion of agriculture, water conservation measures are becoming more important particularly chemical manipulation of transpiration with antitranspirants. Antitranspirants are chemicals sprayed on transpiring plant surfaces with an attempt to reduce water use by reducing transpiration. Depending upon their mode of action, they are stomatal closing type, film forming type, reflectance type and growth retardants. Antitranspirants should have some of the ideal

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properties like non toxic, cheap, stable, long lasting in their effectiveness and they should have some of the assured benefits. Several researchers reported that antitranspirants not only reduce the water loss but also they improve the physiological, disease resistance, quality and yield aspects in many vegetable crops.

Keywords: Antitranspirants, ATs, Vegetables, Growth, Yield

EFFECT OF BORDER CROPS, MICROBIALS AND BOTANICAL ON CHICKPEA POD BORER, *HELICOVERPA ARMIGERA* (HUBNER)

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The present experiment was conducted to study the effect of border crops, microbial and botanical on chickpea pod borer, *Helicoverpa armigera* (Hubner). There were total two sprays taken. On three days after first spray the treatment combinations, Maize + Btk and no border + Btk recorded zero larvae per five plants and found to be best treatments. On three days after second spray the treatment combinations Maize + Btk, Marigold + Btk, Sorghum + Btk, no border + Btk, Sorghum + HaNPV 500 LE ha⁻¹, Maize + *B. bassiana*, Maize + *M. anisopliae*, Sorghum + *M. anisopliae*, Marigold + Azadirachtin, Sorghum + Azadirachtin and no border + Azadirachtin recorded zero larvae per five plants and were found to be best treatment combinations. Three days after second spray the treatment combinations no border + Btk, Sorghum + HaNPV 500 LE ha⁻¹, Maize + Btk, Marigold + Btk, Maize + Azadirachtin and no border + Azadirachtin recorded least per cent pod damage and were at par with each other. At 7 days after second spray the treatment combinations no border + Btk, Sorghum + HaNPV 500 LE ha⁻¹, Maize + Btk, Marigold + Btk, Maize + Azadirachtin, no border + Azadirachtin and Sorghum + Btk recorded lowest per cent pod damage and were at par with each other.

Keywords: *Helicoverpa armigera*, microbial, botanical, chickpea, Trap crop, etc.

SOIL SALINITY: A SERIOUS ENVIRONMENTAL ISSUE FOR PLANT GROWTH AND MICROBIAL TOOL FOR ITS ALLEVIATION

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Salinity is one of the most brutal environmental factors limiting the productivity of crop plants because most of the crop plants are sensitive to salinity caused by high concentrations of salts in the soil, and the area of land affected by it is increasing day by day. There is a need to develop simple and low cost biological methods for salinity stress management, which can be used on short term basis. Salt-tolerant PGPRs have own mechanisms for osmotolerance and could provide a significant benefit to the plants grown in saline soils, in terms of osmotolerance, better growth, vigour and yield. PGPRs enhance plant growth by several different mechanisms such as symbiotic N₂ fixation, solubilisation of mineral phosphate and other essential nutrients, production of plant hormones and other. Bacterial production of 1-aminocyclopropane-1- carboxylate deaminase, induced systemic resistance, ISR and control of phytopathogenic microorganisms in the rhizosphere are also modes of support to the plant. PGPRs mitigate salt stress in crops by enhancing osmolyte accumulation in plants, increasing K⁺ concentration and maintaining a high K⁺ /Na⁺ ratio and scavenging ROS generated by plants with bacterial antioxidant enzymes, etc. Understanding the interaction between consortium of microbial inoculants and plant systems will pave way to harness more benefits from microbial inoculants for improving plant growth and enhancing tolerance to stress.

ENVIRONMENT EFFECT OF AGRICULTURE THE NEED FOR FUTURE OF IPM

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Although IPM has been in participate in principle as the attractive option for the protection of agricultural crops from the ravages of insect and non insect- pests, yet implementation at the farmer's level has been rather limited. Some of the important constraints to wider adoption of IPM and suggested measures to overcome them are given below. Sustainability it is now increasingly that modern agriculture cannot sustain the present productivity levels with can only be by use of holistic pest management programmes. Economics if the cost of pesticide use are taken into account, IPM appears to be a more attractive alternative with lower economic costs. Health production, storage, transport, distribution and application of pesticides involves greater health hazards than the safer inputs and environment used in IPM. This endangers the safety of the entire population. Environment quality the ipm programmes, do not endangers non-target organisms do they pollute the soil, water and air. Social and political stability the pesticides used by the obtained from the corporate

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house and even from other countries. The inputs in IPM are usually on local resources and outside dependence is minimized. This helps in maintaining social and political stability. Local knowledge IPM builds upon indigenous technological knowledge and seeks to build on farmers locally available.

STUDIES ON DEVELOPMENT FROM SQUASH (*CARRICA CARENDAS* L.), GINGER (*ZINGIBER OFFICINALIS* ROSC) AND ALOE VERA (*ALOE BARBADENSIS* MILLER.) BLENDS

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Karonda juice (*Carisa carandas* L.), Ginger juice (*Zingiber officinale* Rosc.) and aloe vera (*Aloe barbadensis* Miller.) gel have nutritional, medicinal and therapeutic values. The karonda juice, Ginger juice and aloe vera gel are used to prepare palatable squash 25 per cent of blend consisting 50 per cent karonda juice, 25 percent ginger juice and 25 per cent aloe vera gel, 50 per cent sugar, 1.25 per cent acidity. Observation on changes during storage revealed that TSS, acidity, reducing sugars, total sugars contents and browning increased whereas, Vitamin-C, non-reducing sugar and organoleptic score decreased continuously with storage period. The syrup prepared from blend of karonda and aloe vera gel could be stored was up to five months under ambient conditions with acceptable quality. Fruits are sour and astringent in taste and are rich source of iron (39.1mg/100g). The karonda fruit also contains good amount of vitamin C (1.6-17.9 mg/ 100g), calcium (21mg/100g), phosphorus (38mg/100g) and protein (1.1-2.25%). Karonda is very useful in curing anemia. The karonda fruits have antiscorbutic properties also. Raw or mature fruits contain high amount of pectin and they are most suitable for pickle making which is liked very much all over the India. These can also be used for making jelly and candy. The wine prepared from ripe fruits contains about 14.5 to 15% alcohol and very much liked by wine fanciers. Ripe fruits can be processed into a squash, syrup or RTS bottled drink.

GENETIC DIVERSITY AND PLANT GENETIC RESOURCES

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Biodiversity refers to variation within the living world, while genetic diversity represents the heritable variation within and between populations of organisms, and in the context of this paper, among plant species. This pool of genetic variation within an inter-mating population is the basis for selection as well as for plant improvement. Thus, conservation of this plant genetic diversity is essential for present and future human well-being. During recent years, there has been increasing awareness of the importance of adopting a holistic view of biodiversity, including agricultural biodiversity, conservation for sustainable utilization and development. These principles have been enshrined in the Convention on Biological Diversity and the Global Plan of Action of the Food and Agriculture Organization of the United Nations. The emphasis is now to understand the distribution and extent of genetic diversity available to humans in plant species, so that the genetic diversity can be safely conserved and efficiently used. It is generally recognized that plant genetic diversity changes in time and space. The extent and distribution of genetic diversity in a plant species depends on its evolution and breeding system, ecological and geographical factors, past bottlenecks, and often by many human factors. Much of the large amount of diversity of a species may be found within individual populations, or partitioned among a number of different populations.

A better understanding of genetic diversity and its distribution is essential for its conservation and use. It will help us in determining what to conserve as well as where to conserve, and will improve our understanding of the taxonomy and origin and evolution of plant species of interest. Knowledge of both these topics is essential for collecting and use of any plant species and its wild relatives. In order to manage conserved germplasm better, there is also a need to understand the genetic diversity that is present in collections. This will help us to rationalize germplasm and develop and adopt better protocols for regeneration of germplasm seed. Through improved characterization and development of core collections based on genetic diversity information, it will be possible to exploit the available resources in more valuable ways.

KEY ROLES OF BIOFERTILIZERS IN SOIL FERTILITY AND PRODUCTIVITY: A BRIEF REVIEW

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Current soil management practices are mainly depends on chemical fertilizers, which reduced the human health and environment. Biofertilizers has become prime importance in agriculture for food security and sustainable crop production. Biofertilizers or microbial

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inoculants defined as preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilising or cellulolytic and lignolytic microorganisms used to increasing the availability of essential macro and micronutrients which can be easily assimilated by plants. Different types of microbial inoculants such as *Rhizobium*, *Azospirillum*, *Azotobacter*, *Azolla* and *BGA* (blue green algae) can add 30-180 kg N/ha year thereby increases 15-25 % of total crop yield. They help in mineral nutrition, water uptake, root development, vegetative growth and atmospheric nitrogen fixation. Some species of biofertilizers such as *Rhizobium*, *BGA*, and *Azotobacter* stimulate the growth promoting substance such as vitamin-B complex, Indole acetic acid (IAA) and gibberellic acid. Phosphate mobilizer or phosphorus solubilizer converts insoluble form of phosphate to soluble form. Mycorrhiza (VAM fungi) helps in uptake of nutrients e.g. P, Zn and S, liberate growth promoting substances to maintain soil fertility and bio-control of soil borne plant pathogens and diseases. They are cost effective, pollution free, eco friendly and renewable energy sources. They improve physical properties of soil, soil tilth; soil health and quality thus, improve soil fertility and soil productivity.

Keywords: biofertilizers, soil fertility, soil productivity, food security.

RECLAMATION OF SALT AFFECTED SOILS

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Soil salinity, a worst hindrance to crop growth and the most common problem of today's era. Soils which possess excessive soluble salts mainly chlorides and sulphates of sodium, calcium and magnesium are termed as saline soils. Soil salinization is mainly due to the use of saline water for irrigation, seepage from the canals, high evapotranspiration rate and poor drainage (due to hard pan). It can easily be recognized by a layer of white crust on the soil surface. Mainly it is found in arid and semi-arid regions. Sodium present in the soil has a dispersing action on the soil particles thus affecting plant growth. The factors contributing to soil salinity are lack of proper drainage facilities, applying heavy dose of fertilizers and even the parent material is also a major contributing factor for that. Soil salinity affects the growth at critical stage and has a long-term effect on soil productivity and in turn crop growth is also affected. Reclamation of these soils is quite essential to achieve better plant stand as well as in improving the soil condition. And this objective can be achieved by either leaching with good quality irrigation water or proper drainage facilities. Reclamation of these soils involve removing excess soluble salts from the root zone such that there is no injury to crop growth due to the osmotic pressure of soil solution. Also, green manuring, use of crop residues, afforestation, use of soil amendments (gypsum or sulphur compounds) and growing of salt tolerant crops (barley, Sugarbeet, cotton, etc.) can also play a key role in this regard.

ABSTRACT FOR THEME 1: RECENT TRENDS IN AGRICULTURAL SCIENCES AND TECHNOLOGY

HYDROGEL: A BOON FOR WATER CONSERVATION

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Labour and water scarcity in India are driving researchers and farmers to find alternative management strategies that will increase water productivity and reduce labour requirement while maintaining or increasing land and water productivity because irrigated agriculture is a major sector affecting water use. Excessive demand coupled with mismanaged water resources and climate change have led to a sad state of affairs. The country's agriculture accounts for approximately 90% of the water consumption and thus, cripples with water stress as a result of unpredictable monsoon and climate change. To put it simply, there's too much demand and not enough supply. So, maximization of water productivity is one of the most important policy in developing countries like India to produce more crop per drop. There is a practically convenient and economically feasible technology i.e. hydrogels, which can help in water threatened agriculture in arid and semi-arid regions of India. It can be used as a technology in water conservation as mitigate water stress, increase water-holding and water use (up to 85% for sand), improve soil permeability, reduce need for irrigation, reduce soil erosion and leaching, ultimately improves plant growth and yield. Hydrogel agriculture technology uses insoluble gel-forming polymers applied directly in soil at the time of sowing of crops in fields or in growth medium for nursery plants. This technology is effective for all crops in relation to soil type and climate of India reporting improvement in growth and yield attributing characters and yield of different field, ornamental and vegetable crops. Agricultural hydrogels are eco-friendly (degrade without leaving toxic residue in plant or soil) and with an addition to water saving they also aid in improving the physio-chemical and biological properties of soil. Hence application of hydrogel may be a fruitful option for increasing agricultural production with sustainability in water-stressed environment. In adopting this technology ensures increased crop yield, high water use efficiency, reduced water and energy consumption.

RESOURCES OPTIMIZATION FOR RICE CROP USING CERES-RICE MODEL IN TARAI REGION OF UTTARAKHAND**GAURAV CHATURVEDI, A.S. NAIN, SHIVANI KOTHIYAL AND SOUPAYAN SAHA***Department of Agricultural Meteorology, G.B. Pant University of Agriculture and Technology, Pantnagar-263145*

Crop simulation modelling is widely accepted as a useful tool for research and management purposes in agriculture. In the study, CERES-Rice model was used to optimize the resources for the rice crop in the field trial experiment that was conducted in the year 2016. The rice varieties that were grown were *HKR-47* and *Pant Basmati-1*. The experiment was laid in Randomized block design (RBD) in three different treatments and three replications. Crop was found to yield more when the crop was transplanted on 25th June, than the crop that was transplanted on 5th July and 15th July. The model prediction was good and there wasn't much difference between the observed and simulated values. Adaptation to climate change consists of initiatives and measures to reduce vulnerability of natural and human systems against actual or expected climate change effects. To combat the effects of climate change on the crop yield, several techniques and measures are adopted and taken into practice. Adaptation techniques using crop simulation models have proved to be a boon for agriculture sector. Climate change scenario i.e. rise in temperature by 1.7 °C during the year 2050 was taken as a strategic intervention to minimize adverse effect of climate change. Changes were made in the transplanting dates, fertilizer application dates and the fertilizer doses which gave significant differences in the output.

Keywords: Adaptation, vulnerability, Climate Change.

EFFECT OF WEANING AGE AND MILK FEEDING LEVEL ON PRE- AND POST-WEANING GROWTH PERFORMANCE OF GANGATIRI CALVES**GAURAV JAIN * AND AJIT SINGH***Department of Animal Husbandry and Dairying, SHUATS Allahabad, Government Veterinary Hospital Chilla Allahabad.*

The objective of the present study was to evaluate pre- and post-weaning growth of Gangatiri calves weaned either at 8 or 12 weeks and offered milk at either 10% or 15% of bodyweight (BW) from birth to weaning. Colostrum fed Gangatiri calves (n = 48) were randomly allocated to four treatments of 12 calves each. Calves were offered milk either at 10% (low-milk) or 15% (high-milk) of BW in two weaning programs (early or late). Early weaned calves were offered milk until Day 35, adjusted weekly for liveweight and then reduced by one-third in each subsequent week until weaned at Day 56 (early weaned). Late-weaned calves were offered milk until Day 63 and were weaned at Day 84 (late-weaned) by reducing milk offered by one-third in each subsequent week. Calves were offered a concentrate ration (21% crude protein and 2.93 metabolisable energy, Mcal/kg) from Day 28 to Day 112. Final BW at 16 weeks was highest (74.6 ± 1.8 kg; $P < 0.01$) in high milk-fed late-weaned calves and lowest in low milk-fed early weaned calves (58.2 ± 1.8 kg). High-milk early weaned and low milk late-weaned calves had comparable final BW (68.7 ± 1.8 vs 72.0 ± 1.8 kg), although lower than that of high-milk late-weaned calves. Thus, offering milk to Gangatiri calves at 15% of BW and weaning at 8 weeks saves milk and labour required for additional days to feed these calves.

Keywords: Gangatiri, calves, weaning age, growth performance.

“EVALUATION OF LINSEED (*LINUM USITATISSIMUM* L.) GERMPLASM FOR IDENTIFICATION OF RESISTANT GENOTYPES AGAINST ALTERNARIA BLIGHT”**GAURAV KUMAR YADAV¹, DHARMENDRA KUMAR²***Department of Plant Pathology, Sardar Vallabhbhai Patel University of Agri. & Tech. Meerut. (U. P.) 250110*

Alternaria blight of is an important disease of Linseed (*Linum usitatissimum* L.) that hampers its productivity and oil content. Studies on symptoms appearance of Alternaria blight of linseed were first appeared on lower leaves as black point that gradually increased in size to become circular to oval or irregular in shape. During severe infections, spots coalesced and covered the large area of the leaves. Microscopic examination of pathogens in diseased tissue revealed that *Alternaria linicola* Groves & Skolko and *Alternaria lini* Dey were two fungi associated with the spots on leaves and capsules. Studies of relative dominance of pathogens associated with the diseased tissue revealed the dominance of *Alternaria linicola* (95.86-98.63%) in comparison to *A. lini* (1.31-4.14%) during different growth period of linseed crop. During study of variability of pathogen, five isolates of *A. linicola* were isolated and variability in growth and pathogenicity were observed. Isolate of Kanpur was found more virulent in comparison to other isolates. Sixty three genotypes were evaluated against this disease under artificial epiphytotic condition to know the level of resistance and susceptibility in different genotypes under artificial inoculated conditions. Out of Sixty three genotypes screened, 2 genotypes namely LCK-152, LCK-7002, rated as resistant, under both the years. While 4 genotypes namely- BUAPUR LOCAL, CR-M-6X22-9, EC-9832, OLC-48 in 2015-16 and 3 genotypes in 2016-17 rated under highly susceptible lines against this disease.

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Key word: Linseed, Alternaria, Isolate, Genotype, Pathogen, Disease.

ECONOMICS OF WHEAT PRODUCTION IN SELECTED DISTRICTS OF WESTERN UTTAR PRADESH

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The present study has been made to work out the cost of cultivation, profitability and production of wheat (grain + straw) in Baghpat, Meerut, Muzaffarnagar and Shamli districts of West Uttar Pradesh. The primary data were collected from 39 sample respondents (farmer and < 2 hectare.) through pre-tested interview schedule. The total cost of cultivation was found to be (80730.70 Rs./hectare). The gross returns received from wheat cultivation was to be ` 97580.16 Rs./hectare on overall farms. Total area of 39 wheat farmers were 24.72 hectare and average area was 0.633846154 hectare. The average net profit, average land preparation cost, average manuring cost, average seed & sowing cost, average fertilizer application cost, average irrigation cost, average weeding & inter-culture operation cost, average plant protection cost, average harvesting cost, average threshing cost, average variable cost, average fixed cost, average total cost, average cost of by-product, average grain cost, average yield cost (grain+straw), average gross return regarding average area *i.e.* (0.633846154 hectare) were found to be `7330.72, `5926.92, `689.10, `2683.51, `272.51, `792.76, `983.82, `4.35, `6801.82, `733.94, `5029.82, `18514.97, `3093.92, `63.91, `27.22, `54.02, and `61850.81 per hectare, respectively on overall farms. The wheat cultivators reported that potential yield could not be achieved due to various production constraints *viz.* lack of technical knowledge regarding soil testing facilities, lack of knowledge of plant protection measures, lack of knowledge of recommended package of practices, irregularity of electricity supply, lack of capital, lack of proper training, disease problems, unavailability of high yielding variety seed and only 3 farmers out of 39 has been applying plant protection chemicals at the time of study. During study the cost of production was founded Rs. 1580.82.

Keywords: Total net profit, cost of cultivation, cost of production.

SOIL HEALTH, LAND RESOURCES AND LAND USE PLANNING AND MANAGEMENT

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Soil health, is also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustain plants, animals, and humans. Soil health is the condition of the soil in a defined space and at a defined scale relative to a set of benchmarks that encompass healthy functioning. It would not be appropriate to refer to soil health for soil-roadbed preparation, as in the analogy of soil quality in a functional class. The definition of soil health may vary between users of the term as alternative users may place differing priorities upon the multiple functions of a soil. Therefore, the term soil health can only be understood within the context of the user of the term, and their aspiration of a soil, as well as by the boundary definition of the soil at issue. Land resources mean the resources available from the land, thus the agricultural land which contain natural fertilizer for growth of the products sown; the underground water, the various minerals like coal, bauxite, gold and other raw materials. Land use planning technique to improve the quality of life in urban areas. This widely adopted technique is one of the most successful methods followed today. According to this various socio-economic activities are allocated space in a particular area, or in other words, areas are assigned based on specific activities based on various parameters which will help in increasing overall efficiency of the urban area. Land-use planning and management is an effective means to ensure that the activities nearby airports are compatible with aviation. Its main goal is to minimize the population affected by aircraft noise by introducing land-use zoning around airports.

Keywords :- Soil health, Land resources, Land use planning, Land management etc.

CROP QUANT: A NEW FRONTIER AUTOMATED PORTFOLIO FOR PRECISION PHENOTYPING, CROP MONITORING AND DIGITAL AGRICULTURE

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Crop Quant is a new an automated technology utilised to throughput phenotyping for crop monitoring and digital and precision agriculture. This technology is utilised for measuring of crop breeding and agronomic practices. High-frequency and high-precision

phenotypic analysis can enable both accurate delineation of the genotype-to-phenotype pathway and the identification of genetic variation influencing environmental adaptation and yield potential. An automated and scalable field phenotyping platform called Crop Quant, designed for easy and cost effective deployment in different environments and preventing crop losses and contributing to food security. To manage in field experiments and crop-climate data collection developed a web-based control system called CropMonitor to provide a unified graphical user interface (GUI) to enable real time interactions between users and their experiments. A high-throughput trait analysis pipeline for phenotypic analyses established so that lightweight machine-learning modelling can be executed on Crop Quant workstations to study the dynamic interactions between genotypes (G), phenotypes (P), and environmental factors (E). These technologies have used since 2015 and reported results generated in 2015 and 2016 field experiments, including developmental profiles of five wheat genotypes, performance-related traits analyses, and new biological insights emerged from the application of the Crop Quant platform.

XOPR T3SS EFFECTOR OF *XANTHOMONAS ORYZAE* PV. *ORYZAE* PLAYS A CRUCIAL ROLE IN SUPPRESSION OF CELL DEATH MEDIATED RICE IMMUNE RESPONSE DURING BACTERIAL BLIGHT DEVELOPMENT

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Bacterial leaf blight caused by *Xanthomonas oryzae* pv. *oryzae* (Xoo) is a major biotic threat to basmati rice production in India. The bacteria suppress the rice innate immune responses by secreting effector proteins directly into the rice cells through type III secretory pathway. XopR one of the core effectors in Indian Xoo strain (race 4), was studied with particular reference to its participation as suppressor of plant defense responses including plant cell death (PCD). We constructed a null mutant for *xopR* gene in Xoo strain using a double crossing over based homologous recombination strategy. We experimentally confirmed that PCD in rice suppressed by the XopR. We further confirmed that PCD induction was compromised when XopR was transiently expressed in tobacco leaves, experimental host. This clearly suggests that XopR acts as suppressor of the PCD mediated defense response of rice events during infection. This apparently helps Xoo to get invaded in plant tissues for its sufficient multiplication. Altogether our study leads to the understanding that XopR T3SS-effector is essential for Xoo to suppress PCD and thereby it supports the *in planta* colonization of Xoo during blight pathogenesis.

Key words: *Xanthomonas oryzae*, T3SS, Phylogenetic analysis, PCD, EYFP.

COMPARATIVE ANALYSIS OF CARBOHYDRATES IN *ACACIA NILOTICA* SEED AND SEED PARTS

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Objective: Identification and quantification of carbohydrates for part specific comparative study in *Acacia nilotica* seeds for nutritional and medicinal aspects. **Hypothesis:** *Acacia nilotica* indigenously known as 'Babool' and belong to family Leguminosae. *A. nilotica* has many traditional and ethanobotanical uses. All the plant parts of *A. nilotica* are important, but seeds are rich in phytochemicals viz. protein, sugar, starch, fatty acid, oil, alkaloids, glycosides, steroids, tannins, phenolics, flavanoid and cyclitols with high nutritional value and therapeutic effects viz. anti-microbial, antifungal, anti-pyretic, analgesic, anti-inflammatory, anti-diarrhoea, anti-asthmatic, cytotoxic and anti-diabetic. Carbohydrate is an important group of phytochemical with such nutritional and medicinal properties. Thus, *A. nilotica* seeds and their parts evaluated for carbohydrates to compare the part specific potential for safer utilization to mankind. **Method:** *A. nilotica* seeds along with cotyledon and endosperm were separated mechanically and powdered to 40 mesh. Powdered materials were then extracted in differential solvents viz. hexane, chloroform, acetone, ethanol and water. These extracts were used for qualitative study of carbohydrates. The quantitative estimations viz. total carbohydrate, sugar and starch were carried out in powdered materials according to the standard methods. **Results:** Ethanol and water extracts of seed, cotyledon and endosperm showed the presence of carbohydrates. Quantitative estimation revealed that total carbohydrate and total sugar were high in cotyledon i.e. 17.83% and 4.73% than seed and endosperm respectively whereas total starch was less in cotyledon than seed and endosperm i.e. 2.3%. **Implication:** Study revealed that cotyledon has rich nutritional and medicinal carbohydrates than the seed and endosperm. Thus, it may be specifically and better utilized for carbohydrate rich supplements and for useful bioactive extracts as natural products for sustainable health benefits.

Key words: *Acacia nilotica*, Carbohydrate, Medicinal, Nutritional, Health.

EFFECT OF DIFFERENT PREHARVEST APPLICATIONS ON PHYSIOLOGICAL AND SENSORY QUALITY OF NECTARINE CVS. SNOW QUEEN AFTER HARVEST**GHAN SHYAMABROL^{1*}, KAMAL SINGH THAKUR² AND NARAYAN SINGH THAKUR²**¹College of Horticulture and Forestry, Rani Lakshmi Bai Central Agricultural University, Jhansi-284003 (INDIA), ²Department of Food Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni Solan-173230 (INDIA)

The present study was conducted to see the effect of preharvest application of growth regulators, nutrients and fungicides on physiological and sensory quality of nectarine fruit. All the preharvest treatments showed a beneficial effect on different physiological and sensory parameter of fruits in comparison to control. Among the preharvest treatments, calcium chloride @ 1.5 per cent, Neemazal @ 0.45 per cent, salicylic acid @ 3000 ppm and CPPU @ 15 ppm proved to be most effective in maintaining fruit quality and minimizing deterioration during 28 days storage at 3 ± 1 °C. These treatments were also effective in reducing the respiration rate and enzymatic activities, thereby reducing the overall ripening process and prolonging storage life. Effect of salicylic acid is to be reported first time on nectarine fruits in the study.

Keywords: Nectarine, Snow Queen, sensory parameters, salicylic acid, CPPU, CaCl₂ and neemazal etc.

BIOFORTIFICATION OF WHEAT OR RICE, EFFECT OF WITH FYM AND WITHOUT FYM LEVEL IN RABI SEASON**¹GIRISH GOYAL, ² R. K. DOHAREY, ³NIDHEE SACHAN AND ⁴HEMANT KUMAR GANGWAR**^{1,4}Department of Agronomy, ³Department of Food Science and Nutrition, ²Department of Agriculture Extension, ¹C. S. Azad University of agriculture & Technology, Kanpur, ³Jiwaji University, Gwalior, ^{2,4}NDUA & TKumarganj, Faizabad

Biofortification of wheat and other cereal crops is being urgently addressed and highly prioritized as a research topic fortification is adding vitamins and minerals to foods to prevent nutritional deficiencies. The nutrients regularly used in grain fortification and improve productivity and cognitive development. As wheat is main source of protein and dietary energy for human beings, its potential to support reducing malnutrition related to Fe can be increased through producing genetically modified wheat varieties with high concentration of Fe. Even though during wheat is commonly fortified promising and more long term solution is biofortification of wheat which bases on the production of new wheat varieties with characteristically higher concentration of iron. Till now May researches, which focused on increasing Fe in wheat aimed at producing natural varieties in progenitor or related species. Biofortification of rice with micronutrient is the only tool to reduce micronutrient malnutrition of staple foods whose edible portions are denser in bio available minerals and vitamins. Inclusion of organic amendments (FYM) in fertilizer schedule was found promising in improving the Zn and Fe content of rice. FYM is one of the components of INM as it is a very food organic source of nutrients. It is a cheap and easily available source of organic nutrients for farmers. Integrating FYM with inorganic fertilizer, scientists are getting very good response of the crop. FYM can supply all the nutrients required by the plant, however, with low quantity. It is always advised to apply FYM to the soil along with chemical fertilizer so that the farmers can obtain very good crop yield.

PRESENTLY WHEAT CROP IS IN THE CROWN ROOT INITIATION (CRI) STAGE OR ECONOMIC IMPORTANT AND CLIMATIC REQUIREMENTS**¹GIRISH GOYAL, ² R. K. DOHAREY, ³PRADIP KUMAR SAINI AND ⁴NIDHEE SACHAN**¹Department of Agronomy, ²Department of Agriculture Extension, ³Department of Crop Physiology, ⁴Department of Food Science and Nutrition, ¹C. S. Azad University of agriculture & Technology, Kanpur, ^{2,3}NDUA & TKumarganj, Faizabad, ⁴Jiwaji University, Gwalior

Wheat is a grass widely cultivated for its seed, a cereal grain which is a worldwide staple food the presently wheat crop is in the Crown Root Initiation (CRI) stage in the Northern States of India. Current cool waves in the key producing states are congenial for the wheat crop growth, according to the Agriculture Expert. A turning point came in the history of wheat in 1965 with introduction of dwarf, photo insensitive, high yielding Mexican wheat breeding materials developed by " N.E. Borlaug". In 1970, triple dwarf varieties were released in India. In India, Wheat is second important staple food crop after rice. Wheat grain flour is used in form of chapatti, pure, bread, cake, sweetmeats, halwa etc. It provides 20 per cent of total calories for human race. Wheat grain contains 12.2 per cent protein, which is more than other cereals. Wheat provides characteristic substance "Gluten" which is very essential for bakers. In bakery, gluten provides the structural framework for the familiar spongy, cellular texture of bread and other bakery products. Wheat straw is also a good source of feed for a large population of cattle in our country. Wheat straw is also a good source of bedding material for livestock. Wheat crop has wide adaptability. Rainfall is one of the most important factors, especially when vegetables are grown under dry land conditions. It can be grown not only in the tropical and sub-tropical zone but also in the temperate zone. Dry and cool weather is most suitable for this crop. Adequate soil moisture is necessary for good crop establishment, good yields and good quality. This moisture may be obtained from rainfall or irrigation. The optimum temperature required for ideal germination of the wheat crop ranges from 20 to 25 °C. Rains received

immediately after sowing, hamper germination and encourage seedling blight, while high humidity and low temperature is conducive for rust attack.

PREDICTION OF HETEROSIS BASED ON TRANSCRIPTOME

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Transcriptome is a collection of whole mRNA providing information about the expressed genes in cell at particular time. Using transcriptome analysis, we can analyse the genes expressed in the parents and their hybrids, and determine the correlation between them. There are several techniques for analysing the transcriptome like cDNA library sequencing, microarray hybridisation and RNA sequencing. Among these, recently developed RNA sequencing technique, is the most popular method on account of several comparative advantages over other methods like high sensitivity and ability to detect splicing isoforms. Transcriptome is precursor for the proteome as the proteins are formed from the mRNAs produced in the cell. Analysis of relative mRNA expression levels is very complicated and difficult because of the fact that small changes in mRNA leads to large changes in the total amount of the corresponding protein present in the cell. The transcriptome profiles and DEGs in the F_2 s have been found related to phenotype bias to the positive GCA effect of parent. The transcriptome bias was also demonstrated by analyzing the genes that controlled the specific phenotypes of plant height and flowering, and H3K36me3 modification on global modification or specific signalling pathways. The transcriptome-based prediction of heterosis and hybrid performance can be useful approach in the future because it directly analyses the expression profiles of the genes. This approach utilises the expressed part of the genome which gives direct relationship with the phenotype. The advents in RNA sequencing technology (RNA-Seq) provide an opportunity to conduct in-depth transcript profiling for heterosis studies. Presently, the technology is in infancy but has high prospect of multiple applications in plant breeding.

Key words: Transcriptome, RNA sequencing, DEGs

CROP RESIDUE MANAGEMENT FOR IMPROVING SOIL FERTILITY AND ENHANCING CROP PRODUCTION

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The cultural practices prevailing in the present agricultural scenario pose a very deleterious effect on soil fertility. The land has been used extensively over and over again; use of chemical fertilizers has been increased that has led to the deterioration of the land. The inherent capacity of the soil i.e., soil fertility, is now decreasing day-by-day. Soil fertility can be defined as, “the ability of soil to sustain crop growth in the long-term”. Soil fertility can be determined by the physical, chemical and biological processes that are interlinked to its soil organic matter content and its quality. Decrease in soil fertility is a major constraint towards low productivity. In recent years, concerns towards healthy food production and environmental quality have been increased. The increased emphasis on sustaining the fertility of soils has raised interest in maintenance and improvement of soil organic matter through appropriate land use and management practices. Crop residues are one of the important source of organic matter that are the left-over of the main produce and upon returning it to the soil for nutrient cycling helps to improve soil physical, chemical and biological properties. Its effective management in the field conserves the soil and its resources causing least damage to the environment.

SOIL HEALTH MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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The concept of soil health or soil quality emerged in the 1990's as the pressure on the land increased. Soil quality as “the capacity of soil to function, within land use and ecosystem boundaries, to sustain biological productivity, maintain environmental health, and promote plant, animal and human health. This definition speaks to the importance of managing soils so they are sustainable for future generations. By using management practices that improve soil health and increase productivity and profitability immediately and into the future, Soil disturbance can be the result of physical, chemical or biological activities. Physical soil disturbance, such as tillage, results in bare and/or compacted soil that is destructive and disruptive to soil microbes, and it creates a hostile environment for them to live. Misapplication of farm inputs can disrupt the symbiotic relationships between fungi, other microorganisms, and plant roots. Overgrazing, a form of biological disturbance, reduces root mass, increases runoff, and increases soil temperature. All forms of soil disturbance diminish habitat for soil microbes and result in a diminished soil food web, increase diversify soil biota with plant diversity, increase the use of organic

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manures, organic manures often improve the productivity of soils and the nutritional value of crop grown, minimum use of fertilizers and pesticides, keep a living root growing throughout the year, keep the soil covered as much as possible Soil cover conserves moisture, reduces temperature, intercepts raindrops, suppresses weed growth, and provides habitat for members of the soil food web that spend at least some of their time above ground. This is true regardless of land use. Keeping the soil covered while allowing crop residues to decompose can be a bit of a balancing act.

Keywords: Soil quality, Productivity, Soil temperature, Raindrops

EFFECT OF FOLIAR APPLICATION OF IRON (FeSO_4) AND ZINC (ZnSO_4) ON PLANT GROWTH, FLOWERING AND CORM PRODUCTION OF GLADIOLUS C.V. PUSA VIDUSHI.

GOVIND KUMAR^{*}, V.N. MISHRA^{**}, B. K. CHATURVEDI^{**} AND ANKIT CHAUHAN^{*}

The gladiolus (*Gladiolus grandiflorus*) belongs to the family Iridaceae and sub-family Exioideae. Which is a bulbous cut flower plant of winter season. It is native to South Africa. It being a potential cut flower grown globally for its attractive spike. Its cut flowers are increasing day by day owing to long self life of its beautiful flowers use to on tables in vases and in the decoration of house and also used in bouquet to offering. Keeping these facts in mind the present study was undertaken at the department of horticulture Raja Balwant Singh college, Bichpuri, Agra. During 2013-14. The experimental variety Pusa Vidushi was planted at 30cm. (row to row) $\times$ 25cm (plant to plant) apart. The experiment was conducted under randomized block design having 9 treatment combinations including 3 concentrations of FeSO_4 i.e. (F_0 -0.0%, F_1 -0.2%, F_2 -0.4%) and 3 concentrations of ZnSO_4 viz. Z_0 =0.0%, Z_1 =0.2%, Z_2 =0.4% which were replicated thrice. On the basis of data recorded during experimentation, it was found that significant effect among treatment and maximum enhance in plant height (80.89cm), total no. of leaf per plant (10.92), maximum length of spike (37.78cm), weight of spike (39.73gm), no. of florets per spike (14.55), maximum vase life (16 days) and no. of corms (266667/ha.) were recorded with foliar spray of 0.4% FeSO_4 (F_2) and 0.4% ZnSO_4 (Z_2).

E-NAM :- A SUSTAINABLE AGRICULTURE MARKETING AND EXTENSION PLATFORM FOR DOUBLING FARMER'S INCOME

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Prosperity of Indian agriculture is possible through two ways: one by emphasizing production constraints which leads to greater agricultural productivity and the other by making agricultural produce accessible to the market where it can be sold off giving remunerative prices to farmers. The country has made significant progress in agriculture production, but agriculture marketing and extension is a challenging task which needs to be addressed immediately. e-NAM or national agriculture market is an online marketing and trading platform for purchase and sale of agriculture commodities by buyers, traders, exporters and ultimately benefiting the farming community. The e-NAM was launched on 14 April 2016 with an objective to centralise, streamline and strengthen agriculture marketing and extension sectors in India. It is a common online trading platform to all the stakeholders, the farmers registered in e-NAM gets fair price or high price for their produce on the other hand, the buyers or traders gets quality agriculture produce in bulk at a time therefore this process eliminates the brokers, agents or middlemen. It is considered to be a transformative step which can revolutionise the agri marketing and extension sector in Indian Agriculture sector. Thus linking all the progressive farmers across all the states and involving all the stakeholders can result in doubling the farmer's income and improving the livelihood of farming community.

Key Words: e NAM, Agri marketing, farmers

RESPONSE OF DIFFERENT MATURITY GENOTYPES OF MAIZE UNDER DIFFERENT DATES OF SOWING IN KHARIF SEASON IN HARYANA

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A field experiment was done during *kharif* season to evaluate the response of different maturity genotypes of maize under different dates of sowing in *kharif* season in Haryana. The experiment was laid out in split plot design with four date of sowing (15th June, 25th June, 5th July and 15th July) as main plot and five maize hybrids of different maturity group namely, HQPM-1 (late), HM-4 (medium), HM-5 (late), HM-6 (early) and HM-7 (extra early) in sub plot replicated thrice. The sowing of maize was done by hand dibbling with a spacing of 75 cm $\times$ 20 cm using a seed rate of 20 kg/ha. Ten days advance, normal and 10 days delay sowing being at par recorded significantly higher plant height, dry matter accumulation, crop growth rate (CGR), days to 50 % tasseling, 50 % silking and maturity and grain yield over

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delayed sowings by 20 days from normal sowing. The effect of sowing date had no significant effect on plant population and relative growth rate (RGR). Among hybrids, HQPM-1 recorded highest plant height at harvest followed by HM-4, HM-7, HM-6 and lowest in HM-5. HM-5 recorded highest dry matter followed by HQPM-1, HM-4, HM-6 and lowest in case of HM-7. HM-5 recorded higher CGR from 60 DAS to maturity than all other hybrids. Higher RGR was recorded under HM-4 than all other hybrids. HM-7 and HM-6 took lower number of days to attain 50 % tasseling, 50 % silking and maturity stage. HQPM-1 and HM-5 being at par took higher number of days to 50 % tasseling, 50 % silking and maturity as compared to HM-4. HM-5 recorded highest grain yield (76.3 q/ha). HM-5 produced 17.5, 37.8, 44.9 and 50.1 % higher grain yield over HQPM-1, HM-4, HM-6 and HM-7, respectively

Key words: Date of Sowing, Hybrids, *Zea mays*, Growth studies and yield

EFFECT OF FEEDING TURMERIC (*CURCUMA LONGA*) AND AMLA (*EMBLICA OFFICINALIS*) POWDER ON GROWTH PERFORMANCE OF BROILERS

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Feeding trial was conducted at poultry unit, Department of Animal Husbandry & Dairy Science, College of Agriculture, Pune, in study the effect of feeding Turmeric and Amla (powder) on growth performance of broilers to the different herbal feed supplement either alone or in combination on broiler diet. The treatment groups consisted of control (T0), 0.25% turmeric (T1), 0.5% turmeric (T2), 0.25% amla (T3), 0.5% turmeric (T4), 0.25% turmeric+amlam (T5) and 0.5% and turmeric+amlam (T6) were included in broiler diet. The feed supplement would give better performance. The results of included body weight, body weight gain, feed consumption, feed conversion ratio, cost of feed per kg, and mortality. In the experiment turmeric and amla (powder) were used at the recommended levels (0.25% and 0.5%) in different either alone or in combination in treatments. The results T5 (0.25%) and T6 (0.5%) indicated that turmeric in combination with amla (powder) gave the better growth performance and also economic returns higher T5 (Rs. 54.51/bird) and T6 (Rs. 54.74/bird) compared to control and other groups. The higher dressing percentage (72.20 %) and meat bone ratio (14.36%) were observed in T6 on per cent live weight basis.

Keywords : Broilers, growth performance, body weight, bone ratio

APPROACHES FOR GENETIC ENHANCEMENT OF CULTIVATED SUNFLOWER (*HELIANTHUS ANNUUS* L.) FOR DESIRABLE TRAITS

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Sunflower by virtue of its wide adaptability has established itself as a major oilseed crop in southern part of the country and has also made a dent in non-traditional areas of Northern India in spring season. Effective utilization of sunflower genetic resources resulted in release of 21 varieties/populations and 37 CMS based hybrids through AICRP in India. Despite these successes with the crop, the major problems threatening sunflower productivity in India are the stagnating and unstable yields and vulnerability to various biotic (sunflower necrosis disease (SND), leaf curl virus (SuLCV), *Alternaria* and powdery mildew) and abiotic (drought and salinity) stresses. Plant breeding efforts to develop varieties/hybrids with inbuilt tolerance to the major diseases are constrained by the narrow genetic base of the cultivated sunflower and low utilization of genetic resources. It is evident that identification of broad diversified parental lines and their utilization for maximization of heterosis is the need of the hour. Towards this goal attempts were made during the past decade to augment breeding lines (CMS, R lines and inbreds) from USDA, USA and also wild *Helianthus* species from USDA, USA and IFVCNS, Serbia. Screening of wild *Helianthus* species resulted in identification of both annual and perennial species confirming resistance to major biotic and abiotic stresses in India. Using conventional methods and techniques of crossing, backcrossing and selection, several prebred lines with altered plant architecture, high yield and oil content, maturity duration and inbuilt tolerance to major biotic stresses have been developed using wild sunflowers at IIOR. The paper deals with the efforts being made and approaches followed to broaden the genetic base of cultivated sunflower for various agronomically desirable traits using exotic germplasm and related wild diploid annuals and perennial species. Prebreeding ensures continuous supply of novel and diverse genetic variability derived from wild *Helianthus* species in readily usable form into the breeding pipelines to develop new climate-resilient cultivars with a broad genetic base.

Key words: Augmentation, genetic enhancement, wide hybridization, interspecific derivatives, wild sunflowers.

NUTRIENT MANAGEMENT IN PIGEONPEA BASED INTERCROPPING SYSTEM UNDER RAINFED CONDITION**NEERAJ KUMAR, ATIKAHMAD, RAJESH KUMAR, H. C. SINGH, AND S.F.A. ZAIDI***Department of Agronomy, N.D. University of Agriculture & Technology, Kumarganj, Faizabad 224 229 (U.P.), India*

Pigeonpea is one of the most important and popular pulse crop with Indian farmers especially in view of their sustainability under dry land conditions and their adoptability for pure as well as mixed/ intercropping system. Nutrient management is a key issue in obtaining potential yield of both crops in any intercropping system. Phosphorus is a major essential nutrient required by pulses. Integrated nutrient management mainly aims at the maintenance of soil fertility as a result of nutrients supply to an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible resources of plant nutrients in an integrated manner. Pigeonpea is a long duration, slow initial growth and wider spacing crop so it provides good scope for intercropping of short duration cereals, pulses and oilseeds. Nutrient management in intercropping system is entirely different from sole cropping, as the requirement of each component crop has to be taken care of. Intercropping of pulses with other crops increases nutrient status of soil and improve the soil health (Singh *et al.* 2012). A field experiment was conducted during *kharif* season of 2012-13 to 2014-15 at Agronomy Research farm of N. D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P.). The soil of experimental field was silty loam in texture having 0.29 per cent organic carbon, 155 kg ha⁻¹ available N, 15 kg ha⁻¹ P₂O₅ and 240 kg ha⁻¹ K₂O with 7.76 soil pH. The experiment was laid out in the factorial randomized block design with 3 replications. The treatments were consisted of three intercropping systems (pigeonpea sole, pigeonpea + black gram and pigeonpea + maize). Seeds of pigeonpea and black were inoculated with *Rhizobium*, PSB and Nano biofertiliser (Harit vardan) as per treatment and FYM was also applied as per treatment before sowing. The crops (pigeonpea 'Narendra arhar-1', Black gram 'Narendra Urd-1, Maize 'MM 1107') were sown. Recommended dose of fertilizers for both pigeon pea and black gram was 20:40:0 kg NPK /ha, which was applied as basal at the time of sowing. However, in maize half dose of nitrogen (40 kg/ha) and full dose of P₂O₅ (40 kg/ha) and K₂O (30 kg/ha) were applied as basal and remaining half of N (40 kg/ha) was top dressed in two equal splits, one at knee height stage and another at tasseling stage of the crop under optimum moisture in soil. Fertilizers in intercropping treatments were given as per row arrangements. Recommended package and practices of crop production were followed. Pigeonpea-equivalent yield was calculated by converting the grain yield of black gram and maize into pigeonpea yield on the basis of existing market price of the crops. The higher grain yield of pigeonpea (15.82 q/ha) was recorded under pigeonpea + blackgram intercropping system which was significantly higher to pigeonpea sole (14.03 q/ha) and pigeonpea + maize (10.97 q/ha). Sizable reduction in pigeonpea yield under pigeonpea + maize intercropping system was due to more competition between maize and pigeonpea for space, nutrients, soil moisture and solar energy. Pulses crop seed inoculated with PSB + *Rhizobium* culture along with RDF and FYM increased the grain yield of pigeonpea, black gram and maize. Significantly higher pigeon pea equivalent yield (PEY) (23.47 q/ha) and Rain Water Use Efficiency (5.92 kg/ha/mm) was recorded under pigeonpea + black gram inter cropping system over pigeonpea sole and pigeonpea + maize. Inoculation of pigeonpea and blackgram seeds with PSB and *Rhizobium* culture significantly increased PEY (17.85 q/ha) and RWUE (4.44 kg/ha/mm) over RDF alone. Similarly addition of FYM @ 5 t/ha along with RDF + PSB + *Rhizobium* culture were also significantly increased the PEY (20.32q/ha) over rest of the nutrient management system while at par with addition of harit vardan biofertilizer (21.48 q/ha). Significantly higher values of available nitrogen, phosphorus and potassium were found under the pigeonpea + blackgram intercropping system compared to pigeonpea sole and pigeonpea + maize intercropping system. Under nutrient management system, pigeonpea and blackgram seed inoculation with PSB and *Rhizobium* culture was not significantly increased organic carbon, while, increased significantly N, P₂O₅ and K₂O in soil over RDF. Incorporation of FYM @ 5 t/ha significantly increased the availability of N and P₂O₅ in soil. Higher net return (Rs. 70170/ha) as well as B: C ratio (2.20) were fetched under pigeonpea + blackgram intercropping system than sole pigeonpea (Rs.58407/ha) and pigeonpea+ maize cropping system (Rs.47796/ ha) due to increase in pigeonpea yield and additional yield of blackgram, which resulted in higher pigeonpea equivalent yield (PEY). Maize crop adversely affected the yield of pigeonpea. Similarly highest net return (Rs. 62197/ha and B: C ratio (1.98) was found in N₄. Similar results have been reported by Tiwari *et al.* (2012).

EFFECT OF DIFFERENT LEVELS OF NITROGEN AND SILICA ON GROWTH AND YIELD OF RICE**H. D. RANE*, N. B. GOKHALE, M. C. KASTURE AND ANURADHA HARMALKAR***Department of Soil Science and Agril. Chemistry, College of Agriculture, Dapoli, Dist. Ratnagiri, Maharashtra*

A field experiment was conducted during *kharif* season 2017 at Experimental Farm, Department of Soil Science and Agril. Chemistry, Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri is situated in subtropical region at 17°19' North and 73°1' East longitude having altitude of 250 meters above mean sea level. A field experiment laid out in factorial randomized block design comprising of sixteen treatment combinations with three replicate. The four levels of Nitrogen viz N₀- 0 % RDN, N₁- 40 % RDN through KAB, N₂- 60 % RDN through KAB, N₃ 80 % RDN through KAB and four levels of Silica i.e. Si₀- 0 kg Si ha⁻¹, Si₁- 50 kg Si ha⁻¹ through potassium silicate, Si₂- 75 kg Si ha⁻¹ through potassium silicate, Si₃- 100 kg Si ha⁻¹ through potassium silicate. It was observed that the

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application of 80 per cent RDN through Konkan Annapurna Briquettes (KAB) with Silica @ 100 kg ha⁻¹ which was applied at 7 days after transplanting between four hills was found promising to enhance the growth and yield of *Ratnagiri-24* variety in lateritic soils of Konkan during *Kharif* season.

Keywords: Silica, nitrogen, growth, rice.

MIRACLE PLANT FENUGREEK: A REVIEW

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Fenugreek (*Trigonella foenum-gracum*) is not only a important spices crops but also one of the most promising medicinal herbs, known from ancient times, having nutritional value too. Fenugreek play a important role to cure a number of diseases in human, their green leaves and seeds are used for multipurpose. It is well known for its gum, fibre, alkaloid, flavonoids, saponin and volatile contents. In modern food technology, it is used as food stabilizer, adhesive and emulsifying agent due its fibre, protein and gum content. This crop has the potential to have positive impacts on commercial, agricultural and environmental aspects of agriculture on this continent. In addition to increasing crop diversity this crop will enrich soil by fixing atmospheric nitrogen and would be easy to incorporate into short term crop rotations to help soil conservation and reduce the impact of soil borne pathogens. Fenugreek seeds are a rich source of the polysaccharide galactomannan. They are also a source of saponins such as diosgenin, yamogenin, gitogenin, tigogenin, and neotigogens. About 30% of the seed weight is protein; 5.57.5%, lipids including linoleic acid and linolenic acid; and 15%, galactomannans. The characteristic flavor of the seeds is mainly due to the presence of a small g-lactone, sotolone (volatile compound). Fenugreek has fiber to an extent of 51.7%, containing 19.2% mucilaginous fiber, and 32.5% neutral fiber, that can slow the rate of postprandial glucose absorption. Fenugreek contains approximately 48% saponins and about 1% alkaloids, contributing to bitterness, gastric stimulation, increased acidity, and increased appetite.

BREEDING OF RICE

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Rice accounts for about 20% of the world's total grain production, second only to wheat. It is the primary staple for more than 50% of the world's population. An estimated 90% of production and consumption of rice occurs in Asia where the per capita consumption is about 100 pounds, compared to a world average of about 60 pounds and a US average of about 20 pounds. Rice production in the United States is dominated by six states Arkansas, California, Louisiana, Texas, Mississippi, and Missouri, together accounting for about 99% of the total US production. Other minor producers in the United States include Florida, Tennessee, Illinois, South Carolina, and Kentucky. Arkansas leads the production in the United States, with about 100 cwt of rice produced in 2001 on about 1.61 million acres.

Rice genetics is quite extensive. Color development in rice is complex. Anthocyanin pigmentation is controlled by a complementary genetic system, the C-A-P gene system. C is the basic gene for chromogen production, while A controls the conversion of chromogen to anthocyanin, P, which is variable, determines the site of pigment expression (e.g., Pg, Pm, Ps, Px, etc.). A smooth hull is desirable for mechanical harvesting and processing. Pubescence on the surface of the blades and hull is controlled by a dominant gene, glabrous (*gl*).

Keywords :- rice, production, breeding methods, chromogen production etc.

INTEGRATED WEED MANAGEMENT IN SUNFLOWER (*HELIANTHUS ANNUUS* L.)

AS INFLUENCED BY DIFFERENT WEED MANAGEMENT PRACTICES

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Sunflower has emerged as one of the important oilseed crops in India. Among the production constraints weed infestation is one of the major factors for loss in yield. This crop is a poor competitor with weeds due to initial slow crop growth and wider spacing. The initial crop growth period is the most critical stage at which abiotic or biotic stresses affect the crop yield. Therefore, keeping this in a view an experiment was laid out in a randomized block design consisting ten treatments and replicated thrice at the Research Farm of Tirhut College of Agriculture, Dholi, RPCAU, Pusa, Bihar, India. Treatments constituted viz., pendimethalin @ 0.75 kg a.i./ha (38.7 CS new

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molecule) as pre-emergence, pendimethalin (38.7 CS new molecule) @ 0.75 kg a.i./ha as pre-emergence + one intercultivation at 20 DAS followed by hand weeding at 40 DAS, pendimethalin (38.7 CS new molecule) @ 1.0 kg a.i./ha as pre-emergence + quizalofop ethyl @ 37.5 g a.i./ha at 20 DAS, pendimethalin (38.7 CS new molecule) @ 1.0 kg a.i./ha as pre-emergence + propaquizafop @ 62 g a.i./ha at 20 DAS, pendimethalin (38.7 CS new molecule) @ 1.0 kg a.i./ha as pre-emergence + fenoxoprop ethyl @ 37.5 g a.i./ha at 20 DAS, farmers practice (one hand weeding at 30 DAS), pendimethalin (38.7 CS new molecule) @ 1.0 kg a.i./ha as pre-emergence + one weeding by power weeder at 35 DAS, one weeding by power weeder at 35 DAS, weed free (two hand weeding at 20 and 40 DAS) and unweeded control. *The soil of experimental site was sandy loam in texture with alkaline pH (8.2), medium in organic carbon content (4.5 g/kg) and available N, P and K.* Weed spectrum of the experimental field consisted of three groups of weeds like grasses, sedges and broad leaved weeds. The maximum seed yield (2149 Kg/ha) and straw yield (4971 Kg/ha) obtained under weed free (twice hand weeding at 20 and 40 DAS) had significantly higher value than pendimethalin (38.7 CS new molecule) @ 0.75 kg a.i./ha as pre-emergence + one intercultivation at 20 DAS followed by hand weeding at 40 DAS, pendimethalin (38.7 CS new molecule) @ 1.0 kg a.i./ha as pre-emergence + propaquizafop @ 62 g a.i./ha at 20 DAS, pendimethalin (38.7 CS new molecule) @ 1.0 kg a.i./ha as pre-emergence + quizalofop ethyl @ 37.5 g a.i./ha at 20 DAS. Hence, it may concluded that weed free treatment is efficient ecological acceptable integrated weed management practices are essential to achieve a maximum return while reducing the weed population.

BIOCHAR IN INDIAN AGRICULTURE: PROSPECTS AND CONCERNS**HARDEEP SINGH SHEORAN^{1*} AND HARENDER SINGH DAHIYA²**¹Haryana Space Applications Centre, CCS HAU Campus, Hisar-125004, ²State Agriculture Department, Government of Haryana

Climate is one of the key drivers behind agriculture. As climate change is uncertain, agriculture should be climate smart and must include agricultural management practices which include the use of bio wastes that could be able to sustain or improve our soil health. Moreover, increase in atmospheric carbon level is becoming a challenging task for the scientific community. Worldwide, successful implement strategies are being developing to drop down carbon dioxide level from the atmosphere but climate change is a becoming a bigger threat to civilization day by day which must be tackled. Biochar, due to its aromatic structure and long mean residence time in the soil has the potential for long-term carbon sequestration in the soil and offers a significant tool to reduce CO₂ and GHG emissions. The trend obtained from the research studies carried out across the world raised our hopes of achieving the goal of maintain or enhancing the crop productivity coupled with environmental sustainability. Therefore, we need to raise awareness among the scientific as well as farming community about the use of biochar as a sustainable option for climate change mitigation and adaptation.

Key words: Biochar, Climate change, Mitigation, Adaptation and Environmental sustainability

FLY ASH: A POTENTIAL SOURCE OF NUTRIENTS IN AGRICULTURE**HARENDER SINGH DAHIYA^{1*} AND YOGENDRA KUMAR BUDANIA**¹Agriculture Department, Government of Haryana

Coal among all is one of the important non-renewable resources and is considered as the core raw material for generation of energy and plays a key role in meeting the over increasing fossil fuels demands in India and across the world. However, advances in technological sector are leading to exert a great pressure on our valued natural resources such coal etc. Though in preceding few decades various alternate energy sources have come into the limelight, the use of coal as primary source of energy cannot be counter balanced. Despite of the increased efforts to prevent, reduce, reuse and recycle, the appropriate management of fly ash remains a major issue and it is hard truth that to meet the growing energy demand will continue to create various problems that may be environmental, economic and social. These problems are associated with generation of large amount of fly ash and therefore, lack of its judicious use and proper disposal is in question. It has been proved to be a useful supplement for agricultural application in addition to use in cement, bricks and blocks, road embankments, low lying area filling, mine applications, etc. Fly ash, being a good soil ameliorant and source of major and plant nutrients can significantly improve the physio-chemical properties. *Incorporation of fly ash in agricultural soils is best alternate use or way to dispose it* and studies around the world confirmed that fly ash application in agricultural soils have shown promising results with respect to crop production and possess wide prospects of using fly ash in agriculture while providing safe environment by its safe consumption in agriculture.

Key words: Coal, Fly ash, Environment, Agriculture and Productivity

MATURITY AND MATURITY INDICES OF FRUITS AND VEGETABLES**HARENDRA, ASHOK KUMAR AND ABHINAV KUMAR***Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad*

The principles dictating at which stage of maturity a fruit or vegetable should be harvested are crucial to its subsequent storage and marketable life and quality. Fruits harvested too early may lack flavour and may not ripen properly, while produce harvested too late may be fibrous or have very limited market life. Similarly; vegetables are harvested over a wide range of physiological stages, depending upon which part of the plant is used as food. For example, small or immature vegetables possess better texture and quality than mature or over mature vegetables. Therefore harvesting of fruits and vegetables at proper stage of maturity is paramount importance for attaining desirable quality. The level of maturity actually helps in selection storage methods, estimation of shelf life, selection of processing operations for value addition etc. The term maturity is derived Latin word 'Maturus' which means ripen. It is that stage of fruit development, which ensures attainment of maximum edible quality at the completion of ripening process. The maturity has been divided into two categories i.e. physiological maturity and horticultural maturity. Post-harvest physiologists distinguish three stages in the life span of fruits and vegetables: maturation, ripening, and senescence. Maturation is indicative of the fruit being ready for harvest.

Keywords- maturity, storage methods, attaining desirable shelf life, selection of processing etc.

GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT ANALYSIS IN BITTERGOURD (*MOMORDICA CHARANTIAL.*)**HARISHANKAR, P.K. SINGH, G.C. YADAV***Department of Vegetable Science- NDUA&TKumarganj, Faizabad (222429) U.P.*

Variability, correlation and Path coefficient among eight horticultural characters of twenty bitter gourd hybrids were studied. High genotypic (GCV) and phenotypic coefficient of variation (PCV) was observed for number of fruits per plant, fruit weight and fruit length whereas low GCV and PCV was observed for days to first male and female flower anthesis (days after sowing). For most of the parameters under study, PCV was found to be higher than GCV. High heritability with high genetic advance (GA) was observed for fruit weight, fruit length and number of fruits per plant which is an indicative of greater proportion of additive genetic variance and consequence a high genetic gain from selection. High heritability with low genetic advance was observed for days to first male and female flower anthesis and days to marketable maturity from anthesis, indicated that non-additive gene effects were involved for the expression of these characters. Higher Genotypic and phenotypic coefficient of variation was recorded for number of fruits per plant, fruit weight and fruit length indicated that, these test hybrids exhibited much variation among themselves with respect to these characters offering more scope for selection. PCV and GCV recorded for days to first male and female flower anthesis was low and in agreement with Islam et al (2009). High heritability coupled with low genetic advance, low heritability with high genetic advance or low heritability and low genetic advance offers less scope for selection because of non additive genetic effects. High heritability coupled with high genetic advance showed greater proportion of additive genetic variance and consequence a high genetic gain expected from selection (Devi and Mariappan, 2013).

GENETIC DIVERGENCE STUDIES IN BITTER GOURD (*MOMORDICA CHARANTIAL.*)**HARISHANKAR, P.K. SINGH, G.C. YADAV, D.P. YADAV, VIJAY KUMAR.***Department of Vegetable Science- NDUA&TKumarganj, Faizabad (222429) U.P.*

An investigation was carried out with ten wild and cultivated cucurbitaceous rootstocks viz., Mithipakal (*Momordica charantia* var. *muricata*), fig leaf gourd (*Cucurbita ficifolia*), pumpkin (*Cucurbita moschata*), zucchini squash (*Cucurbita pepo*), sponge gourd (*Luffa cylindrica*), ridge gourd (*Luffa acutangula*), bottle gour (*Lagenaria siceraria*), ash gourd (*Benincasa hispida*), kumatikai (*Citrullus colocynthis*), African horned cucumber (*Cucumis metuliferous*) on two bitter gourd (*Momordica charantia*) scions viz., Palee F1 and CO 1 for resistance against root knot nematode *Meloidogyne incognita* and Fusarium wilt (*Fusarium oxysporum*). The influence of using different rootstocks on the success percentage of grafting, plant growth, earliness, fruit yield and fruit quality of bitter gourd was also studied to select the best graft combination. The grafting technique followed in this study is side grafting. Screening of rootstocks to *M. incognita* under pot culture condition revealed that the rootstocks viz., kumatikai (*Citrullus colocynthis*) followed by African horned cucumber (*Cucumis metuliferous*) and pumpkin (*Cucurbita moschata*) which exhibited resistant reaction and sponge gourd (*Luffa cylindrica*) and mithipakal (*Momordica charantia* var. *muricata*) showed moderately resistant reaction which can be used for grafting in bitter gourd. The results on grafting studies revealed that Palee F1 grafted onto pumpkin rootstock recorded the highest success percentage followed by Palee F1 grafted onto sponge gourd rootstock at 15, 30 and 45 days intervals. From this study pumpkin and sponge gourd could be identified as the best rootstock for grafting with bitter gourd. Evaluation of graft combinations based on the performance of biometric, biochemical and quality traits revealed that the graft, Palee F1 grafted onto pumpkin rootstock was found to be the best as it expressed good performance in terms of earliness, yield and yield contributing traits and quality parameters.

GENETICS OF YIELD AND YIELD COMPONENTS IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) UNDER SALINITY**HARISHANKAR, P.K. SINGH, G.C. YADAV, ANUPAM DUBEY,***Department of Vegetable Science- NDU&TKumargunj, Faizabad (222429) U.P.*

An investigation was carried out with twenty two bitter gourd genotypes collected from different geographical locations under saline soil. The genetic divergence studies based on fourteen quantitative characters resulted in the formation of six gene constellations, with a maximum of fourteen genotypes constituted by cluster I. The eight genotypes viz., MDU 1, CO 1, IC 85643, Bikaneer 1, Bikaneer 3, BGS 1, Vadipatti Local and Paravai Local identified from the six clusters based on genetic diversity were crossed in a full diallel fashion to get fifty six direct and reciprocal cross combinations. All the fifty six F1 hybrids and the eight parents were evaluated for fifteen characters under saline sodic condition to unravel information on the nature and magnitude of gene action, combining ability and heterosis to identify superior crosses for heterosis as well as recombination breeding. Considering the per se performance for the two important traits viz., yield of fruits per vine and leaf sodium: potassium ratio as an index of salt tolerance, two parents (IC 85643 and BGS 1) and six hybrids (IC 85643 X Bikaneer 1, Bikaneer 1 X MDU 1, Bikaneer 1 X Bikaneer 3, Bikaneer 3 X BGS 1, Bikaneer 1 X CO 1 and Bikaneer 3 X Paravai Local) were considered superior. Based on the gca effect, the parent Bikaneer 1 was found to be the best combiner for seven of the fifteen characters studied, including yield of fruits per vine and leaf sodium: potassium ratio. The analysis of genetic components and genetic ratios also revealed the existence of both additive and dominant gene action for majority of the traits. The prevalence of dominant gene action was recorded for yield of fruits per vine and leaf sodium: potassium ratio.

STUDIES ON GENETIC VARIABILITY OF YIELD AND YIELD ATTRIBUTES IN MORPHOLOGICALLY DIVERSE BOTTLE GOURD [*LAGENARIA SICERARIA* (MOL.).**HARISHANKAR, P.K. SINGH, G.C. YADAV***Department of Vegetable Science- NDU&TKumargunj, Faizabad (222429) U.P.*

The present investigation entitled 'Studies on genetic variability of yield and yield attributes in morphologically diverse bottle gourd [*Lagenaria siceraria* (Mol.). was carried out at the Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) with the following five objectives i. To record biodiversity in fruit and seed characters ii. To identify high yielding genotype(s) among morphologically diverse groups of bottle gourd genotypes, iii. To identify association of morphologically distinct bottle gourd genotypes with yield and yield attributes, if any, iv. To study the coefficient of variability, nature & magnitude of heritability, and genetic advance of agronomic traits, and v. To study correlation coefficients among the yield and yield attributes. The experiment was conducted in Randomized Block Design with three replications. Observations were recorded on 12 economic traits viz., node number to first staminate flower anthesis, node number to first pistillate flower anthesis, days to first staminate flower anthesis, days to first pistillate flower anthesis, days to first harvest, average fruits length/polar length (cm), average fruit circumference (cm), average fruit weight (kg), average number of fruits per plant, vine length at the time of last harvest (m), number of primary branches per vine at the time of last harvest and average fruit yield (kg/plant). The highest fruit yield per plant of 7.95 kg, recorded in NDBG-619-11-2 followed by Narendra Dharidar (7.83 kg), NDML-SS-9 (6.66 kg), NDBG-701 (6.22 kg), and NDBG-703 (6.22 kg).

GENETIC DIVERSITY, HERITABILITY AND MORPHOLOGICAL CHARACTERIZATION IN BOTTLE GOURD (*LAGENARIA SICERARIA* MOL.)**HARISHANKAR, P.K. SINGH, G.C. YADAV***Department of Vegetable Science- NDU&TKumargunj, Faizabad (222429) U.P.*

A field experiment was conducted at Vegetable Research Farm, Kumargunj, NDU&T., Faizabad (UP.) during winter season in the year 2016-17 and 2017-18. The present investigation was undertaken with 16 genotypes of bottle gourd for evaluating their performance for various horticultural characters. There was a great deal of significant variation for all the characters among the genotypes. The significantly higher yield in Narendra Shivani (311.53 q/ha) might be due to higher values of yield attributes (fruit set percentage, fruit length, number of fruit per vine, fruit weight and fruit width) followed by Narendra Sanker Lauki. Whereas, the lower yield was found in case of Narendra Jyoti (101.86 q/ha), respectively due to lower yield attributes. High genotypic co-efficient of variation (GCV) was observed for fruit weight (39.48%). In all cases, phenotypic co-efficient variances were higher than the genotypic co-efficient variance. High heritability with high genetic advance in percent of mean was observed for all characters were under additive gene control and selection for genetic improvement for this trait would be effective. Among all the genotypes, Narendra Shivani, Narendra Sanker Lauki, and NS 421 gave promising results. The bottle gourd can be easily distinguished from other pumpkin varieties by its white flowers and

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characteristic fruit, seed and leaf shapes (Cutler and Whitaker, 1967). Bottle gourd variability has been studied by many authors, including Heiser (1979); Marimoto and Mvere, (2004); Marimoto et al. (2005) etc. Studies in India demonstrated the significant regional variability (Sivaraj and Pandravada, 2005). These findings were in line with the results reported by Sakar (2004), who reported fruit size and shape as the most apparently distinguishable morphological traits in the Mediterranean region.

ALLELE MINING AND ITS APPLICATIONS IN CROP IMPROVEMENT**HARIKANT YADAV* AND HIMANSHU CHAUDHARY**

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Allele Mining is an approach that is used to dissect naturally occurring allelic variations or suitable alleles of a candidate gene controlling key agronomic traits which has potential in crop improvement. It helps in tracing the evolution of alleles, identification of new haplotypes and development of allele-specific molecular markers for use in marker-assisted selection (MAS). In general, there are two approaches available for allele mining: (1) Modified TILLING (Targeting induced Local Lesions in Genome) (2) Sequencing based allele mining. TILLING is one of the reverse genetics approach where mutations are induced and useful mutations are detected. Eco-TILLING an extension of TILLING allows the rapid detection of variation in many individuals and is cost effective because only one individual for each haplotype needs to be sequenced. The technology is applicable to any organism including those that are heterozygous and polyploid. Recently, a rapid and cost effective method for detecting novel allelic variants of known candidate on agarose gel and its utility in candidate gene mapping has been described called sequence based allele mining. This technique involves amplification of alleles in diverse genotype through PCR followed by identification of nucleotide variation by DNA sequencing and it would help to analyse individuals for haplotype structure and diversity to infer genetic association studies in plant. Allele mining can be successfully employed for the detection of alternative form of gene of interest in diverse genetic resources and plays an important role in realizing the worth of plant genetic resources.

Key words: Allele mining, haplotypes, marker assisted selection, TILLING, Eco-TILLING, Candidate gene.

INITIATIVE FOR DOUBLING FARMERS INCOME IN HORTICULTURE**HARIOM KATIYAR, S.K. LODHI AND KALPANASINGH**

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Horticulture has emerged as a core sector of agriculture over the past decade, growing steadily in annual area coverage and output. By 2022, 6.5 lakh ha of additional area will be brought under horticulture crops through area expansion and 1.75 lakh ha of additional area will be brought under protected cultivation. Horticulture is seen as optimal option for crop diversification in agriculture. The per unit earning capacity of farmers is much higher than in case of food grains and it also addresses environmental concerns. Nevertheless, most horticultural output requires specialised market linkages and connectivity, post harvest infrastructure and to make this sector more remunerative, there is a need to address the constraints involved. The productivity of vegetables and fruits was negligible in case of aromatic crops and spices. Therefore, there is more need to focus on aromatic crops and spices in state programme as compared to other commodities. Honey production is a potential sector in horticulture; hence apiculture should be integrated with fruit and vegetable production for increasing the income of farmers. Productivity growth in fruits and vegetable was meagre over the past decade. This is only due to non-availability of quality planting material, dwindling status of natural resources, abundance of resource poor farmers and low adoption of modern technologies. The challenge is to enhance productivity by increasing the factor productivity of all the horticultural production inputs, and at the same time sustaining it by adoption of good practices and precision farming principles. Hence, situation specific modern technologies should be identified/developed, refined/validated and popularized. High cost of input in horticulture crops, prevalence of old and senile orchards, unorganized supply chain are the major bottle neck, therefore, adoption of organic agriculture practices and farming system approach should be promoted for decreasing input cost and ultimately increasing the income. Moreover, rejuvenation of old and unproductive orchard and organized marketing are also very important for getting remunerative income. Facilitation of micro-irrigation in horticulture sector in rainfed areas. As reported 30% produce of horticultural crops are being spoiled due to their perishability. So their perishable nature should be judiciously targeted based on assessment of production and availability of market to escape unexpected low prices of produce due to high level of production. Based on a survey, it is found that the major problems faced by horticulture farmers are finance, marketing, labour, storage, maintenance, education etc. Major thrust areas for horticulture development are cluster approach linked with post-harvest management and marketing, market intelligence to promote market led production, quality seeds and planting material, adoption of improved varieties and rejuvenation with improved cultivars, hi-tech horticulture, precision farming and high density plantations to double our farmers income.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**APICULTURE****HARISH KUMAR NAIDU***Maya Group Of Colleges.*

Apiculture, the study and keeping of bees, can be expanded into a small business. Honey has a long and distinguished history in the human diet. Employing both sound beekeeping and business practices can generate a substantial income from the sale of honey. The main objective was to assess the potential of apiculture as an alternative source of income generation through survey and field trials. Cost benefit analysis was also compared with traditional cereal crops production. The field trial employed the construction, baiting and mounting of Kenyan top bar beehives and for the survey; questionnaire was designed to collect information on beekeeping. A profit of GHc 462.00 could be obtained from apiculture using 6 beehives on an acre of land compared to profit of GHc 148.00 could be obtained from an acre of maize farm and with a profit difference of GHc 314.00 proved that apiculture could be a good alternative source of income. Apiculture is a very good business venture as an alternative source of income generation and has potential to improve the economic status of people in the Upper East Region of Ghana. More farmers, women and unemployed youth in the region are advised to take up apiculture to generate more income and improve their economic status. Government agencies such as SADA and NGOs involved in afforestation should also promote apiculture to improve the vegetation of the region.

HORTICULTURAL INNOVATIONS, FOOD PROCESSING AND VALUE ADDITION BREEDING FOR NUTRACEUTICALS IN BELL PEPPER**'HARNOOR KAUR DHILLON, 'SHUBHAM KUMAR, 'SUNIL KUMAR, 'PRIYANKA, 'ESHANEE, 'SHIVANI CHAUHAN AND 'BHALLAN SINGH SEKHON***CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.) - 176062*

Capsicum or bell pepper is a cool season crop. It is mostly eaten in cooked form in India (green capsicum) whereas in USA and Europe it is relished in salads, so red and yellow ones are more popular. Capsicum is also consumed in the form of pickles, baked and stuffed form. Red and yellow capsicum are increasingly becoming popular in India, being used in pizzas and other processed foods. It is low in calories and rich in carbohydrates mainly present in the form of glucose and fructose. It is very rich source of ascorbic acid which can be justified by the fact that about 400gm of raw bell pepper contains enough ascorbic acid to supply daily requirement of nine persons. It is available in wide range of colours like- green, red, yellow, orange, chocolate, purple and blue. It is rich in carotenoids like capsanthin (red), violaxanthin (yellow), lutein (green), quercetin and luteolin. Quercetin plays a major role in combating diseases like cancer and heart ailments. Luteolin nutraceuticals has been isolated from sweet pepper and it has eye benefits. Red pepper and orange pepper are more nutritive than the green ones. These contain eleven times more vitamin A and 4 times more vitamin C than the green pepper. Yellow peppers reduce age related degeneration, risk of prostate cancer, lower cholesterol and blood pressure. Purple peppers support retinal health, boost immune system, reduce tumor growth and fight inflammation. Plant breeding programs in bell pepper are mostly concerned on improving yield, resistance to diseases, tolerance to abiotic stresses, increasing shelf life, developing early and late maturing varieties. With the people becoming aware about the health benefits of consuming colourful vegetables giving origin to the concept of rainbow cultivation it has become imperative that nutraceutical and edible colour rich varieties are bred. This can be accomplished by combining the conventional breeding methods with molecular biology. Identification of sources of variation for nutraceuticals content can be accomplished by screening germplasm collections, evaluating morphological characters and origin, evaluating mutations in key genes. Nutraceutical rich varieties can be developed by identifying important bio-active compounds present in sweet pepper, searching sources of variation with breeding potential and discussion of breeding strategies and developing suitable ideotype.

Keywords: Capsicum, conventional breeding, nutraceuticals, quercetin, rainbow cultivation

SITE-SPECIFIC NUTRIENT MANAGEMENT (SSNM)**HARPUNEET KAUR***L-2017-A-6-M Msc Agronomy, PAU, Ludhiana*

Site-specific nutrient management (SSNM) as developed through partnerships of IRRI with national organizations across Asia provides the principles and pointers that modify farmers to use fertilizer to optimally match the requirements of their rice wheat crop in an exceedingly specific field and season. It aims to attain high yield and high potency of nutrient use, resulting in high money price of the harvest per unit of fertilizer endowed. A lot of the nutrients needed by rice plants come back from the soil however the availability of nutrients isn't ready to meet the nutrient necessities for realizing higher rice yields. The employment of fertilizers is thus, essential to fill the gap between the crop desires for nutrients and also the offer of nutrient from soil. For economical and effective SSNM, the

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employment of soil and plant nutrient standing sensing devices, remote sensing, GIS, call support systems, simulation models and machines for variable application of nutrients play a crucial role. The Leaf colour chart is an efficient tool for adjusting fertilizer N use to field-specific desires of rice wheat for supplemental N. Farmers' historical use of fertilizer P and their possible crop yields will be accustomed estimate field-specific fertilizer P desires. Straw management, soil K-supplying properties and possible crop yields will be accustomed estimate field specific fertilizer K desires. The appliance and management of nutrients are dynamically adjusted to crop desires of the placement and season. The principles of SSNM are referred to as the "4 R", go back to a minimum of 1988 and are attributed to the International Plant Nutrition Institute. They are right product, right rate, right time and right place. The SSNM reduces the wastage of fertilizers by preventing excessive use of fertilizers and avoiding fertilizer application once the crop doesn't need nutrient inputs. It additionally assures that N, P and K are applied within the quantitative relation needed by the supposed crop. Need of SSNM is due to yield stagnation/decline in modern present agriculture, over mining of nutrients, emerging nutrient deficiencies, water quality deteriorations, variations in input levels, development of soil salinity/sodicity/acidity and low fertilizer use efficiency. Challenges to adoption of SSNM are technology and data requirements, availability of fertilizers and variable economic benefit.

The site-specific nutrient management (SSNM) could be a new and helpful thought. This makes the economical utilization of nutrients by crop plants and avoids the wastages of fertilizers. The environmental footprints of chemical fertilizers also are reduced. Farm profit and NUE increase convincingly by victimization this novel thought.

FREEZE DRYING: A EFFECTIVE WAY OF DRYING OF FRUITS AND VEGETABLES

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Freeze drying is the most prominent example of separation by sublimation. In Freeze drying water is removed as vapour from a frozen substance. Freeze drying process is subdivided into three steps i.e. prefreezing, sublimation drying and the secondary drying. Fruits and vegetables are dried to enhance storage stability, minimize packaging requirement and reduce transport weight. Preservation of fruits and vegetables through drying based on sun and solar drying techniques causes poor quality and product contamination. In freeze drying due to the absence of water and the presence of low temperatures, most of deterioration and microbiological reactions are stopped which gives a final product of excellent quality. Industrial application of freezing drying includes some exotic fruits and vegetables, pineapple, Barbados cherry, guava, papaya, strawberries, guava pulp, Mango pulp, Orange juice, passion fruit juice, carrot, capsicum, mushrooms, onion stalk soup ingredients, coffee. Freeze drying at present finds its largest application in food dehydration. A high cost of the freeze-drying still limits the wide-scale application in the food industry.

IMMERSION FREEZING: A NOVEL TECHNOLOGY FOR LONG-TERM STORAGE OF FROZEN FOODS

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Immersion freezing (IF) consists of a food product freezing by direct immersion in a refrigerant that remains liquid throughout the process. Refrigerated aqueous solutions of propylene glycol, sodium chloride, calcium chloride and mixture of sugars and salts can be used as medium of freezing. Immersion freezer consists of a tank with a cooled freezing medium. The product is immersed in this solution while being conveyed through the freezer. This requires a separate mechanical refrigeration system to cool the freezing medium. This process is different from other freezing techniques as the food is in direct contact with the liquid freezing medium, allows intimate contact of every surface of the material with the freezing medium and thus ensures very efficient heat transfer. It is the most rapid way of freezing since liquids have better heat conducting properties than air. The freezing rate of IF is 10 times higher than that of air-blast freezing as it allows rapid nucleation and formation of small ice crystals. The average size of ice crystals is <200 µm. For the successful freezing, product should be greater in density than the solution. IF is ideal for unpacked Fruits, meat and sea foods, also for freezing marinated or glazed products, and for creating a highly adhesive surface for accepting a glaze post-freeze. A commonly seen problem in this freezing system is dilution of the solution with the product, which can change the concentration and process parameters. Thus, in order to avoid product contact with the liquid refrigerant, flexible packaging can be used. The immersion freezing technology improves the overall quality and greatly extends the shelf-life. Therefore, IF should be considered as a promising novel technology for long-term storage of frozen foods.

FLUIDIZED BED FREEZER FOR GREEN PEAS**HARSH P. SHARMA¹, ANURAG NEMA¹, VAISHALI², AND HARSH M. RAVAL¹***College of Food Processing Technology and Bio-energy, Anand Agricultural University, Anand-388110, ²Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut-250110*

Fluidized bed freezing is used extensively throughout the world to freeze various solid food particles ranging in size from peas to strawberries can be fluidized by forming a bed of particles 1-5 in. deep on a mesh belt or mesh tray and then forcing air upward through the bed at a rate sufficient to partially lift or suspend the particles. This tumbling exposes all sides of the food to the cold air and minimizes the resistance to heat transfer at the surface of the food. In some designs there are two stages: after initial rapid freezing to produce an ice glaze on the surface of the food. Formation of glaze is useful for many products having tendency to clump together. There are a number of advantages of fluidized bed freezing over the conventional freezing methods. In fluidized bed freezing heat transfer as well as rates of freezing is very rapid with this; less product dehydration and less frequent defrosting of equipment also take place. A major disadvantage of fluidized bed freezing is that large or non-uniform products cannot be fluidized at reasonable air velocities. Fluidized bed freezing is highly suited to the production of individual quick frozen (IQF) foods.

STUDIES ON SEAWEED GRANULES (SOLIGRO GR.) AND NITROGEN DOSES ON GROWTH AND YIELD OF HYBRID MAIZE CULTIVARS (ZEA MAYS L.)**HARSHITA SHARMA, RAM PYARE AND GAUTAM VEER CHAUHAN***Department of Agronomy, C.S. Azad University of Agriculture & Technology, Kanpur-208002 (UP), India*

Maize (*Zea mays L.*) is one of the most important cereal crops next to wheat and rice in the world. In India, it is third most important crop after rice and wheat. Maize is grown throughout the year in India, but mainly as *kharif* crop. Maize is being consumed both as food and fodder and also required by the various industries to produce agro product. In the present scenario the demand for maize is found to be increasing not only for human consumption, but also as livestock feed and as an industrial raw material. The sudden increased demand in industrial use of maize as bio-fuel production is likely to create an additional demand for maize in the coming decades with the increase in industrial requirements and value-added foods for a growing economy and population, making maize to continue holding its share as a significant crop. New production technologies of seaweed manure with nitrogen doses offer great promise for increasing production to meet the growing demands of consumers and have favorable impacts on physical and chemical properties of soil. Studies have demonstrated that the majority of our food today is lacking in minerals, which is linked with the causes of our major health problems. Organic Seaweed fertilizers include Magnesium, Potassium, Zinc, Iron and Nitrogen-all of which are beneficial for plants, human and livestock. Seaweed has more than 70 minerals, vitamins and enzymes. Being a crop, maize shows relatively high responses to above combination of seaweed manure and nitrogen fertilizer as compared to other staple food crop, hence, Maize crop becomes an interest of study. There arises a strong need to incorporate such strategies that seek to meet future food demands of India's ever increasing population. Such kind of strategy will have to feature the use of novel organic fertilizers such as seaweed.

Key word: Seaweed, Nitrogen doses, Maize cultivars.

IN-VITRO EVALUATION OF SYSTEMIC FUNGICIDES AGAINST *FUSARIUM OXYSPORUM* F. SP. *LYCOPERSICI* AND THEIR COMPATIBILITY WITH BIOAGENTS**HARSHITA¹, ANKITA SINHA², U.K. TRIPATHI¹, SHUBHA TRIVEDI¹, J.B. KHAN¹, ABHISHEK MISHRA¹ AND SUPRIYA DIXIT¹***¹Department of Plant Pathology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, U.P, India-208002, ²Rajendra Prasad Central Agricultural University, Pusa (Samastipur), Bihar, India-848125*

Fusarium oxysporum f. sp. *lycopersici* causing tomato wilt is highly destructive soil borne pathogen and is a major limiting factor in the production of tomato. Application of fungicides is commonly used to effectively control the disease, although they are undesirable due to environmental consequences. To cope with these problems, use of bio-control agents alone or in integration with suitable systemic fungicides may be advised to the farmer as an eco-friendly approach for profitable farming. Therefore, current study was carried out to evaluate different concentrations of commercially available potential systemic fungicides like Topsin M and Carbendazim *in-vitro*, for their efficacy against *Fusarium oxysporum* f. sp. *lycopersici* and to test their compatibility with potential fungal and bacterial bioagents in order to determine whether they can be used in combination. Screening of Carbendazim and Topsin M at three concentrations (50 ppm, 100 ppm and 200 ppm) by poisoned food technique revealed that Carbendazim at 200 ppm has the strongest anti-mycotic potential followed by Carbendazim at 200 ppm showing 96.36 and 94.72 percent inhibition respectively. The compatibility of *Trichoderma harzianum* with systemic fungicides was tested *in-vitro* by poisoned food technique and the results indicated that lesser concentration of

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the two systemic fungicides had lesser inhibitory effect as compared to higher concentration. Topsin M @ 200 ppm showed maximum percent inhibition (80.19) followed by Carbendazim @ 200 ppm and Topsin M @ 100 ppm with 76.92 percent inhibition. Similarly, two potential bacterial antagonists viz. *Bacillus subtilis* and *Pseudomonas fluorescens* were tested *in vitro* for their compatibility with different concentrations of systemic fungicides using well diffusion technique and absence of a distinct inhibition zone around the wells indicated that these two bacterial bio-control agents were compatible with different concentrations (50 ppm, 100 ppm, 200 ppm) of systemic fungicides (Carbendazim and Topsin M).

HYBRID RICE: DEVELOPMENT, CONSTRAINTS AND PROSPECTS A REVIEW

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Rice (*Oryza sativa* L.) is the world's most important cereal crop that is consumed by a large part of the world's population after wheat and maize. It is the staple food for more than half of the world's population and global rice demand is estimated to rise from 8.52×10^8 t in 2035. More than 90% of the world's rice is produced and consumed in Asia. Hybrid rice production is one of the best practically feasible and readily adaptable one options to enhance the productivity. Hybrid rice technology plays important role in increasing the rice production. The main reason for the cultivation of hybrid rice is to obtain better yield followed by higher pricing ability, better taste, higher profitability, suitable for parboiling, better resistance to pests and diseases. The increase in rice yields due to hybrid rice has, in turn, improved food security for an estimated 60 million additional people per year.

Keywords CGMS, EGMS, TGMS, CIMS, Heterosis and Apomixis.

EFFECT OF NUTRIENT MANAGEMENT ON THE PERFORMANCE OF ONION (*ALLIUM CEPA* L.) CV. AGRIFOUND LIGHT RED.

***HEMASOLANKI, **V.N.MISHRA, *DEEPAK KARAN AND *RAJIT**

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Onion (*Allium cepa* L.) Belongs to the family Alliaceae. It is a herbaceous annual for the edible bulb production and biennial for the seed production. Onion is like for its flavour and pungency which is due to the presence of a volatile oil allyl propyl disulphide organic compound rich in Sulphur. Onion bulbs is a rich source of minerals like phosphorus, calcium and carbohydrates. Keeping these importance's the present investigation was conducted at the Department of Horticulture Raja Balwant Singh College, Bichpuri, Agra during 2016-17. The experimental variety was Agri found light red transplanted at 15×10 cm with having 8 treatment combinations viz. T₁(RDF), T₂(100% RDF +Azotobacto), T₃(100% RDF+FYM), T₄(100% RDF+ Azotobactor+ FYM), T₅(80% RDF+ Azotobactor +FYM), T₆(80%RDF+FYM), T₇(80% RDF+ Azotobactor) and T₈(control). The experiment was conducted under Randomized Block Design with three replication. On the basis of analysed data recorded during experimentation, the significant effect was found among between the treatment combinations. The significantly maximum plant height(50.14cm), number of green leaves(8.65), maximum length of leaf(45.53cm), maximum fresh weight of tops at peak stage of growth (45.34gm), maximum fresh weight of bulbs(84.32gm), maximum diameter (6.9 cm) and the maximum bulb yield per hectare(339.58 qt.) Were recorded from treatment T₄(100% RDF +Azotobacter +FYM).

SELECTION FOR YIELD, STABILITY AND RESISTANCE TO WILT SIMULTANEOUSLY FOR DESI CHICKPEA IN NORTH EAST PLAIN ZONE OF INDIA

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Development and use of high-yielding genotypes, resistant to the prevalent wilt (*Fusarium oxysporum*) in a given area is the most practical and cost-efficient individual disease control measure for management of the disease and accordingly genotypes are promoted in next level of trial in particular to AICRP system. Taking consideration of wilt infestation along with genotypic stability and average yield an index has been developed and computed to rank the chickpea genotypes for the promotion of genotypes in next level of the trial. Average yield, genotypic stability and percentage wilt infestation are three components in this index. For stability component additive main effects and multiplicative interaction (AMMI) model is used, as it captures a large portion of the interaction sum of squares and often provides meaningful interpretation of data to support a breeding program such as genotypic stability. Based on the AMMI model, this index has been used to rank the genotypes along with wilt infestation and average yield. This index is the weightage of wilt infestation, genotypic stability and yield component and higher the index value better is the genotypes. The index of 31 promising

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chickpea genotypes, evaluated in North East Plain Zone of All India Coordinated Research Project on chickpea program during 2016-17, were computed with 10% weight to wilt infestation, 10% weight to stability component, and 80% weight to average yield. Ranking of genotypes are done based on this index and genotype CSJ907 with index value 1.1658 was found best genotype followed by BRC-1 with index value 1.1025 and RKG1375 with index value 1.0919. Therefore, these three genotypes may be used by the chickpea breeder for developing high yield, stable and wilt resistance chickpea lines.

EDIBLE COATING IN FRUIT CROPS

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Edible films are defined as a thin layer of material which can be consumed and provides a barrier to moisture, oxygen and solute movement for the food. The material can be a complete fruit coating or can be disposed as a continuous layer between food components. Application of waxes and coatings has long historic background and commercially applied about sixty years ago. Edible films can be formed as food coatings and free-standing films, and have the potential to be used with food as gas aroma barrier. The films can enhance the organoleptic properties of packaged foods provided they contain various components (flavorings, colorings, sweeteners). Components used for the preparation of edible films can be classified into three categories: hydrocolloids (such as proteins, polysaccharides, and alginate), lipids (such as fatty acids, acylglycerol, waxes) and composites. Chitosan is often considered to be the ideal preservative coating for fresh fruit because of its excellent film-forming and biochemical properties. These coatings offer many advantages, such as improved appearance, antimicrobial properties, selective permeability to gases (CO₂ and O₂), good mechanical properties, non-toxicity, non-polluting properties and low cost. The use of edible coatings with certain additives, such as those with essential oils (EOs) incorporated, has been particularly highlighted over the years, because of its effect on extending the shelf life and facilitating the processing and consumption of fruits. Edible coatings create a modified atmosphere around the fruit by providing a semi-permeable barrier to O₂ and CO₂, thereby reducing respiration and oxidation reaction rates. Edible coatings protect perishable fruits from deterioration by retarding dehydration, suppressing respiration, improving the textural quality, helping retain the volatile flavour compounds and reducing the microbial growth. In this way, the application of edible coatings on fresh fruits can provide an alternative method to extend the post harvest life, reducing quality changes and quantity losses, and can also result in the same effect as modified atmosphere storage in modifying the internal gas composition.

Keywords: Edible coating, Postharvest, Shelf life, Quality

STUDIES ON THE INFLUENCE OF FRENCH MARIGOLD IN NEMATODE MANAGEMENT IN BRINJAL CROP.

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French marigold has been found to suppress nematode population drastically in solanaceous crops. It was found that its roots releases chemicals which are nematicidal in nature. Three methods were used to apply French marigold with the aim to suppress nematodes population. In first method double row of brinjal plantation followed by 10 dense rows (4x4cm) of French marigold plant and this sequence was followed in 10 m square area. In the second method alternate planting of French marigold and brinjal Plant was done. In third method around the brinjal plant dense planting of French marigold in triple rows was done. It was found that the first method in which double row of brinjal along with 10 dense rows of French marigold was best in plant growth development and yield. Root development was normal and rarely knots were observed. The second best result was recorded in second method followed by third method. All the treatments were better over Control. The exudate of marigold plant proved entomophagous. The other reason might be high concentration of organic substances which proliferate fungus population and ultimately suppress the nematodes population significantly.

FARMER PRODUCER COMPANY (FPC): A NEW CO-OPERATISM TOWARDS DOUBLING FARMER'S INCOME IN INDIA

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In India, the income received by a farmer from agriculture is insufficient to address agrarian distress and to reduce poverty. Hence, aiming to boost the Indian agriculture, the Government has set this lofty goal of doubling farmer's income by 2022. To achieve this target, collectivization of producers, especially small and marginal farmers, into producer companies to improve their bargaining power

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through backward and forward linkages has emerged as one of the most effective pathways. Farmer Producer Company (FPC) can be seen as hybrid between private company and cooperative society. The producer-company concept is aimed to combine the efficiency of a company with the spirit of traditional cooperatives. The rationale behind Farmer Producer Companies is that farmers, who are the producers of agricultural products, can form groups and register themselves under the Indian Companies Act. FPC aims to integrate smallholders into modern supply networks by minimizing the involvement of middle-men in marketing of produce and reducing the transaction and coordination costs. FPC facilitates various services to its members like financial services, input supply services, value addition services, procurement and packaging services, networking Services etc. Through the Equity Grant Fund scheme, eligible FPCs receive a grant equivalent in amount to the equity contribution of their shareholder members, thus it doubles the overall capital base of the FPC. In a nutshell Farmer Producer Companies if handled and nurtured properly, can make a sustainable long term change in the lives of our small farmers by doubling their income by eliminating vulnerability of the current market and environmental situations.

ROLE OF SYNTHETIC CHROMOSOME TECHNOLOGY IN CROP IMPROVEMENT

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Genetic engineering is a scientific tool used in field of plant, animal and human sciences. Plant genetic engineering technology has changed the face of plant sciences and the first generation of transgenic crops has become the most rapidly adopted technology in modern agriculture. But genetic engineering has some boundaries and therefore still there is a need of new technologies to overcome issues like gene stacking, transgene position effects and insertion-site complexity. The recent strategy that researchers have developed to overcome those boundaries is the development of plant artificial minichromosomes for delivery of large DNA sequences, including large genes, multigene complexes, or even complete metabolic pathways. A minichromosome is an extremely small version of a chromosome that has been produced by *de novo* construction using cloned components of chromosomes or through telomere-mediated truncation of endogenous chromosomes. It has created a new paradigm for all the agricultural researchers to use the minichromosome techniques for crop improvement. Engineered minichromosomes also offer huge opportunity to get better crop performance. With rapidly expanding research in minichromosome as a second generation genetic engineering tool we can hope that it will bring a new generation of improved crop species to meet the global demands. Engineered minichromosomes establish the means to add or subtract multiple transgenes, multigene complexes, or whole biochemical pathways to plants to change their properties for agricultural applications or to use plants as factories for the production of foreign proteins or metabolites.

Key words: Synthetic chromosome, Genetic engineering,

IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND NUTRIENT UPTAKE BY MARIGOLD (*TAGETUS ERECTA*) WITH SPECIAL REFERENCE TO MINIMIZE THE EFFECT OF CHEMICAL FERTILIZERS ON ENVIRONMENT

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The present study, deals about the effect of INM on growth, yield and nutrient uptake by *Tagetis erecta* to minimize the effects of chemical fertilizers. In India, agriculture is the main economic gainer, but after green revolution the traditional agriculture was replaced by modern agriculture. Modern agriculture is good economic gainer and provides the financial growth to the country. This is the one phase of the coin let see another phase of the coin, this Agriculture has degraded the environmental quality in enormous manner. We have exhausted the environmental resources in very short period of time for fulfill the demand of agricultural product for the human being. No doubt agriculture is the necessity for the human being, we can't survive without crop development and variations, but the time has been come to accept the concept of sustainable agriculture for long time survival on the earth planet. INM is the technique to grow crops by the using of minimum amount of chemical fertilizers and resources. In this study we have carried out an experimental research on the effects of nutrient management on the selected crop. By accepting the nutrient management plan, we will be able to give more enhanced and advanced quality of crops to our next generation without causing the degradation of the environmental quality. So INM is the technique of great concern not only for the enhancement the quality of crops but for the human welfare also by which we will be able to provide eco-friendly product to the human society.

Keywords: Sustainable Agriculture, Nutrient management, Environmental quality

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH ATTRIBUTES OF KALMEGH

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**[ANDROGRAPHIS PANICULATA (BURN.F.) WALLNEES]****HIMANSHU VERMA*, M. S. NEGI**, B. S. MAHAPATRA** AND ANIL SHUKLA*****Department of Agronomy, College of Agriculture, GBPUAT, Pantnagar, Uttarakhand, India, Department of Agronomy, College of Agriculture, GBPUAT, Pantnagar, Uttarakhand, India*

A field experiment was conducted during *kharif* season of 2017 and 2018 at Medicinal Plants Research & Development Centre (MRDC) of G. B. Pant University of Agriculture & Technology Pantnagar, District Udham Singh Nagar (Uttarakhand) to study the effect of different nutrient management approaches on growth attributes viz; plant height, number of branches, leaf to stem ratio and leaf area index of *Kalmegh*. The soil of the experimental site was sandy clay loam in texture having high organic carbon, low available nitrogen, high available phosphorus and medium in exchangeable potassium with slightly alkaline in reaction. The experiment was laid out in Split plot design having 3 main plot treatments and 4 subplot treatments and were replicated 3 times. Among main plot treatments No organics, poultry manure @ 5 t/ha and vermicompost @ 5 t/ha and among subplot treatments, different levels of Nitrogen with same P & K per hectare viz: 0: 50: 50, 50: 50, 75: 50: 50 and 32.5 + 32.5: 50:50 kg NPK per hectare were there. Application of organics and different levels of nitrogen with same P & K kg per hectare had a significant effect on growth attributes viz, plant height, number of branches, leaf to stem ratio and leaf area index etc. at all the stages of crop growth during both the years. Significantly more growth of *kalmegh* plant was recorded in plots treated with vermicompost @ 5 t/ha as compared to poultry manure @ 5 t/ha and no organics. Among sub plot treatments, significantly higher growth trend of the crop was recorded in the plots treated with split application of 75 kg N/ha (half as basal application and half as top dressing at 25 DAT) with same P and K per hectare over 0: 50: 50, 50: 50, 75: 50: 50 kg NPK per hectare.

INTEGRATED FARMING: AN OPPORTUNITY TO CONQUER CLIMATE CHANGE**HITESH MUWAL¹, DWARKI LAL² AND VINOD BHATESHWAR³***Department of Animal Husbandry & Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 221005 (U.P.), India, ³ Department of Animal Husbandry & Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 221005 (U.P.), India*

Fish provides food, income, employment, and trade in fishery products contribute to poverty reduction and national economic growth in many developing nations. Fishery is, threatened by the effects of warming: changes in ocean currents, precipitation that affects lake levels, river flows, increasing storminess, extreme floods and droughts. Fish can provide opportunities to adapt to climate change by, integrating aquaculture and agriculture, which can help farmers to cope with drought while boosting profits and household nutrition. In the present scenario of climate change additional demands for maximizing food production has led to an approach of integrating fish farming with agriculture & fishery. The integration holds a considerable potential for augmenting production of animal protein, generation of employment opportunities in the rural areas and improvement of socio-economic condition of the farmer. Fish farming can be integrated with livestock, poultry, duck, cash crops, paddy fields, horticulture and floriculture. The main objective of the integrated recycling is to utilize the wastes and by-products from one component of the cycle to the other as a feed, fertilizer. Agriculture plays a significant role in fight against climate change: good practices can increase food security, and reduce emissions. Integrated farming can play a crucial to combat climate change. Rural populations are the future of food security and rural poverty reduction. Integration of fisheries with agriculture is the need of the present situation and a very effective way to overcome climate change.

Key words: Integrated, Farming, Fish, Livelihood and Climate change

POPULATION DYNAMICS OF MAJOR INSECT PESTS ON BRINJAL IN RELATION TO WEATHER PARAMETERS**HUMANE A. N. AND SHINDE A. G.***Department of Agricultural Entomology, College of Agriculture, VNMKV, Parbhani - 431 402 (M.H.)*

Brinjal (*Solanum melongena* L.) is a delicate tropical perennial often cultivated as a tender or half-hardy annual in temperate climate. This economically important commercial crop is infested by more than 142 species of insects, 4 species of mites and 3 species of nematode from planting to harvest. Among the various insect pest attacking the eggplant, shoot and fruit borer, stem borer, jassid, leaf hopper, lacewing bug, Aphid, and white fly, were designated as major pests. Seasonal incidence of jassid, whitefly and shoot and fruit borer on brinjal was studied at research farm of the Department of Agricultural Entomology College of Agriculture, VNMKV, Parbhani during *kharif* season of 2017 and found that the activity of both jassid and whitefly was initiated in the second week of April with mean density of 5.21 hoppers and 5.99 whiteflies per plant. It was associated with 33.94 °C and 21.80 °C maximum and minimum temperatures and maximum relative humidity around 75%. The peak activity of these insects was observed during second week of May when the day and night temperatures fluctuated between 25 °C and 35 °C and relative humidity around 65%. The correlation studies between jassid and

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whitefly and different weather parameters revealed no significant effect of ambient weather on the population fluctuations of these insects. Shoot and fruit borer incidence was first observed on brinjal fruits during first week of April with peak activity of 60% in May first week when day and night temperatures varied from 25°C and 35°C and maximum relative humidity around 65%. Correlation studies between % fruit damage by fruit borer and ambient weather revealed a significantly negative relationship with minimum temperature and significantly positive relationship with maximum relative humidity.

KEY WORDS: Brinjal, population dynamics, sucking pests, weather parameters.

DIGITAL AGRICULTURE: PATHWAY TO INCREASING AGRICULTURE PRODUCTIVITY

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Agriculture must become more efficient and sustainable if it is to provide enough food for a growing world population. Given that 68 per cent of India's population is rural and agriculture is the main source of livelihood for 58 per cent of the population, with advancement in technologies especially in the field of information technology, there is need to consider the role of Digital Agriculture in increasing the productivity by efficient and timely management of inputs. Digital Agriculture refers to use of ICT (Information and communication technology) and data ecosystems to support the development and delivery of timely, targeted (localized) information and services to make farming profitable and sustainable (socially, economically and environmentally) while delivering safe, nutritious and affordable food for all. The key components to support the implementation of Digital Agriculture is Spatial (and Temporal) Data Infrastructure (SDI) and low-cost smart phones and tablets to support the bi-directional flow of data and information to rural consumers. Digital technology will be key to increasing agriculture productivity by delivering tailored recommendations to farmers based on crop, planting date, variety sown, real time localized observed weather and projected market prices. These recommendations will be based on advanced big data analytics related to down-scaled daily observed weather conditions that feed into crop growth models to estimate yields, harvest date and potential pest and disease outbreaks to optimize pest control measures. Remote sensing is another big data resource to support the development of derived weather products (radar), improved hydrology and watershed management, soil health, crop coverage and crop health estimates among other application. Agriculture is a data-intense enterprise when one considers soil variability, moisture and nutrient levels, rainfall variability, timing of key operations like planting and harvesting, and market price volatility. Advanced agriculture industries help farmers manage these production and market risks through the application of spatial/temporal data bases that are cloud enabled and integrated through Application Programming Interfaces (APIs). This creates a rich and dynamic data ecosystem that enables advanced analytics to inform farmers of the best economic options to maximize profitability and minimize risk - the two critical variables in farming.

Keywords: APIs, Digital agriculture, ICT, Spatial, Temporal, Remote sensing

MICROWAVE ASSISTED OIL EXTRACTION OF BLACK SEED (*NIGELLA SATIVAL*)

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Nigella sativa L. also known as black cumin or black seed is an annual herbaceous plant belonging to the Ranunculaceae family. *Nigella* seed oil is considered as one of the newer and prospective sources of edible oils that have an important role to play in human nutrition and health. Black seeds are used for edible and medicinal purposes in many countries including India, Egypt and Syria. Mostly, the oil extracted from the black seeds is done by conventional extraction method i.e., pressing but the problem associated with this method is its much time consumption and poor yield. In order to overcome this problem newer technologies of extraction are in process like Microwave assisted extraction and Ultrasound assisted extraction. In this context, a study for microwave-assisted oil extraction from black seed was conducted using three independent variables of three levels each. The best possible combinations of extraction variables was obtained with the full factorial design. The variables were Microwave time (3, 5, 7 min), Microwave power (320, 480, 640 W), and solvent to solid ratio (10:1, 15:1, 20:1). The maximum oil yield of 33.6% was achieved at the microwave power of 480 W, microwave time of 5 minutes and the solvent to solid ratio of 15:1.

Keywords: Black seed, oil extraction, microwave assisted extraction.

EFFECT OF CROP INTENSIFICATION AND ESTABLISHMENT TECHNIQUES ON ECONOMICS OF DIFFERENT CROPPING SYSTEM

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The field experiments were conducted during 2015-16 and 2016-17 at Norman E. Borlaug Crop Research Center, G.B Pant University of Agriculture & Technology, Pantnagar, U.S. Nagar (Uttarakhand) India, to study intensification and establishment techniques of rice-wheat system and influence on economics under irrigated condition. Among various cropping systems the maximum cost involvement was registered in Rice (DSR) Potato Cowpea sequence (₹ 120693 /ha during 2015-16 and ₹ 122066 /ha during 2016-17). The maximum values of gross return (₹ 483007 and ₹ 500302 /ha during 2015-16 and 2016-17, respectively), and net return (₹ 362314 and ₹ 378236 /ha during 2015-16 and 2016-17, respectively) were obtained in [Rice (DSR) Potato Cowpea]. However, the benefit: cost ratio was found to be the highest (3.25 and 3.37) in [Rice (DSR) vegetable pea maize (cob+ fodder)] during 2015-16 and 2016-17, respectively. During 2015-16 the maximum system profitability (1192 ₹/ha/day) was recorded in Rice (DSR) Potato Cowpea sequence, while, during 2016-17, [Maize (Bed) (cob + fodder) + Cowpea (vegetable) (Bed) + Sesbania (Furrow)-2:1:2 - Vegetable pea + Toria-3:1 - Groundnut+Mentha-3:1 (Broad bed furrow 105cm x 30 cm)] recorded the maximum value (1245 ₹/ha/day) being at par with Rice (DSR) Potato Cowpea sequence. The highest crop profitability was recorded in Rice (DSR) Potato Cowpea sequence with 992.64 and 1036.26 ₹/ha/day during 2015-16 and 2016-17, respectively. The highest relative economic efficiency (233.09 % and 241.49 %) was noticed in [Rice (DSR) Potato Cowpea] cropping system during 2015-16 and 2016-17, respectively. Rice (DSR) Potato Cowpea sequence was found economically efficient in overall treatments.

Keywords: intensification, establishment techniques, rice-wheat and economics

MICROWAVE ASSISTED FLUIDIZED BED DRYING OF CAPSICUM: EFFECT ON DRYING KINETICS AND ANTIOXIDANT PROPERTIES

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The experiments were conducted to study the effect of microwave power, inlet air velocity and inlet air temperature on drying characteristics and antioxidant properties of capsicum dried by microwave assisted fluidized bed drying (MAFBD). Samples were prepared by cutting the capsicum to a uniform size (1.5 cm x 1.5 cm x 0.5 cm) to allow power fluidization at different velocities. This was done by carrying out the trials of different sizes at different air velocities to obtain proper fluidization and hence satisfactory results. Capsicum samples were then dried to moisture content of about 6% (db) at different power levels (180 W, 360 W and 540 W), inlet air velocities (15 m/s, 17.5 m/s and 20 m/s) and inlet air temperature (40 °C, 55 °C and 70 °C). Drying time was greatly reduced in MAFBD as compared to fluidized bed drying. The results obtained at the least level of parameters when compared with those obtained at extreme levels, a 50 % reduction in drying time was obtained. The increase in microwave power, inlet air velocity and inlet air temperature enhanced the dehydration of the capsicum cubes. Face centered response surface methodology was applied to obtain regression polynomial models for drying parameters. Design expert 13 was used for the optimization and work plan of the whole experimentation. The quadratic model was found to be significant for drying time and antioxidant properties of capsicum. Keeping the responses like vitamin C content, total phenolic content, total flavonoid content, total carotenoid content and drying time in consideration, the optimum values of microwave power, inlet air velocity and inlet air temperature were 540 W, 20 m/s and 70 °C respectively.

A STUDY ON KNOWLEDGE, ATTITUDE AND ADOPTION BEHAVIOR OF PADDY GROWER IN JAMMU DISTRICT OF J&K STATE

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Agriculture is the back bone of Indian economy. To access the Knowledge level, attitude and adoption pattern of Paddy growers. The study was conducted purposively in Marh and R.S Pura block of Jammu District of J&K State due to maximum Paddy growing farmers in these two blocks. A total Nos. of 240 farmers were interviewed by preparing a interview schedule. The result of finding shows that there is a significant and positive correlation regarding seed technology, usage of fertilizer application plant protection technology. The attitude of the farmers were also found significant regarding these technology.

Key words:- Knowledge ,Attitude, Behavior ,Paddy farmers

THE QUALITATIVE PHYTOCHEMICAL ANALYSIS OF FOUR MEDICINAL PLANTS (*ALLIUM SATIVUM*, *CURCUMA LONGA*, *TINOSPORA CORDIFOLIA* AND *WITHANIA SOMNIFERA*)**IQRANAZIR¹* AND RIKHI. S. CHAUHAN²**

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The phytochemical analysis of the plants is very important commercially and has great interest in pharmaceutical companies for the production of the new drugs for curing of various diseases. Phytochemicals have two categories i.e., primary and secondary constituents. Primary constituents have chlorophyll, proteins sugar and amino acids. Secondary constituents contain terpenoids and alkaloids. Medicinal plants have antifungal, antibacterial and anti-inflammation activities. The present study involves the qualitative phytochemical analysis of four different medicinal plants: *Allium sativum*, *Curcuma longa*, *Tinospora cordifolia* and *Withania somnifera* that are locally available in pantnagar, region of Uttarakhand. The aqueous and ethanolic extract samples were used for the phytochemical analysis to find out the phytochemical constituents in the plants. Garlic, turmeric, guduchi and ashwagandha are very renowned medicinal plant for its versatile pharmaceutical properties. For finding several compounds qualitative phytochemical analysis is very important. Two different solvents viz; water and ethanol were used to obtain extracts. These extracts were used for qualitative preliminary phytochemical analysis using standard chemical tests. Data indicates the presence of flavonoids, alkaloids, proteins, phenolic compounds, cardiac glycosides and tannins.

Key words: Ethanolic, phytochemicals, *Tinospora cordifolia*, *Curcuma longa*, flavonoids.

MOLECULAR METHODS FOR DETECTION OF *ALBUGO CANDIDA* (PERS.) KUNZE CAUSING WHITE RUST OF RAPESEED-MUSTARD**IRFAN KHAN^{*1} AND IQBAL AHMED²**

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Albugo candida, biotrophic, the oomycete pathogen, causes white rust disease of rapeseed-mustard globally. The characteristic symptoms of the disease are formation of white to cream-coloured pustules on leaves, stems, and inflorescences, sometime staghead galls formation takes place as the result of inflorescence infection. The pathogen causes significant losses in oilseed brassicas. A prerequisite to the control of diseases is detection and proper identification of the causal organism. Traditional methods are some limitation viz. they are the relatively slow process, often requiring the skilled person to reliable identification of the pathogen. Recently, the potential of molecular methods for the detection of plant pathogen has been recognized. Molecular techniques based on DNA analysis are very useful for pathogen detection because they are highly specific and sensitive. Internal transcribed spacer (ITS) based primers are used for routine detection of *A. candida*. Real-time PCR is the most rapid method, reproducible and accurate to detect the target pathogen in the plant. The proteomic study is currently using by the researcher to explore the molecular mechanisms of defence responses by *Brassica juncea*. PCR-based marker, such as random amplified polymorphic DNA (RAPD), has an advantage that it does not require prior information about genomic sequences. RAPD markers are usually dominant because polymorphisms are detected as the presence or absence of bands. RAPDs are used successfully as genetic markers in genetic studies of *A. candida*. Amplified fragment length polymorphism (AFLP) markers also have been used for genetic analysis and genome mapping of this devastating pathogen.

EVALUATION OF PROMISING CHEMICALS TO ENHANCE FLOWERING, FRUITING AND SHELF LIFE OF LITCHI (*LITCHI CHINENSIS* SONN.)**J.C. CHANDOLA¹, SATISH CHAND¹, SHWETA KUMARI², RANJAN SRIVASTAVA¹, RATNA RAI¹, D.S. MISHRA³ AND M.K. BHATT⁴**

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The present investigation entitled "Evaluation of promising chemicals to enhance flowering, fruiting and shelf life of litchi (*Litchi chinensis* Sonn.)" was conducted at Horticultural Research Centre, Patharchatta, Department of Horticulture, G.B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar (Uttarakhand) in the year 2013 to 2015. The experiment was conducted to determine the effect of chemicals viz., KNO₃ (1%), K₂HPO₄ (1%), KH₂PO₄ (1%), K₂HPO₄ (2%), KH₂PO₄ (2%), K₂HPO₄ (1%) + KNO₃

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(1%), KH_2PO_4 (1%) + KNO_3 (1%), Ethrel (400 ppm) and water which were sprayed thrice at monthly interval from October to December. There were nine treatments which replicated thrice in randomized block design. The results obtained indicate that foliar application of KNO_3 (1%) was effective for improving number of vegetative flushes (4.83), sex ratio (1.54 to 1.86%), number of shoots showing panicle emergence (90%), fruit breadth (3.82 cm), fruit weight (21.93g), fruit retention (28.33%), shelf life (5.8 days) and significantly reduced fruit drop (45.37%), total acidity (0.33%) of fruits in litchi. On the other hand, Ethrel (400 ppm) was effective for early panicle initiation *i.e.*, on 3rd February, fruit set (2nd April), increasing fruit length (3.93cm), early fruit harvest (10th June and 5th June during the years 2014 and 2015), fruit yield (105.42 kg/tree), TSS (20.70⁰B), total sugars (13.19%) along with increasing higher number of fruits in the extra-large grade (82.06%). Therefore, it could be concluded that KNO_3 (1%) and Ethrel (400 ppm) sprays can be recommended for enhancing quality and yield characters of litchi fruits cv. Rose Scented.

EFFECT OF DIFFERENT ROOTSTOCK-SCION COMBINATIONS ON VEGETATIVE GROWTH OF PEAR UNDER NURSERY LEVEL**J PRATHORE, AMIT KUMAR, M K SHARMA, ANIL SHARMA AND TSERING DOLKAR***Division of Fruit Science, FOH, SKUAST-Kashmir, Shalimar Campus, Srinagar (J & K)*

A field study on "Effect of vegetative growth on different rootstock-scion combinations in Pear" was carried out at Experimental Farm, Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar (J&K) during 2017. Treatments consisted of four levels of scion cultivars (Carmen, Abate Fetel, William Bartlett and Chinese Sandy Pear) and five levels of rootstocks (Quince C, BA-29, Quince, Kainth and Pear Sucker) constituting twenty treatment combinations. It was found that earliest bud burst date (14th April) was recorded in Chinese Sandy Pear/Quince, Highest grafting success per cent (96.67 %) was recorded in Carmen/Quince C, Abate Fetel/Quince C, Chinese Sandy Pear/Quince C, Abate Fetel/BA-29 and Chinese Sandy Pear/Quince, Highest initial stock girth was observed (34.29 mm) in Chinese Sandy Pear/Quince, Highest initial scion girth was observed (38.51 mm) in William Bartlett/Kainth, Maximum initial stock-scion ratio was recorded in Chinese Sandy Pear/Quince (0.90), Final scion girth was recorded maximum in Carmen/Quince (6.18), Maximum plant height (132.15 cm) was recorded in Chinese Sandy Pear/Pear sucker whereas minimum plant height (98.16 cm) was recorded in Carmen/Quince. Maximum number of branches per plant was recorded in Chinese Sandy Pear/Pear sucker (3.55), Maximum leaf area was recorded in Chinese Sandy Pear/BA 29 (23.46 cm²), Maximum number of leaves per plant (91.93) was recorded in Chinese Sandy Pear/Quince C. Maximum specific leaf area (44.81 cm²/g) was observed in Chinese Sandy Pear/Kainth, Maximum internodal length was recorded in William Bartlett/Pear sucker (2.31 cm), Maximum saleable plants were achieved in William Bartlett/Quince (86.33 %). On the basis of foregoing summery, the results may be concluded as follow: effect of vegetative growth on different rootstock-scion combinations in pear in the present study. Among the different rootstock-scion combinations Quince C performed better with respect to all the studied parameters followed by Quince.

ECONOMICS OF BUFFALO MILK PRODUCTION IN DIFFERENT SEASONS AND ITS CONSTRAINTS IN FAIZABAD DISTRICT OF UTTAR PRADESH**J.N. YADAV¹, R. A. SINGH², HARENDER YADAV³, V.P.S. YADAV⁴, RAJENDER KUMAR⁵***Agri. Economics, NDUAT, Faizabad, Scientist - B, CTR & TI, Piska Nagri, Ranchi, Jharkhand Principal Ext. Specialist/ Professor, KVK, Faridabad.*

The livestock sector considered to be a major enterprise in agriculture sector. It is increasingly recognized that dairying could play a more constructive role in promoting rural welfare and reducing poverty. Besides, dung is an important input as organic manure for crop production and also widely used as fuel in rural areas. Keeping in view the importance of livestock among farming community a study was carried out in five villages of Faizabad district of Uttar Pradesh. For the study sixty buffalo milk producing households were selected randomly. The highest feeding cost was worked out in summer followed by winter and rainy seasons., it was Rs. 64.70, 63.96 and 50.32 in marginal herd size group ; Rs. 60.13, 58.74 and 47.46 in small herd size group and Rs. 55.82, 45.88 and 44.58 in medium herd size group during winter, summer and rainy seasons respectively. The net maintenance cost of per milch buffalo per day was estimated by deducting the income from dung from the total maintenance cost. In winter, summer and rainy seasons, it was Rs. 101.85, 98.95 & 91.85 on marginal, Rs. 96.07, 92.94 & 86.60 on small and Rs. 88.14, 85.44 & 80.30, respectively on medium herd size groups. The net profit of milk production per milch buffalo per day was Rs. 70.28, 69.34 & 86.41 on marginal, Rs. 85.98, 83.84 & 104.24 on small, Rs. 105.77, 103.42 & 121.73 on medium herd size groups in summer, winter and rainy seasons respectively. The cost benefit ratio per milch buffalo per day was reported 1.63, 1.64 & 1.86 during winter, summer and rainy seasons, respectively on marginal herd size groups. The same trend was found in small and medium herd size groups. The results highlighted that the women participation in milk production was higher in feeding, compost making, milking, as compared to other practices. As constraints in dairying farming were studied, these were reported as low price of milk, inadequate knowledge about balanced feeding, lack of vaccination at appropriate time, lack of dairy

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processing unit and Unavailability of risk cover.

Keywords: Milk production, Cost, Income, Employment and Constraints.

“MITIGATION OF SPOT BLOTCH OF BARLEY (*HORDEUM VULGARE* L.) THROUGH AGRICULTURAL PRACTICES FOR MAXIMIZATION OF THE SEED QUALITY.”

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Barley (*Hordeum vulgare* L.) belonging to the family Poaceae, is an annual monocotyledonous herb, tribe *Triticeae*. Barley is evolutionarily closely related to two other small-seeded cereal species, wheat and rye. India has about 7.57 lakh ha area with production of 14.72 lakh tonnes and productivity of 19.44 q/ha. In UP, barley occupied an area of 2.86 lakh ha with a total production of 6.38 lakh tonnes with productivity of 22.25 q/ha. Uttar Pradesh alone contributed more than one fourth of India's total production of barley during 2016-17. We are still below the world average in its productivity level as it is cultivated under minimum input management conditions. The demand for the malt barley from industry is on the rise which is presently nearly 18-20 per cent of the total barley production of the country. A good quality seed should maintain the viability and germination till the next sowing season. Germination of quality seed lot should be high for obtaining the desired crop stand in the field. Vigour of quality seed should be high as the vigorous seeds will stand better in the field in adverse condition. All these qualities of seeds are affected by various factors including various seed borne pathogens. Spot blotch disease caused by the fungus *Bipolaris sorokiniana* (teleomorph *Cochliobolus sativus*) is one of the most important fungal disease of barley. Many factors including climate conditions (Rainfall, temperature and humidity) and agricultural practices influence the development and spread of disease and thus affect the seed crop. Considering quantum of losses, the investigations on management of spot blotch, for maximizing the seed quality, experiment were conducted at CRS, Masodha and Students' Instructional Farm and Seed Pathology Laboratory at Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during 2016-17 and 2017-18. Effect of date of sowing, organic and chemical amendments on disease severity was quantified during the present investigation. Effect of different nitrogen levels and treatment with Plant Growth Promoting Rhizobacteria on disease severity was studied. Also the disease management through seed treatment and fungicidal foliar sprays was tried to recommend a management schedule for bring down the disease severity, maximize seed yield and its quality. Minimum seed infection of *Bipolaris sorokiniana* (5.5%) was recorded through the crop sown in mid-November with recommended dose of fertilizers + FYM @ 5t/ha plus paddy straw mulching followed by two sprays of zinc sulphate and KCl. This treatment resulted in maximize the viability, germination, seedling length and vigour index also. Nitrogen @30 Kg/ha with seed treatment of Azatobacter plus PSB was found best for minimizing the disease and optimizing the seed quality attributes. Seed treatment with Vitavax Power @ 2.0 g/kg seed and two foliar sprays of Propiconazole @ 0.10% (first at tillering and second after 15 days) in minimizing the spot blotch severity with highest seed quality traits. This treatment also resulted in 40.64 per cent yield increase as compared to untreated and water sprayed plot.

MARKER ASSISTED BREEDING IN IMPROVING WHEAT FOR CLIMATE RESILIENCE

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Ever increasing threats of climate change to crop production and food security are being currently discussed globally. Wheat (*Triticum aestivum* L.) is one of the most important food crops worldwide, occupying largest cultivated area, and supplying 40% of food globally and 25% of calories for the developing world. Hence increase in its production and productivity is very much desired to meet the demand of ever increasing population. Climate change and global warming have profound effect on resurgence of new races/pathotypes of different disease causing organism. It has also been proved that yield potential of high yielding varieties is seldom realized due to disease pressure. Therefore, development of disease resistance varieties has been one of the important goals in crop improvement. Wheat is affected by several diseases, but rusts caused by *Puccinia* spp. are the most important. The impact of rust on yield reduction in wheat ranges from 10% under moderate and 65% under intense epidemics. In India too, the losses caused by rust infection are around 40% under conducive environment. Yellow rust epidemic in 2010-11 and breakdown of Yr9 resistance in mega wheat variety PBW 343 and susceptibility of other high yielding varieties like UP 2338, DBW 17, HD 2967 after a small period of their release warrants attention to develop wheat varieties with durable rust resistance. Five new pathotypes, namely, 110S119, 238S119, 110S84, 110S247 and 46S117 of stripe rust (*Puccinia striiformis*) reported in 2014 demands serious attention towards preparedness to fight against potential threat of this devastating pathogen. Due to change in climate, the severity of spot blotch (*Bipolaris sorokiniana*) incidence is increasing in North

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Western Plains Zone (NWPZ) of India where leaf and stripe rust, and powdery mildew were major diseases. Hence exotic germplasm obtained from CIMMYT, Mexico were screened under epiphytotic conditions and resistance lines were identified using gene linked markers. Considering the importance of yellow rust in Northern Hills Zone (NHZ) and yellow as well as brown rusts in North Western Plains Zone (NWPZ), two major yellow rust resistance genes, Yr10 and Yr15 and brown resistance genes Lr19/S25, Lr24/Sr24 and Lr34/Yr18 from the donor genotypes were mobilized in popular cultivars and elite genotypes. It is envisaged that marker-assisted deployment of major genes along with APR genes will confer durable rust resistance in wheat.

WEED MANAGEMENT IN KHARIF GREENGRAM (*VIGNA RADIATA* L.) UNDER MIDDLE GUJARAT CONDITIONS**J.P. PATIL*, S.V. AHIRE AND P.K. SURYAWANSHI**

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A field experiment was conducted during *kharif* season of the year 2010 at the farm of DWSR-Anand Centre, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat). The twelve weed control treatments viz., pendimethalin @ 1000 g ha⁻¹ (PE) (T₁), pendimethalin @ 1000 g ha⁻¹ PE *fb* hand weeding at 30 days after sowing (T₂), quizalofop-ethyl @ 50 g ha⁻¹ (POE) (T₃), quizalofop-ethyl @ 50 g ha⁻¹ POE *fb* HW at 30 DAS (T₄), quizalofop-ethyl @ 100 g ha⁻¹ POE (T₅), quizalofop-ethyl @ 100 g ha⁻¹ POE *fb* HW at 30 DAS (T₆), imazethapyr @ 50 g ha⁻¹ POE (T₇), imazethapyr @ 50 g ha⁻¹ POE *fb* HW at 30 DAS (T₈), imazethapyr @ 100 g ha⁻¹ POE (T₉), imazethapyr @ 100 g ha⁻¹ POE *fb* HW at 30 DAS (T₁₀), Interculture and HW at 20 & 40 DAS (T₁₁) and weedy check (T₁₂) were studied in randomized block design with four replications. At 25 and 50 DAS, significantly lower weed population, dry weight of monocot and dicot weeds were recorded in interculturing and hand weeding carried out at 20 & 40 DAS which were at par with the treatment of quizalofop-ethyl @ 50 g ha⁻¹ POE, quizalofop-ethyl @ 50 g ha⁻¹ POE *fb* HW at 30 DAS, quizalofop-ethyl @ 100 g ha⁻¹ POE and quizalofop-ethyl @ 100 g ha⁻¹ POE *fb* HW at 30 DAS, in case of monocot weeds and imazethapyr @ 100 g ha⁻¹ POE and imazethapyr @ 100 g ha⁻¹ POE *fb* HW at 30 DAS in dicot weeds. Maximum weed control efficiency recorded in interculturing and hand weeding treatments at 25, 50 DAS and at harvest. The treatment of interculturing and hand weeding carried out at 20 & 40 DAS recorded significantly higher plant height at 30 DAS and at harvest, dry weight of *Rhizobium* nodule, no. of branches plant⁻¹, no. of pods plant⁻¹, length of pod, test weight, seed and haulm yield.

STUDY ON DAIRY HUSBANDRY PRACTICES IN SAHARANPUR DISTRICT**JAGDEEP KUMAR, RAJBIR SINGH, RAJKUMAR, DEEPAK KUMAR & SOMNATH**

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The present study was carried out in Saharanpur district of Uttar Pradesh through 200 dairy farmers to measure the study on dairy husbandry practices in Saharanpur district. The study showed that majority of the respondents 80.50 percent kept their animals in *pucca* houses, whereas 78.00 per cent kept in close house type. 89.50 percent respondents provided manger but 84.50 percent had *pucca* type manger. 67.00 percent respondents cultivate green fodder crops and 84.00 and 63.50 percent respondents fed green non-leguminous fodder and shedha grass, respectively. Paddy straw was major ingredient 89.00 percent used as dry fodder, 66.50 percent respondents fed homemade + compound cattle feed as concentrates to their milking animals, Bred their animals by artificial insemination 79.50 percent between 12-18 hours after heat detection 85.00 percent, 74.00 percent respondents bred their animals after 2 to 3 months of calving and 80.50 percent respondents followed the pregnancy diagnosis. 71.50 percent respondents followed treatment of anestrous/repeaters in their dairy animals. 69.50 percent respondent using knuckling methods of milking. 83.50 percent respondents followed stripping at the end of milking and all the respondents did not wipe the udder and teats just after milking. 64.50 percent respondents allowed calves for suckling before milking. 95.50 percent respondents practiced regular vaccination of their animals against FMD and HS disease. 62.00 percent respondents practiced deworming of their dairy animals regularly, followed various practices for control of ecto-parasites 81.00 percent. 90.50 percent respondents followed practice to feed colostrum to new born calves but only 52.50 percent respondents fed colostrum to new born calves within one hour of birth. 68.50 percent respondents followed weaning practices at the age of three months. Dairy farmers should keep farm records of their animals which will help them in reproductive management, health management and selection of good animals for the future generation.

Key Words: Housing, Feeding, Breeding, Health Care and Milking management.

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ROOT BORDER CELLS AND SECRETIONS AS CRITICAL ELEMENTS IN PLANT HOST DEFENSE

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The adaptation of plants to land ecosystems involves complex rhizosphere interactions between organic matter and microbial communities. Border cells (BC) constitute the first living boundary in plant-soil ecosystems and play an important role in environmental sensing and signaling in response to different biotic and abiotic conditions. Border cells and border-like cells are released from the root tip as individual cells and small aggregates, or as a group of attached cells. These are viable components of the root system that play a key role in controlling root interaction with living microbes of the rhizosphere. As their separation from root tip proceeds, the cells synthesize and secrete a hydrated mucilage that contains polysaccharides, secondary metabolites, antimicrobial proteins and extracellular DNA (exDNA). This exDNA-based matrix seems to function in root defense in a way similar to that of recently characterized neutrophil extracellular traps (NETs) in mammalian cells. Both cell types export a complex of extracellular DNA (exDNA) and antimicrobial proteins that neutralize threats by trapping pathogens and thereby preventing invasion of host tissues. Extracellular DNases (exDNases) of pathogens promote virulence and systemic spread of the microbes. In plants, adding DNase I to root tips eliminates border cell extracellular traps and abolishes root tip resistance to infection. Mutation of genes encoding exDNase activity in plant-pathogenic bacteria (*Ralstonia solanacearum*) results in reduced virulence. Engineering the rhizosphere to increase plant resistance to pathogens could be achieved through breeding, which potentially selects for novel root and root border cells' architecture and function.

IMPROVING SOIL HEALTH THROUGH VERMICOMPOST IN AGRICULTURE

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Vermicomposting is an effective means of composting the decomposable organic wastes using earthworms naturally present in the soil. Vermicomposting is a mixture of worm casts enriched with macro and micronutrients (N, P, K, Mn, Fe, Mo, B, Cu and Zn.), some growth regulating substances (such as gibberellins and auxins) and useful micro flora (*Azospirillum*, *Actinomyces* and *Phosphobacillus*) etc. which naturally helps in improvement of soil fertility or soil quality. Excessive use of chemical fertilizers in agricultural land causes large number of environmental problems. Ignorance in terms of manure and fertilizer application with respect to the fertility status is one of the major factors leading to the low productivity of the crops. The return, therefore, is not a constant and reliable factor for the farmers resulting in their low financial status. In order to evaluate the requirement of balanced fertilizers to be applied in the field analysis of soil for available nutrients is quite necessary. In this background, use of organic manure such as vermicompost may improve quality of agricultural products and enhancement of soil quality by organic amendment especially vermicomposting is becoming increasingly popular among farmers as a source of soil fertility and also as a source of income generation.

Keywords: Vermicomposting, soil and fertilizer.

ROLE OF DISEASE FORECASTING IN PLANT DISEASE MANAGEMENT

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Forecasting of plant diseases means predicting for the occurrence of plant disease in a specified area ahead of time, so that suitable control measures can be undertaken in advance to avoid losses. Forecasting involves all activities in ascertaining and notifying the farmers in a community that the conditions are sufficiently favourable for certain diseases, that the application of control measures will result in economic gains or that the disease expected is unlikely to be enough to justify the expenditure of time, energy and money to be utilized for its control. Disease forecasting are mainly of two types, positive forecast employs need based chemical sprays, provides adequate protection to crop and reduce damage to environment. Negative forecast avoids unnecessary chemical sprays, no risk to the crop health and no disruption of environment. To develop a plant disease forecast, one must take into account several characteristics of the particular pathogen, host, and of course, environment. In general, for most monocyclic diseases (such as root rot of peas) and for a few polycyclic diseases that may have a large amount of initial inoculums (such as apple scab), disease development may be predicted by assessing the amount of the initial inoculums. For diseases in which both the amount of initial inoculums and the number of disease cycles are large, both factors must be assessed for the accurate prediction of disease epidemics. Such assessments, however, are often difficult or impossible, and, despite considerable improvements in equipment and methods, assessments of initial inoculums or rapidity of infection cycles are seldom accurate. Plant pathologists should write programs that allow the simulation of epidemics of the most important plant diseases. One of the first computer simulation programs, called EPIDEM, was written in 1969 and resulted from modelling each stage of the life cycle of a pathogen as a function of the environment. EPIDEM was designed to simulate epidemics of

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early blight of tomato and potato caused by the fungus *Alternaria solani*. Subsequently, computer simulators were written for Cercospora blight of celery (CERCOS), for *Mycosphaerella* blight of chrysanthemums (MYCOS), for southern corn leaf blight caused by *Cochliobolus* (*Helminthosporium maydis*) (EPICORN), and for apple scab caused by *Venturia inaequalis* (EPIVEN). A more general and more flexible plant disease simulator, called EPIDEMIC, was written primarily for the stripe rust of wheat but could be modified easily for other host pathogen systems. Computer simulation programs are now available for numerous plant diseases.

THE ROLE OF AGROFORESTRY IN THE VIEW OF AGRICULTURE & ENVIRONMENT

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Advent of "Climate Change" has put forth more emphasis on agroforestry. Agroforestry is economically and ecologically viable option for producing more crop yields along with environmental amelioration and resource conservation. Agroforestry provides robustness against extreme and erratic weather shelter against storms soil water retention capacity of the soil and add organic matter to the soil. On the other hand it acts as a major carbon harvester. Agriculture is well known as a significant contributor to global greenhouse gas emissions, but emerging practices in land management have the potential to curtail these emissions and reverse much of the ecological and climate harm caused by overly intensive systems. One such practice, cultivation and conservation of trees in agricultural practices, or agroforestry, is an important climate-smart solution with many important co-benefits. Trees can provide quality timber as well as fuel while the farmer can continue to raise livestock or grow crops. It also contributes to the reduction of greenhouse gas emissions from farms. Agroforestry is one of the best practices for sustainable agriculture. In this regard pulse crops play a vital role and provide a rich source of protein. It is, therefore, agroforestry is indeed an integral part of environment & agriculture. But the benefits are significant.

Key Words: Agroforestry, Economic, Farmer and Environment.

TO STUDY THE NUTRITION LEVEL ON SESAMUM (*SESAMUM INDICUM* L.) VARIETIES UNDER RAINFED CONDITION

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An experiment was conducted during kharif 2017, (August to October) in micro plot at Department of Crop Physiology Chandra Shekhar Azad University of Agriculture & Technology Kanpur, Uttar Pradesh, (India). Complete Randomized Block Design was used in trial aimed with to study the effect of Nitrogen, Phosphorus, Potassium, Sulphur and Farm Yard Manure used in the experiment were 40:20:20:20 kg/ha and 2.5 t/ha respectively. Significantly increased growth yield and quality of sesamum varieties Shekhar (V_1), Pragati (V_2), and Tarun (V_3) and treatment as control (NPK) T_1 , NPK+S (T_2), NPK+FYM (T_3) and NPK+S+FYM@ 40:20:20:20 kg /ha and 2.5 t/ha. (T_4). Result revealed that the application of T_4 (Nitrogen, Phosphorus, Potassium, Sulphur and Farm Yard Manure) and variety Tarun over all best response in all observation like as used in the experiment were Significantly increased seed yield (q/ha.), Chlorophyll intensity (%), RWC (%), plant height (cm), Branches/plant were significantly enhanced in comparison to control (NPK).

RESPONSE OF SESAMUM (*SESAMUM INDICUM* L.) CULTIVARS UNDER DIFFERENT VARIETIES AND LEVEL OF DOSE ON FERTILIZER UNDER RAINFED CONDITION

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A trial was conducted during kharif 2017, in micro plot at Department of Crop Physiology Chandra Shekhar Azad University of Agriculture & Technology Kanpur. To study the effect of Nitrogen, Phosphorus, Potassium, Sulphur and Farm Yard Manure used in the experiment were 40:20:20:20 kg/ha and 2.5 t/ha respectively. Randomized Block Design was applied in trial aimed with Significantly increased growth yield and quality of sesamum varieties Shekhar (V_1), Pragati (V_2), and Tarun (V_3) and treatment as control (NPK) T_1 , NPK+S (T_2), NPK+FYM (T_3) and NPK+S+FYM@ 40:20:20:20 kg /ha and 2.5 t/ha. (T_4). Result revealed that the application of T_4 (Nitrogen, Phosphorus, Potassium, Sulphur and Farm Yard Manure) and variety Tarun significantly higher in observation of chlorophyll intensity(%), Relative Water Content (%), Plant height(cm) branches per plant, dry matter accumulation and yield were significantly enhanced in comparison to control.

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BIOLOGICAL CONTROL OF PLANT PARASITIC NEMATODES.

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An environmental and health concerned over the use of pesticide have increase the need for developing alternative measures to control plant Pathogen. Among plant Pathogen, nematodes are an important plant parasites causing considerable direct and indirect loss to the plant. Majority of plant parasitic nematode are soil borne plant pathogens causing damage to root system of the plant. Some of the nematodes are foliar nematode but they also need the soil for completely their life cycle. The number of bio agent such as Fungi, Bacteria, Predatory nematode, Mites, Collembola, Turbellarians are organism which play an important role in the management of plant parasitic nematodes. Nematophagous fungi, a natural enemy of nematodes, have received major attention in biological control of plant-parasitic nematodes. This is due to their specific ability to capture and kill nematodes. Nematophagous fungi are divided into four groups according to their mode of action against nematodes, several fungi such as *Pochonia chlamydosporia* and *Paecilomyces lilacinus* have been developed as commercial biological nematocides. Bacterial parasites are mainly *Pasteuria penetrans*, *Bacillus thuringiensis* and *Streptomyces avermitilis*. Among These bacteria which have been most intensively studied in connection with nematodes, only *P. penetrans* is a true parasite. Mites exhibit density dependent traits of effective and specific predators. Collembola, feeding of plant parasitic nematodes has been reported by various investigators. Turbellarians are soil inhabiting, carnivorous, flatworms that feed on nematodes and other soil organisms. Predacious nematodes constitute a large portion of the biomass in some soils; their role as bio-control agents of plant-parasitic nematode is not well known. Many genera of the nematode i.e., *Mononchida*, *Dorylaimida* and *Diplogasteroidea* are largely considered as predacious nematodes. These bio agents may be useful in management of plant parasitic nematodes which can protect the environment by reducing the parasitic nematodes.

CONSERVATION OF NATURAL RESOURCES THROUGH EFFECTIVE UTILISATION OF AGRICULTURAL WASTE

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Agricultural wastes are defined as the residues from the growing and processing of raw agricultural products such as fruits, vegetables, meat, poultry, dairy products, and crops. They are the non-product outputs of production and processing of agricultural products that may contain material that can benefit man but whose economic values are less than the cost of collection, transportation, and processing for beneficial use. Their composition will depend on the system and type of agricultural activities and they can be in the form of liquids, slurries, or solids. Agricultural waste is the material obtained due to crop production or from plant growth. In the past this biomass and agricultural waste were either burnt or naturally converted into organic fertilizer under favourable condition. But now in these days biomass produced from agricultural waste are used to generate energy because it carries great potential to convert into energy. Since the biomass is available throughout the world in abundant quantity so it is necessary to use alternate energy resources to fulfill our needs of energy consumption. The effective utilization of agricultural waste is a good option to convert these wastes in energy. For this efforts have been made and many more are under way, it requires guidelines concerning the utilization of agricultural biomass for energy purposes and optimal production. Production of energy from biomass can provide farmers with new prospects and possibilities to diversify agricultural activities.

Keywords: Agricultural waste, utilization and energy.

EFFECT OF METEOROLOGICAL PARAMETERS ON CROP RESPONSE

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Various meteorological factors like light, temperature, carbon dioxide and moisture affect the crop crucially. However, the levels of these climate inputs, particularly rainfall, vary between locations and years, in part due to climate variability. Temperature and water supply also vary over the long-term, including in response to climate change, with major implications for crop production, and the livelihood of crop producers. Crop management is therefore very much about managing climate risk so as to have financially viable and sustainable agricultural systems. Climate and management also impact on the spread of weeds, pests and diseases, which in turn affects crop yields, harvest and producer's cost and return. These climatic effects on crop production around the world impact on global trade, with implications for net exporters, net importers and consumers, as well as for national and global food security. Climate variability and changes in the frequency of extreme events are important for yield, its stability and quality. In this context, threshold temperatures for

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crop processes are found not to differ greatly for different crops and are important to define for the major food crops, to assist climate modellers predict the occurrence of crop critical temperatures and their temporal resolution. The rate of growth of roots, stem and leaves depends on the rate of photosynthesis, which in turn depends on light, temperature, moisture and carbon dioxide. Temperature and day length also determine when plants produce leaves, stems and flowers, and consequently the filling of grain or the expansion of fruit. The yield of grain crops depends on grain number and grain weight at harvest, which in turn depends on biomass at anthesis and the availability of moisture post-anthesis. Thus the different meteorological parameters and their increase/decrease affect the crop and its final response/yield accordingly.

Keywords: climate risk, temporal resolution, critical temperatures, day length

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE PROTECTED HORTICULTURE

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Protected horticulture is one of the most promising areas of horticulture in the new age. It is an upcoming and alternative production system involving high-tech and intensive practices mainly for urban and pre-urban areas. Being a different, distinct and new area involving vast multidisciplinary aspects of agriculture, establishing scope of protected horticulture would be of great help to generate appropriate human resources and technologies including soilless cultivation, hydroponics, aeroponics, vertical vegetable production, riverbed cultivation, mulching, mechanization and maintenance of polyhouse/structure, vegetable/fruit grafting, container farming, off season vegetable and flower nurseries, off season vegetables, year round cultivation of vegetables and organic protected horticulture. Protected horticulture generate employment and income through involving youth as well as farmers to grow, process and market horticulture produce using protected cultivation technologies. Farmers are gradually adopting different protected structures to combat the climatic vagaries and emerging challenges in vegetable production. The technology of protected farming mainly of vegetables and flowers is most suited to promote much needed peri-urban and urban agriculture being useful to both small-scale and large-scale farmers.

EFFECT OF GUAVA LEAVES EXTRACT TREATMENT ON COTTON

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Guava leaves extract treatment was prepared and applied on cotton fabric. To find out the efficiency of Guava leaves extract treatment physical properties of controlled, treated and washed samples were compared. Extraction of Guava leaves was conducted by cold aqueous maceration for 24 hours which showed yield percentage of 15 %. The Guava leaves extract was applied on cotton woven fabric by exhaust method in 5g/l concentration. After desizing and scouring fabric weight, thickness, bulk and fabric count both in warp and weft direction of fabric increased significantly while tensile strength in both warp and weft directions and air permeability decreased significantly. The percent changes in bending length in both warp and weft directions, flexural rigidity and moisture regain were found to be non-significant. After Guava leaves extract treatment fabric weight and bulk of fabric increased significantly while tensile strength in warp and weft directions, flexural rigidity and air permeability decreased significantly. The changes in thickness, bending length, fabric count in both warp and weft direction and moisture regain were found to be non-significant. After washing weight, bulk, flexural rigidity and tensile strength in warp and weft directions of Guava leaves extract treated samples decreased significantly while air permeability increased significantly. The changes in thickness, bending length, fabric count in both warp and weft direction and moisture regain were found to be non-significant. Conclusively, the Guava leaves extract treated fabrics exhibited excellent efficacy against washing. However, it is needed to be renewed after every wash for good resistivity to washing.

Keywords: Cotton, extract, maceration, exhaust, bending length.

ASSESSMENT OF INFLOW CUT BACK RATIO IN WHEAT IRRIGATION

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Farmers often use to irrigate wheat crop till water stagnation in the field for more than 12 hours thus there is excessive use of irrigation water. An on farm trial has been conducted at farmer's field in Jehanabad District of Bihar during Rabi season 2016-17 and 2017-18 to assess the cut back ratio in wheat irrigation and its effect on water saving, no. of irrigations applied and yield. The experiment was laid out in Randomized Block Design with 6 replications (no. of farmers). The trial was conducted with three technological options: TO 1- Irrigation till water stagnation in the field for more than 12 hours (Farmers Practice), TO 2- Irrigation using 85 % cut back ratio and TO 3-

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Irrigation using 90 % cut back ratio. Three irrigations were applied in each treatment by making 5 m wide border strips in wheat field. Result revealed that in the year 2016-17, TO 3 (wheat irrigation using 90 % cut back ratio) saved 481.6 cubic meter/ha (22.93 %) irrigation water, with B:C ratio of 2.09 as compared to 1.97 in farmers practice (TO 1) whereas in 2017-18, again TO 3 proved best technological options with a saving of 470.0 cubic meter/ha (22.3 %) irrigation water with B:C ratio of 1.97 as compared to 1.81 in farmers practice. Findings of the study indicated that practice of water stagnation in the wheat field for more than 12 hours is not necessary for optimum production and water use can be lowered without yield reduction if irrigation is stopped at 90 percent cut back ratio followed by irrigation using 85 percent cut back.

Key Words: Cut back ratio, Irrigation, On farm trials, Technological options, Water saving

RECENT ADVANCES IN PRODUCTION TECHNOLOGY OF ONION (*ALLIUM CEPAL.*)

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Onion is an important export earning vegetable crop worldwide and has been used in various forms as food. There are different types of onion available depending on shape, size and color. Processing industry uses it in the form of dehydrated onion flakes and powder, one of the remarkable features of onion is its excellent transportability. China ranks first followed by India with an area of 1270000ha production of 21564 000MT. The major Onion producing states includes Maharashtra 27.09MT /ha, Gujarat 25.48MT/ ha Karnataka stood 16th position in productivity *i.e.*, 14.16 MT/ha during 2017. There are some constraints in onion production like poor seed germination, nutritional deficiencies, lack of storage life, and most of the onion is production is under low rainfall areas and most of the onion growing area fall under *rabi* season to avoid these production constraints there are some recent technologies like drip irrigation, fertigation, raised bed cultivation, seed priming, seed production, improved storage structures introduced by NAFED Nasik, development of varieties or hybrids suitable for both *kharif* and *rabi* season. Considering its export potential and demand there is a need for improving the productivity of onion by adopting above said technologies to balance the fluctuations in the onion production

ANIMAL HEALTH: INNOVATIONS AND CHALLENGES AHEAD

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A major area for product innovation will be animal feed. Policymakers can encourage the intensification of food production by providing farmers with innovative, targeted incentives. ... Food safety is a global public good that is dependent on the resources allocated to animal health. Modern animal health, as we now recognize it, began in 1761 with the founding of the world's first veterinary medicine school in Lyon. Since then, the animal health industry has been responsible for a steady stream of innovation. The first vaccines against anthrax and rabies were developed in the late 18th century, with protection against other common diseases, such as foot and mouth and brucellosis following in the early 1925s. It is a contributor to STAR-IDAZ, the global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals. It is also identifying and bridging research gaps in over 35 targeted and emerging diseases through developing vaccines, diagnostics and treatments. A world where population growth is outstripping food supply agricultural and especially animal- biotechnology, needs to be swiftly implemented in all walks of life. The full realization of the agricultural biotechnology revolution depends on both continued successful and innovative research and development activities and on a favorable regulatory climate and public acceptance.

Keyword food safety, medicine, diseases, agriculture biotechnology, etc.

INTEGRATED FARMING AND SMART FARMING COMBINATION: A KEY OF SUSTAINABILITY

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Since Integrated Farming System (IFS) is an interrelated complex matrix of soil, water, plant, animal and environment and their interaction with each other enable the system more viable and profitable over the arable farming system. It leads to produce the quality food. Diversified systems consist of components such as crops and livestock that co-exist independently from each other. In particular, HEIA farmers can have pigs, dairy and crops as quite independent units. In this case the mixing of crops and livestock primarily serves to minimize risk and not to recycle resources. Smart farming reduces the ecological footprint of farming. Minimized or site-specific

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application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases. Smart farming can make agriculture more profitable for the farmer. Decreasing resource inputs will save the farmer money and labor, and increased reliability of spatially explicit data will reduce risks. Optimal, site-specific weather forecasts, yield projections, and probability maps for diseases and disasters based on a dense network of weather and climate data will allow cultivation of crops in an optimal way.

INFLUENCE OF PLANTING METHOD'S AND ORGANIC MANURE'S ON PHYSIOLOGICAL CHARACTERS OF KHARIF ONION (*ALLIUM CEPA* L.)**JITENDRASINGH GURJAR¹, S.S. SINGH², MANOJ KUREEL³ AND P.K.S. GURJAR⁴***M.G.C.G.V.V., Chitrakoot, Satna, M.P., R.V.S.K.V.V., Gwalior, M.P.*

The experiments were conducted at the farmer's field in the near College of Agriculture, Gwalior (M.P.) during two consecutive years of *Kharif* seasons in 2013-14 and 2014-15 to evaluate the influence of planting method's and organic manure's on physiological characters of *Kharif* onion in Gwalior conditions. Results revealed that the physiological parameters like Fresh weight of plant (g), Dry weight of plant (g), Crop growth rate (g/m²/day), Absolute growth rate (g/day), Relative growth rate (g/g/day) and Leaf area (cm²) were seedlings transplanted on ridges resulted significantly highest values at 40, 60, 80, 100 and 120 DAT over those transplanted in furrow and flat beds. Furrow planting method was also found significantly superior to flat planting method for all the physiological parameters. Among all the treatments of organics, application of poultry manures @ 4.2 t/ha resulted in significantly highest values of these physiological characters. The second best treatment was S₄ (VC 4.2 t/ha) followed by S₂ (FYM 25.0 t/ha). The PSB inoculated seedlings produced more fresh and dry weight per plant, whereas diameter of neck was superior under *Azospirillum* inoculated seedlings. Phosphorus is one of the essential major nutrients and needed in adequate amounts in the available form for growth and reproduction of plants. Seedlings inoculated with PSB transplanted on ridges with 25.0 t FYM/ha and PSB 5 kg/ha accrued the highest net monetary return amounting Rs. 97060/ha followed by P₃S₂B₂ (Rs. 93790/ha) while the highest B: C ratio of 2.65 was obtained by ridge transplanting with 12.5 t FYM/ha and PSB 5 kg/ha.

Key Words: Onion, Planting method, Organic nutrient sources, Bio-fertilizer, physiological character

INDIGENOUS PEST AND DISEASE MANAGEMENT : A PRACTICES FOR ORGANIC FARMING**JITENDRASINGH SHEKHAWAT; DAYA SHANKAR MEENA AND KISHORE KUMAR DAS***College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner- 334006*

Indigenous method of cultivating crops using self reliance locally available resources without external inputs. Traditional farming system is an ecologically based age-old farming system developed by ancient farmers through generations of their interaction with nature and natural resources for food, fodder and fiber and this concept is used for Indigenous pest and diseases management. Some of the indigenous traditional knowledge (ITK) being used by these traditional farmers in all the system of crop cultivation have been explained with rationale which may be use for integration in the existing IPM concept of organic farming.

NEW METHOD FOR NUTRIENT APPLICATION FOR PRODUCTION OF LOW POTASSIUM TOMATO FRUITS IN HYDROPONICS TECHNIQUE**JITENDRASINGH SHIVRAN***SKN Agriculture University, Jobner, Jaipur (Rajasthan)*

Recently, chronic kidney failure becomes a global problem, and patients are often restricted for K intake because of the problem with excretion of excess K. So low K tomato fruit will improve the dietary habits of the patients and their QOL. In this study, a best method for the production of low K content tomato fruit was investigated. of producing tomato fruit with low K content was investigated. Medium-sized and cherry tomato (*Solanum lycopersicum* L.) cultivars were used, and the supply of K was restricted using hydroponic technology. In medium-sized tomatoes, fruit K content decreased 45% to 60% depending on cultivar by K withdrawal from the nutrient solution. Although total soluble solid content decrease, titratable acid content was also affected by K restriction and decreased 20% to 40% depending on cultivar. In either case, K withdrawn in hydroponic culture from anthesis of the 3rd truss was effective in producing tomato fruit with low K, and could decrease the fruit K content to at least 50% of the expected tomato fruit K content. Next study, we applied the newly developed management method, quantitative management, about nutrient supply in hydroponics to control the K supply more precisely. In quantitative management, total amount of nutrients necessary for the plants to achieve their life cycle is divided by the estimated cultivation period. And the calculated amount of fertilizers is supplied to the solution tank at every regular interval. Low K fruit (100 mg K/100 g fruit) was achieved when 0.9 g of potassium was supplied. From these results, restriction of K supply in

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hydroponics with double or triple truss system is hopeful to produce low K tomato fruits, and quantitative control is thought to be more suitable for low K tomato production. Further study is necessary to expect the cultivation period accurately before the cultivation to plan the schedule of K supply.

Key words : Hydroponics technology, tomato fruit, quantitative management, potassium.

EXIGENCY OF PRECISION AGRICULTURE

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Department of soil science

Precision agriculture (PA), satellite farming or site specific crop management (SSCM) is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. Precision agriculture is a key component of the third wave of modern agricultural revolutions with new technological advancements in the agricultural revolution of precision farming. John Deere was the first to introduce this technology using GPS location data from satellites. A GPS-connected controller in a farmer's tractor automatically steers the equipment based on the coordinates of a field and save seed, fertilizer, fuel, and time. India, issues of agricultural sector range from low per capita productivity, scarcity of skilled labour, high cost of cultivation and insufficient soil management practices which is improve by practices of precision agriculture. There is a lot of technology used to make modern agriculture more efficient. For example, some farmers use global positioning systems (GPS) and GPS-computer guided tractors and harvesters. Precision agriculture is geographical site-specific practices may include: electromagnetic soil mapping, collection of soil sample and crop yield data collection, aerial imager, crop or soil colour index maps, soil types, soil characteristics, drainage level, potential yields. Each of these geo-referenced data layers helps subdivide a large field area into smaller management zones. Using small management zones reduces waste while increasing production potential. One example of a precision agriculture practice is to evaluate the natural soil variability of a field. If the soil in one area holds water better, crops can be planted more densely and irrigation can be sparing. Hence, precision agriculture is a way to produce more food at a fraction of the cost and conserve soil for sustainable food production in climate smart agriculture.

PHENOTYPIC DIVERSITY IN PEARL MILLET [*Pennisetum glaucum* (L.) R. BR.] GERMPLASM LINES

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For effective trait selection, it is very important to have knowledge of association between traits and heritability. So, a study on phenotypic diversity in pearl millet [*Pennisetum glaucum* (L.) R. Br.] was intended in a set of 48 maintainer lines using 9 quantitative traits. Significant mean sum of squares indicated presence of sufficient variation in the lines. The GCV were slightly lower than PCV indicating the slight influence of environment on the expression of characters. Number of productive tillers/plant, plant height, 1000 grain weight, grain yield/plant had high heritability with high genetic advance as % of mean suggesting the prevalence of additive gene action in their inheritance which suggest that selection will be more effective based on these traits. Correlation coefficient analysis revealed that days to 50% flowering, spike length, number of productive tillers per plant, 1000 grain weight, dry and green fodder yield were significantly and positively correlated with grain yield per plant. The traits, days to 50% flowering, spike length, number of productive tillers/plant had high significant direct contribution towards grain yield/plant for which indirect selection can be made in future breeding programme to enhance grain yield.

Keywords: Phenotypic diversity, GCV, PCV, correlation coefficient, path analysis, pearl millet

BIOFERTILIZERS : A HAND TOWARDS ORGANIC AGRICULTURE

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Essential plant nutrient mainly nitrogen (N), phosphorus (P) and potassium (K) are supplied by fertilizers. These fertilizers adversely affect human health. Due to this reason, farmers are growing crops without use of any fertilizer. Biofertilizers plays an important role in organic agriculture. A biofertilizer is a substance which contains living microorganism which, when applied, colonize the rhizosphere of the plant and promote growth by supplying nutrient to the host plant. They have capability to provide required nutrients to the crop in sufficient amount that enhance the crop yield. They not only contribute in plant growth, but also protects plants from pathogens by secreting antibiotics. Biofertilizers are now gaining emphasis among small and marginal farmers due to low cost. Biofertilizers add nutrients through nitrogen fixation, solubilizing phosphorus, and synthesis of growth-promoting substances. They provide 'eco-friendly

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organic agro-inputs. Biofertilizers are effective even under semi-arid conditions. Biofertilizers like blue green algae (BCA), *Rhizobium* and *Azotobacter* have been in use from a few years. Bacteria and cyanobacteria has the property of nitrogen fixation while mycorrhizal fungi withdraw nutrients from organic matter for the plant with which they are associated. They maintain fertility and natural habitat of the soil. Most biofertilizers also secrete hormones like auxin, cytokinin and vitamins which are essential for plant growth. They increase the yield of plant by 15-35%. Overall, the important role of biofertilizers makes them a powerful tool for organic agriculture.

Keywords: Biofertilizers, Antibiotics, *Rhizobium*, *Azotobacter*, Eco friendly

OPTIMIZATION AND CHARACTERIZATION OF SIDEROPHORE PRODUCING PLANT GROWTH PROMOTING BACTERIA FOR ENRICHMENT OF IRON CONTENT IN WHEAT

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More than two billion people are affected from micronutrient deficiencies of iron, vitamin A, iodine and zinc and it leads to important health consequences. To reduce the level of micronutrient deficiency it is required to biofortified our staple food crops. Implication of potential rhizobacteria for biofortification is a novel approach, can lead to augment micronutrient concentration in food crops along with significant yield and growth. In this context, present study was carried out for isolation and screening of plant growth promoting rhizobacteria from rice rhizosphere, Chiplun, Maharashtra, India and examined for their plant growth promoting abilities such as zinc solubilization, siderophore, ammonia, indole-3- acetic acid (IAA), hydrogen cyanide (HCN), exopolysaccharide and 1 aminocyclopropane 1-carboxylase (ACC) deaminase production potential. The potential bacterial isolate was further examined for optimization and characterization of siderophores. The results of optimization revealed that bacterium was able to produce siderophore (58 to 75% units) in the optimum condition of pH 8.0 at 36°C with sucrose and glucose as a C source. Furthermore, the characterization was done by means of spectrometric analysis which unveiled that type of siderophore produced by potential bacterial isolate was catecholate. The effectiveness of bacterial isolate was further analyzed through *in situ* plant growth promoting study in wheat (*Triticum aestivum* PBW-373) and assimilation of iron content in plant shoot and grains through AAS (Atomic absorption spectrophotometer), which showed significant influences on plant growth and productivity as well as iron assimilation in shoot and grains over control. Thus, the bacterial isolate can be developed as a potential bioinoculant reducing malnutrition intended for sustainable agriculture strategies after further evaluation and validation.

ORGANIC FARMING IN ORNAMENTAL CROPS

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Organic farming is a technique, which involves cultivation of plants in natural ways avoiding synthetic substances to maintain soil fertility and ecological balance. It is based on crop rotation, green manure, biological pest control, bio-fertilizers and organic manures. Flower cultivation nowadays is a way for diversification. By using inorganic fertilizers one can get higher yield but continuous use of agrochemicals deteriorates soil health and create imbalance to environment by polluting air, water and soil. There is an urgent need to reorient the research priorities towards developing alternate system in crop production. Many research works has been successfully conducted in different flower crops to observe the growth and yield characters under organic conditions. Organic flowers have longer vase life, drought tolerant and are free from chemical residues. The pre and post harvest quality was found to increase due to application of vermicompost, poultry manure and bio fertilizers. Poultry manure increased the growth and yield with maximum cost of benefit ratio in African marigold (Idan *et al.*, 2014). Application of vermicompost and VAM along with foliar application of vermiwash improved the floral attributes and shelf life of gladiolus cv. White Prosperity (Pathak and Kumar, 2009). Organic manures and bio inoculants improved the quality and yield of chrysanthemum (Bohra and Kumar, 2014).

Key words: Organic farming, flowers, balance, quality.

STUDIES ON INFLUENCE OF CROP BIODIVERSITY ON PIGEON PEA *CAJANUS CAJAN* L. (MILLSP.) INSECT COMPLEX.

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Pigeonpea crop accounts ~5% of global acreage (4.16 million ha) and production (2.85 million tonnes), of which Asia is nearly the sole contributor (Ahlawat *et al.*, 2005). In India pigeonpea occupies an area of about 4.42 million ha with a total production of 2.89 million

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tonnes with productivity of 655 kg/ha (Anonymous, 2011). In the country, the crop is extensively grown in Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Gujarat. Studies on insect pest complex and their natural enemies in three diverse crop habitats *i.e.* pigeonpea bordered with maize (PP+M), bordered with sorghum fodder (PP+S) and pigeonpea sole unprotected and protected (PP + UP and PP+P), revealed that the following insects were recorded the pigeonpea crop. Jassid, *Empoasca fabae* Harris (Hemiptera: Cicadellidae); Aphid, *Aphis craccivora* Koch (Hemiptera: Aphididae); Leaf webber, *Grapholita critica* Myer. (Lepidoptera: Tortricidae); Red pumpkin beetle, *Raphidopalpa foveicollis* Lucas. (Chrysomelidae: Coleoptera); Green stink bug, *Nezara viridula* Linn. (Hemiptera: Pentatomidae); Cow bug, *Otinotus oneratus* W. (Hemiptera: Membracidae); Tur plume moth, *Exelastis atomosa* Walsingham (Lepidoptera: Pterophoridae); Pod bug, *Clavigralla gibbosa* Spinola (Hemiptera: Coreidae); Pod fly, *Melanagromyza obtusa* Malloch (Diptera: Agromyzidae); Thrips, *Megalurothrips usitatus* Bagnall (Thysanoptera: Thripidae); and Gram pod borer, *Helicoverpa armigera* Hub. (Lepidoptera: Noctuidae).

Diversification of crop habitat significantly influenced the incidence of pod infesting pest complex. Pigeonpea sole under protected condition was found to be most promising as it recorded minimum grain damage by pod infesting pest complex and registered highest grain yield, followed by pigeonpea bordered with maize, and sorghum fodder and highest damage and lowest yield pigeonpea sole under unprotected condition. Incidences of insect on border crop and parasitization by *C.chloridae* and *Carcelia* sp.

EFFECT OF *PLEUROTUS EOUS* SUPPLEMENTED DIETS ON THE ALBUMIN, GLOBULIN AND TOTAL PROTEINS IN EXPERIMENTAL ANIMAL (MALE ALBINO WISTAR RATS)

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India blessed with various climatical condition which seems to be quite suitable for large-scale production of Oyster mushroom *P.eous*. Hence studies were taken up with an objective to find new technologies to test the Albumin, Globulin and Total Proteins of *P.eous*. With regard to the studies on medicinal properties of *P.eous*, The level of albumin, globulin and total protein showed steady increase in the rats co-administrated with various levels of *P.eous* the level of RBC, WBC, hemoglobin and haematocrit showed a significant increase in rats co-administered with different concentration and durations of observation. Among the three levels of *Pleurotus eous* diet tested, the 10 per cent level recorded the maximum increase level when compared to 2.5 and 5 per cent level in the both serum and liver. The level of albumin, globulin and total protein are analysed by feeding rats with 10 per cent of *Pleurotus eous* diet (Group D) over a period of 90th day observed a gradual increase when compared with control (Group A) and therefore the study revealed the beneficial effects of *P.eous* on the increased level of albumin, globulin and total protein content.

Key words : *Pleurotus eous*, Hemoglobin, Haematocrit, Albumin, Globulin, Wistar rats .

POLYSACCHARIDE PROFILING OF *XANTHOMONAS AXONOPODISPV. PUNICAE* CAUSING BACTERIAL BLIGHT OF POMEGRANATE

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Lipopolysaccharides (LPS) of *Xanthomonas axonopodispv. punicae* constitute one of the main component of the outer membrane of this bacteria which play an essential role for bacterial growth and survival. Similarly, the capacity of this bacteria to induce persistent water-soaking in leaves plays a crucial role during pathogenesis that seems to be accomplished by synergistic interaction between bacterial Exopolysaccharides (EPS) and plant polymers. We have studied Lipopolysaccharides (LPSs) and Exopolysaccharides (EPS) profiling of 23 different isolates of *Xanthomonas axonopodispv. punicae* in present investigation. Exopolysaccharides profiling of isolates showed that the amount of exopolysaccharides in the wall of different *X. axonopodispv. punicae* isolates varied from 98.94 to 183.90 µg/mg. Higher exopolysaccharides was found in isolate KD-11 whereas lowest exopolysaccharides containing isolate was GBV-21. Whereas, Lipopolysaccharide profiling of these isolates showed that isolate KD-11 contained higher amount of lipopolysaccharides *i.e.* 139.90 µg/mg. while, less amount of lipopolysaccharides was observed in isolate RH-22 *i.e.* 48.86 µg/mg, others isolates contained varied amount of LPS.

INDUCTION OF MOISTURE STRESS TOLERANCE IN GERMINATING SEEDS OF CHILLI (*CAPSICUM ANNUM* L.) THROUGH SEED PRIMING

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To ascertain the role of seed priming for mitigating the adverse effects of moisture stress during seed germination, seeds of chilli cv.

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Kashmir Long-1 were primed in water (30 hours), -0.5MPa solution of PEG 6000 (18 hours), 8x dilution of vermiwash (30 hours) and 5ppm solution of melatonin (30 hours) and unprimed seeds were taken as control and tested for their germination potential under normal (no stress) and moisture stress conditions. Seed priming is simply the hydration of seeds by exposing them to aqueous solution and re-drying to original moisture level. For the germination test under normal and moisture stress conditions 50 primed seeds of each priming treatments were sown in nursery trays and supplied with distilled water and -0.5 MPa solution of PEG 6000, respectively. Data indicate that germination potential of chilli seeds was significantly declined under moisture stress condition while as different priming treatments tend to improve the germinability of seeds particularly under moisture stress condition. Among different priming treatments melatonin priming resulted in highest germination as well as seedling emergence percent (90.66 % & 87.33 %), days to 50% of germination & days to 50% of emergence (G_{50} 10.0 & E_{50} 12.33), Timson's index (35.24), radical & plumule length (4.74 & 4.39 cm), seedling root & shoot dry weight (0.15 & 0.05 g/ seedling), seedling vigour index I & II (810.59 & 17.50), leaf chlorophyll content and its stability (0.86 mg/g & 97.92 %) and proline content (33.77 μ mol/g) followed by osmopriming against the minimum values in control with respect to germination as well as seedling emergence percent (83.33 % & 74.00 %), speed of germination & seedling emergence (G_{50} 11.67 & E_{50} 14.00), Timson's index (30.04) radical & plumule length (3.80 & 3.79 cm), seedling root & shoot dry weight (0.09 & 0.02 g/seedling), seedling vigour index I & II (632.71 & 10.80), leaf chlorophyll content and its stability (0.48 mg/g & 72.72 %) and proline content (17.14 μ mol/g).

STUDIES ON INFLUENCE OF CROP BIODIVERSITY ON PIGEON PEA *CAJANUS CAJAN* L. (MILLSP.) INSECT COMPLEX.

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Pigeonpea crop accounts ~5% of global acreage (4.16 million ha) and production (2.85 million tonnes), of which Asia is nearly the sole contributor (Ahlawat et al., 2005). In India pigeonpea occupies an area of about 4.42 million ha with a total production of 2.89 million tonnes with productivity of 655 kg/ha (Anonymous, 2011). In the country, the crop is extensively grown in Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Gujarat.

Studies on insect pest complex and their natural enemies in three diverse crop habitats i.e. pigeonpea bordered with maize (PP+M), bordered with sorghum fodder (PP+S) and pigeonpea sole unprotected and protected (PP + UP and PP+P), revealed that the following insects were recorded the pigeonpea crop.

Jassid, *Empoasca fabae* Harris (Hemiptera: Cicadellidae); Aphid, *Aphis craccivora* Koch (Hemiptera: Aphididae); Leaf webber, *Grapholita critica* Myer. (Lepidoptera: Tortricidae); Red pumpkin beetle, *Raphidopalpa foveicollis* Lucas.(Chrysomelidae: Coleoptera); Green stink bug, *Nezara viridula* Linn. (Hemiptera: Pentatomidae); Cow bug, *Otinotus oneratus* W. (Hemiptera: Membracidae); Tur plume moth, *Exelastis atomosa* Walsingham (Lepidoptera: Pterophoridae); Pod bug, *Clavigralla gibbosa* Spinola (Hemiptera: Coreidae); Pod fly, *Melanagromyza obtusa* Malloch (Diptera: Agromyzidae); Thrips, *Megalurothrips usitatus* Bagnall (Thysanoptera: Thripidae); and Gram pod borer, *Helicoverpa armigera* Hub. (Lepidoptera: Noctuidae).

Diversification of crop habitat significantly influenced the incidence of pod infesting pest complex. Pigeonpea sole under protected condition was found to be most promising as it recorded minimum grain damage by pod infesting pest complex and registered highest grain yield, followed by pigeonpea bordered with maize, and sorghum fodder and highest damage and lowest yield pigeonpea sole under unprotected condition. Incidences of insect on border crop and parasitization by *C.chloridae* and *Carcelia* sp.

A STUDY ON EVALUATION OF DEVELOPMENT -AGRICULTURE AND INFRASTRUCTURE IN DEVIPATAN DIVISION OF EASTERN UTTAR PRADESH

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Socio-economic development is one of the most important concerns of all the countries. Present study is regarding the level of development of 4 Districts and 44 blocks of Devipatan division in Eastern Uttar Pradesh. Secondary data on a number of indicators published by Uttar Pradesh Government for the year 2012-2013 have been used in the study. Principal Component & Factor Analysis methods along with techniques adopted by Narain *et al.* have been used. The level of development was examined for Agriculture and Infrastructure systems. The Ranking of Districts is- Gonda, Behraich, Sravasti and Balrampur in respect of Agriculture & Infrastructure. Indicators available at District Level are more informative than Block level Indicators. Variables/Indicators like- Production & Productivity of Food grains, Gross value of agriculture produce, % irrigated area have been found important in this study. These

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variables are not estimated at Block levels. Development process of any system is dynamic in nature and depends on large number of parameter. This study attempted to capture latest dynamics of development in devipatan division in Eastern Uttar Pradesh in respect of three dimensions- Agriculture, and Infrastructure. Technique adopted by Narain et al. (1991) have been used in addition to principal component and factor analysis. Ranking seems to very close to ground reality and provides useful information for further planning and corrective measures for future development of Eastern Uttar Pradesh's District. The Composite Indices (C.I) of development in respects of 23 developmental indicator for the total 4 Districts and 44 block of Eastern Uttar Pradesh have been estimated for the year 2011-12. The Block Jamunha was showed a higher level of development (C.I=1.05) in Agriculture development and Infrastructure development Districts Karnailganj (C.I=0.73) followed by the Block Mihipurwa (Agriculture, C.I=1.83), and Block Katra Bajar (Infrastructural C. I = 0.74). Principal Component and Factor Analysis seem to be more reliable at District level in comparison to Block levels. Correlation Matrix of Indicators at District level is indicating strong trends but at Block level the trends are moderate or weak. Ranking of Block and its comparison with previous study in 2004 shows many changes that requires further investigation.

Keyword: Composite index, Developmental Indicator, Factor analysis, Principal component analysis, Socioeconomic.

EFFECT OF ROOT AND FOLIAR APPLIED FERTILIZER ON YIELD OF POTATO AND CABBAGE

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An investigation was conducted to estimate the absorption efficiency of root and foliar applied nutrients on cabbage and potato in Regional Agriculture Research and Development Centre, Bandarawela (6°49'59.99" N 80°58'59.99" E), Sri Lanka during 2014 and 2015. Experiment was conducted in 1x1x0.2 m wooden boxes filled with soil less medium (Cair dust based) and maintained in protected environmental conditions. A complete nutrient mixture (Albert solution) was applied directly into plant roots, sprayed into leaves to drain out the excess into medium, foliar application only without allowing draining out to medium and compared with no fertilizer control. Experiment was laid out in CRD with three replicates. Plant growth and yield were recorded and Nutrient Use Efficiency (NUE) was calculated. Results showed that, growing medium pH and EC were varied with initial values and after the crop pertinent to fertilizer application methods and root applied treatment showed higher variations. Root application of plant nutrients was recorded significantly higher yield than foliar application. Significant yield increment recorded by root absorbed nutrients from drained portion of fertilizer to growing medium than only foliar applied treatment according to plant growth and yield of cabbage and potato. It reflected superior NUE in root applied plant nutrients and always cabbage shows higher NUE than potato. Foliar application was not able to fulfill the total plant nutrient demand of cabbage and potatoes.

Key Words Cabbage, Fertilizer, Foliar application, Potato, Root application

DOUBLING FARMERS' INCOME THROUGH INNOVATIVE APPROACHES

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In an effort to boost the agriculture sector, the government has set the ambitious goal of doubling farmers' income by 2022. At the current 3-per-cent growth rate it would take 25 years to double farmers' income. In doing so, it has unveiled strategies ranging from a focus on irrigation to provision of quality inputs, investments in warehousing and cold chains, promotion of food processing and crop insurance schemes, among others. What is clear is that to transform the agriculture sector, it needs to move from a production-driven system to a demand-driven food value chain that increasingly connects the consumer to the producers. Doubling of farmers' income must be attempted by creating a framework where all related agencies come together and work in harmony, with a maestro conducting that orchestra. Doubling rural income in nominal terms is possible by increasing agriculture output & minimum support prices (while keeping inflation below 5%), doubling rural income in real terms would be a daunting task considering increasing agriculture output by 12% every year with no additional land likely to be utilized for agricultural activity. There is every possibility not only to double the income of farmers through enhancement in productivity, changes in cropping pattern, inspire additional income through many supplementary activities but also provide stability in farmers' income. If a large number of agricultural households are connected to mass consumption markets both domestic and global the objective of doubling farm income doesn't seem daunting. The focus must shift from increasing per acre productivity to gainfully employing farm households in other farm-related activities. The explosion of the services sector allowed that to happen in urban India. We need a similar catalyst for the lowest end of the income spectrum among rural households.

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AILANTHUS BASED AGROFORESTRY SYSTEM IN ARID AND SEMI-ARID REGIONS

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Arid and semi-arid zones are characterized by hostile climatic conditions i.e., low and erratic rainfall and intense solar radiation coupled with high wind velocity, poor nutritional status of soil with low water holding capacity, poor quality and deep seated underground waters. In absence of favourable conditions for intensive agriculture, livestock rearing is an alternative source of livelihood of majority of the rural population in arid ecosystems of India. Therefore, to meet the increasing demand for fodder (green and dry) for livestock and food, fuel wood and timber etc. for human population on sustainable basis without degradation of land resources, the only alternative in the land productivity is agroforestry. Agroforestry plays an important role in meeting the diverse needs of people resorting to them as inter-dependent benefits of the three components, viz. trees, crops and livestock in addition to the 6Fs, i.e. food, fruit, fodder, fuel, fertilizer and fiber from limited land resources. After khejari (*Prosopis cineraria*), ardu (*Ailanthus excelsa*) is the only tree that not only feed to the animals but also used in manufacturing of plywood, match-sticks, toy and packing materials, medicines etc. Ardu reflects wider adaptability and higher tolerance to biotic and abiotic stresses hence, a potential species during drought/ climate change. The selection of ardu for commercially important agroforestry models to obtain higher productivity holds significance in producing fodder, fuel wood, timber etc. in arid ecosystem. Realizing its multiple uses, its cultivation in various systems extended and came out to be a profitable venture in agroforestry and silvi-pastoral system.

Keywords: *Ailanthus excelsa*, Mahaneem, Maharukh, Agroforestry, Ardu

CERTAIN MORPHOLOGICAL CHARACTERS IMPARTING RESISTANCE IN TOMATO AGAINST FRUIT BORER, *HELICOVERPA ARMIGERA* (HUBNER)

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Tomato is one of the most preferred vegetable crops in the world with the total global area of 45,82,438 thousand ha and production of around 15,05,13,813 thousand tones. Despite of the good area, production is not up-to the mark as tomato is more prone to insect pests viz., tomato fruit borer, green house whitefly, serpentine leaf miner, etc due to its tenderness and softness as compared to other crops. Among them, the tomato fruit borer, *Helicoverpa armigera* (Hubner) is main bottle neck and causes heavy loss in yield. Host plant resistance or varietal resistance constitutes an important field of study with the hypothesis that different varieties/lines of tomato possess varied degree of population and infestation of *H. armigera*. The present studies were carried out on Vegetable Research Farm, IAS, BHU, Varanasi during 2017-18. On the selected twenty two tomato varieties/lines morphological characters viz. number of branches per plant, number of calyx per fruit, density of trichomes on the calyx, density of trichomes on the leaf surface, fruit pericarp thickness were measured and compared. The results showed that the correlation of branches per plant ($r=0.674$) and number of calyx per fruit ($r=0.373$) were significantly positive while density of trichomes on the calyx ($r=-0.522$), density of trichomes on leaf surface ($r=-0.322$) and fruit pericarp thickness ($r=-0.473$) exhibited significantly negative association with the damage of tomato fruit borer. The morphological characteristics used under present studies can be used as marker traits by breeders to develop insect resistant varieties/lines of tomato through breeding programs.

Keywords: Morphological characters, *H. armigera*, fruit infestation, correlation analysis

PARTIAL ROOT ZONE DRYING: AN EMERGING TECHNIQUE FOR INCREASING WATER USE EFFICIENCY AND QUALITY IN FRUITS UNDER ARID AND SEMI-ARID REGIONS

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Irrigated agriculture depends on ground water and ground water going to be an ever-increasing pressure due to increasing water demand for cultivation of agricultural as well as horticultural crops. Partial root-zone drying is a modified, novel form of deficit irrigation method. It involves irrigating only one half of the root-zone in each irrigation event, leaving another half of root-zone to dry up to certain soil water content, than shifting irrigation to the dry side. In PRZD, generally the alternate wetting and drying sides of root system is to done on a 10-14 days interval. It alters the plant physiology by creating stress to the plants thus helps in reducing water loss from the plants. The stress results in poor growth but increase quality parameters like soluble solid contents, sweetness, antioxidants, defence related enzymes and also shorten the juvenile phase of plants, make them adaptable to semi-arid and dry areas. In fruit crops under partial

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root zone drying can reduce irrigation water up to 50 per cent of the commercial irrigation and increase water use efficiency to the extent of 80-92 per cent. In grape, orange, mango, pomegranate and apple PRZD increases WUE and fruit quality without affecting the yield. Its usefulness has been proven in grapes, orange, pomegranate and apple. With changing climatic conditions and fluctuation in rainfall, shortage of available water resources, especially in arid and semi-arid areas, so there is urgent need to improve irrigation techniques and agricultural water management in the era of scared water condition.

PROBLEM, PROSPECTS AND MANAGEMENT STRATEGIES OF PULSE PRODUCTION UNDER RAINFED SITUATION

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Agriculture production in rainfed regions constitute about 65% of the area under cultivation and account for about 40-45% of the total production in India. It is expected to suffer severe water crisis due to delayed monsoon, uneven rains distribution as a result of above climate change threats. But, pulses are one of the important segments of Indian agriculture after cereals with 25% share in the global pulse production and covering an area of about 263 m ha, majority of which falling under rainfed condition where irrigation facilities are inadequate or not available. Pulses are rich sources of protein and energy, but in india these are largely cultivated under energy starved conditions, mostly on marginal and sub-marginal land and more than three-fourth of the area under pulses is still rainfed resulting in poor crop productivity (Choudhary 2013). In India, production of pulses is around 19.3 million tonnes (ESI 2015) with a very low average productivity of 764 kg/ha. As a result, the productivity of the pulses in India is quite low. Besides, to meet the demand of pulses, India imports huge amount of pulses every year. Thus, there is a great challenge to enhance pulse productivity to meet out the national and local pulse requirements. India needs around 32 million tons of pulses by 2030, to feed the estimated population of about 1.68 billion. Global supply of pulses is limited, as India happens to be the largest producer and consumer of pulses. This is only possible when farmers adopt improved technologies in pulse production like moisture conservation, seed replacement with improved varieties, raised bed planting method, use of biofertilizers, foliar application of fertilizers at critical stages in rainfed areas, application of secondary and micro-nutrients and adoption of appropriate modules for integrated weed and pest management and appropriate crop management practices). However, a concerted effort by farmers, researchers, development agencies, and government are needed to ensure that India becomes self-sufficient in pulses.

KEYWORDS: Pulse production, Rainfed conditions, Strategies and Technology

PRECISION AGRICULTURE: A TOOL FOR DOUBLING FARMERS INCOME

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Precision agriculture merges the new technologies borne of the information age with a mature agricultural industry. It describes an approach to the mechanized production of food and fiber in which production inputs (seed, fertilizer, irrigation, water, pesticides, etc.) are prescribed and applied and crop yields are monitored on a site-specific basis rather than the traditional whole field basis. The goal is not new but the new technologies now available, such as 'Global positioning systems' (GPS) and 'Geographical information systems' (GIS), allow the concept of precision agriculture to be realized in a practical production setting. Farmers are usually aware of their fields having variable yields across the landscape. These variations can be an outcome of poor management practices, soil properties and/or environmental characteristics. Soil properties that affect yields include texture, structure, moisture, organic matter, nutrient status and landscape position while environmental characteristics include weather, weeds, insects and diseases. Seeing this magnitude of variation prompts most farmers to ask how the problem that is causing the low yields can be fixed. There is no economical feasible method of "fixing" the depleted top soil areas in this field, so the management challenge is to optimally manage the areas within the field that have different production capacities. This does not necessarily mean having the same yield levels in all areas of the field. Precision farming is a direction of research rather than a destination. Extensive research on precision farming requires immediate attention of the researchers and policy makers. It should not be misunderstood that precision agriculture because of its sophisticated nature is only suitable for the large are resource rich farmers rather it could be more useful for a resource poor farmer. The goal is to optimize production inputs in order to maximize profit. When fully developed, PA also has the potential to minimize negative environmental impacts associated with production inputs (fertilizers, pesticides, water). In addition, fertilizer, plant population and even choice of crop hybrid/variety can be adjusted to account for changing soil types, fertility, pH differences, infiltration rates and slope aspect.

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**EFFICACY OF ORGANIC AND INORGANIC NUTRIENT IN MANGO****KALYANI NAGRAJ¹, ISHWAR MARKAM², GULSHAN GAWDE³***Department of Fruit Science 2- Department of Floriculture 3-Department of Ag.Economics, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, (C.G)*

A investigation was carried out for the Study on effect of organic, inorganic and biofertilizer on growth, yield and quality of mango cv. Amrapaliit was carried out during 2015-2016 at Horticulture Research Farm, Department of Fruit Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), found that the application of 80% RDF + Cowdung slurry@10 lit/tree produced the highest shoot length, shoot girth, number of leaves per shoot, number of primary branch, length of panicle, number of panicle per rachis, number of flower per panicle and minimum flowering duration. Yield and yield attribute character like fruit length, fruit width, fruit volume fruit weight and number of fruit plant⁻¹ (140.33), fruit yield (29.60 kg tree⁻¹ and 11.84 MT ha⁻¹) was obtained under the treatment 80% RDF + Cowdung slurry@ 10lit/tree. Quality parameter like peel weight, pulp weight, stone weight, TSS, reducing sugar, non reducing sugar, total sugar, ascorbic acid, sugar acid ratio were maximum under the treatment 80% RDF + Cowdung slurry@10lit/tree. The peel per cent, pulp per cent and stone per cent were showed non- significant difference. The acidity was maximum under control. The nutrient status of mango leaves like N, P, K, Ca, Mg, Cu, Zn, Mn and Fe were also higher under the treatment 80% RDF + Cowdung slurry @10lit/tree. The treatment 80% RDF + Cowdung slurry@10lit/tree produced the maximum yield and also gave the highest gross return, net return and benefit: cost ratio which was closely followed by 100% RDF and 80% RDF + Vermiwash@ 10lit/tree.

EFFECT OF PLANTING DATES AND VARIETIES ON GROWTH AND QUALITY IN GLADIOLUS (GLADIOLUS HYBRIDUS HORT.) UNDER SUB-HUMID ZONE OF RAJASTHAN**KAMAL KISHORE NAGAR, ASHUTHOS MISHRA, SUSHMAPATIL AND J PRATHORE¹***Department of Floriculture & Landscaping, College of Horticulture & Forestry-Jhalawar, Agriculture University Kota (Rajasthan), Division of Fruit Science, FOH, SKUAST-Kashmir, Shalimar-190025*

A field experiment was conducted during winter season of 2015-16 to study "Studies Effect of Planting Dates and Varieties on Growth and Quality on Gladiolus (*Gladiolus hybridus* Hort.) under sub-humid zone of Rajasthan" having 15 treatment combinations of five Varieties (V₁- African Star, V₂- Hunting Song, V₃- Legend, V₄- PusaSrijana and V₅- Snow Princess) and three planting dates (D₁- 10th October, D₂- 25th October and D₃- 9th November). The treatment V₂D₁ (Hunting Song + 10th October planting) recorded the maximum plant height (116.10 cm), highest number of leaves per plant (8.77), main stem diameter (1.50 cm), number of florets per spike (15.8), spike length (91.80 cm), rachis length (57.90 cm), floret diameter (10.04 cm), vase life of spike (13 days), While the maximum leaf length (64.20 cm), leaf width (4.96 cm) in (V₃D₃) and maximum spike girth (0.91cm) was found in (V₁D₂). The growth and flowering quality was found superior in compare to other planting dates.

"CONSTRAINTS FACED BY FARMERS ABOUT SCIENTIFIC PRODUCTION TECHNOLOGY OF OKRA"**KAMAL KISHORE¹, PRAKASH SINGH², R.K. DOHAREY³, KAUSHIK PRASAD^{*4}, ATUL KUMAR⁵, ARVIND PRATAP SINGH⁶, MANOJ KUMAR⁷ AND SUBODH KUMAR⁸***^{1,2,3,4,5,6,7} Department of Extension Education, College of Agriculture, N.D.U.A &T., Narendra Nagar (Kumarganj), Faizabad (U.P.) 224229, India, ⁸Department of Veterinary Extension, College of Veterinary, N.D.U.A &T., Narendra Nagar, (Kumarganj), Faizabad (U.P.) 224229, India*

The study was conducted in Chhibramau and Talgram blocks of **Kannauj** district (UP) selected purposively, because these blocks one more popular for area and production of okra. A total number of okra growers were selected through random sampling from eight selected village's panchayats on the basis of ten respondents from each selected village panchayats. The some structured schedule was developed keeping in view the objectives and variables under study. The respondents were contacted personally for data collection. Social problems in okra cultivation perceived maximum number of the respondents 87% with adopt a rank of first were agreed with the statements that damage due to lack of good seedling is the common problem, followed by damage due to pest and insect 85% at ranks second. Economic problems in okra cultivation perceived maximum number of the respondents 87.50% with adopt a rank of first were agreed with the statements that lack of Minimum Support Price is the common problem, followed by lack of grading, and middleman dominancy 85.50% at ranks second. Technical problems in okra cultivation perceived maximum number of the respondents 95% with adopt a rank of first were agreed with the statements that "highly susceptibility of diseases, insect and pests" is the common problem, followed by low keeping quality of okra varieties 93.00% at ranks second.

Keywords: Constraints, knowledge and sampling, awareness, scientific cultivation, etc.

SUSTAINABLE APPROACH TO INTEGRATED PEST MANAGEMENT IN COLE CROPS**KAMALRAVISHARMA¹, SVS RAJU¹, RASHMIREKHA SINGH² AND RAMESH BABU S¹**¹Departem^t of Entomology and Agril. Zoology, I. Ag. Sc., B.H.U., Varanasi-221 005, ²Departem^t of Entomology, COA, OUAT, Bhubaneswar- 751 003

Cole crops belong to plants in the crucifer family within the Genus Brassica. Cole crops cultivated extensively in tropical and temperate regions in the world including India. The main constraint in the production of cole crops is the damage caused by insect pests complex from seedling to harvesting. In India, a total more than 40 insect pests have been recorded on cole crops. The extent of damage caused by these insect pest from 7 to 90 per cent with consequent reduction in yield from 20 to 80 per cent. In the last century the farmers have added one more weapon to their armoury to use against the insect pest, *i.e.* the use of chemical pesticides. However, over reliance and indiscriminate use of pesticides resulted in a series of problems in the agro-ecosystem mainly, the development of resistance in insects to insecticides, resurgence of treated population, out-break of secondary pests into primary nature, environmental contamination and residue hazards, destruction of natural enemies of insect pests, expenses on pesticides, equipment, labour etc. All these problems contributed to a new way of thinking the sustainable approach for concerning insect pest control practices, *i.e.* Integrated Pest Management (IPM). Integrated pest management is a systems approach to pest control that combines the all suitable management practices with the judicious use of pesticides. IPM is a dynamic and constantly evolving system in which all the suitable control tactics and available surveillance and forecasting information are combined into a holistic management programme delivered to the farmer at requisite interval as part of the sustainable crop production technologies in cole crops.

Keywords: Cole crops, Insect pests, Insecticide, Integrated Pest Management.

EFFECT OF ZINC AND BORON ON GROWTH AND YIELD OF MAIZE (ZEAMAYS L.)**KAMAL SINGH, SATYBHAN SINGH AND PRADEEP KUMAR***School of Agricultural Sciences & Engineering, IFTM University, Moradabad-244102*

Maize (*Zea mays* L.) is one of the most important cereal crops throughout the world. The present study entitled impact of Effect of Zinc and Boron levels on maize in north-western Uttar Pradesh plain zone of India was carried out a School of Agricultural Sciences and Engineering, IFTM University Moradabad in 2017-18. the effect of Zinc has a pronounced effect on the important processes of plants like photosynthesis, protection against reactive oxygen species, nitrogen metabolism, carbonic anhydrase activity, chlorophyll synthesis and resistance to biotic and abiotic stresses Boron deficiency depresses commercial corn yield primarily through grain set failure, and Zinc and Boron both play an important role in the basic plant functions like photosynthesis, protein and chlorophyll synthesis. With Treatment T₁ (Control), T₂ (Zinc Soil Application), T₃ (Zinc Foliar Application), T₄ (Zinc Two Foliar Application), T₅ (Zinc Soil Application + Zinc Foliar Application), T₆ (Boron Soil Application), T₇ (Boron Foliar Application), T₈ (Boron Two Foliar Application), T₉ (Boron Soil Application And Foliar Application), T₁₀ (Zinc + Boron Soil Application), with three replication. Observation to recorded, Plant height (cm), Number of leaves plant⁻¹, Fresh weight (g), Plant dry weight (g), Stem girth (cm), Days taken to 50% tassel, Days taken to 50% silking, Crop growth rate (CGR), Absolute growth rate (AGR), Yield Attributes, Number of cobs plant⁻¹, Number of grains row⁻¹, Number of grains cob⁻¹, Seed index(g), Grain yield (q ha⁻¹), Strove yield (q ha⁻¹), Biological yield (q ha⁻¹), Harvest index (%), Economics, Cost of cultivation, Gross return, Net return, Beneficial cost (B:C) ratio.

CHARACTERIZATION OF MAIZE GENOTYPES FOR ROOT ARCHITECTURAL TRAITS USING AGAR MEDIATED SCREENING**KAMALUDDIN*, I. A. DAR, Z. A. DAR, P. A. SOFI, A. A. LONE AND A. R. VAID****, Deptt. Of Genetics & Plant Breeding, CoA, BUAT, Banda, Division of GPB, FoA/RRS Wadura (SKUAST-Kashmir)*

The essential function of root is to uptake water and nutrients for plant growth, function as storage organs, attach plants to the soil and are the site of interactions with pathogenic and beneficial organisms in the rhizosphere. Roots are also crucial for nutrient and water acquisition and can be targeted to enhance plant productivity. Because of the underground location of root, it is challenging task for plant breeder to phenotype it and selection of plants with desirable root characteristics. Available approaches for root phenotyping in laboratory, greenhouse and field encompass simple agar plates to labor-intensive root digging. The present study was carried out in the laboratory conditions of Division of Genetics and Plant Breeding, Faculty of Agriculture, Wadura, SKUAST-Kashmir. The experimental material was comprised of thirteen released varieties of maize from different parts of India. The present study showed that Pratap Makka-5 had shallowest root angle and Pratap Makka-4 had steepest root angle. No. of seminal roots were highest in Kishan Ganga-2 and lowest in Aravali Makka-1. Length of tap root was highest in Kishan Ganga-1 and lowest in Pratap Makka-4. The results obtained from this study suggested that selection for root angles, either of seminal roots or of lateral roots, may be helpful to identify genotypes with a root

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architecture system better adapted to water-limited environments.

Keywords: Root; Phenotyping; Breeding; Root angle; Root system architecture

NUTRIENT INTERACTION IN PLANT AND SOIL

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Agriculture is the back bone of India, in which nutrient is the one of the most important input of the crop production. The nutrient interaction is one of the factors that affect availability of nutrient to the crop. Interaction occurs when the level of one production factor influences the response to another factor. It may be positive or negative very from nutrient to nutrient or crop to crop at both plant or soil level. The positive interactions have served as the science-based justification for development of a “balanced” plant nutrition programme. The positive nutrient interaction increased the soil fertility as well as crop productivity, whereas the negative interaction suppressed the soil fertility status as well as crop productivity. The interaction of nitrogen with phosphorus, potassium and sulphur was found synergistic effect on yield of almost crops. In soil, interactions of N x K and P x S had synergistic effects. In contrast, combination of phosphorus and zinc had antagonistic effect on available phosphorus and zinc in soil. It is essential to understand the mechanism of nutrient interaction in soil their effect on plant metabolism for higher crop production and efficient utilization of inputs in soil and plant. For obtaining higher crop production and maintaining soil fertility, there is a need to consider the nutrient interaction for nutrient management.

Key words: nutrient, interaction, positive or negative, productivity

STRATEGY FOR GOAT FARMING IN THE 21ST CENTURY

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The objective of this paper is to contribute to progress in the choices of strategies for further development of goat farming in the 21st century. During the last 20 years, the number of goats around the world increased (by about 60%) not only in the countries with low income (75%) but also in those with high (20%) or intermediate (25%) income. This situation is due to the capacity for adaptation by goats to very different environments, to the development of goat farming in developing countries where subsistence farming, barter economy and community culture are important, and where the market economy is relatively limited, and to the ecological image of goat farming and products in developed countries. Goat farming is in a good position to pursue its development in the 21st century, if a satisfactory policy is applied tactfully. For that, the factors explaining goat farming success during the end of the 20th century must be maintained and developed as the social aspects of goat farming in developing and developed countries, particularly in land management and the sociological integration into an economically sustainable life. Moreover we have to improve or maintain the good image of goat products. The two main improvements to bring into goat farming in the 21st century concern research organisations, which must encounter the needs of goat farmers and be well adapted to different production systems in order to lower the research deficit in the goat sector, and investments for better supplies particularly to the poor goat farmers.

EFFECT OF WEATHER PARAMETERS ON KHARIF RICE FOR BETTER PLANNING AND MANAGEMENT IN BHARUCH (GUJARAT)

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India economy mainly depends on agriculture sector as it account 18 percent of national GDP and it is most important occupation for most of the Indian families so; it is the soul of Indian economy. Rice is the most important staple food in India which play crucial role in daily requisite of diet. In the current study statistical crop modeling was engaged to provide forecast in advance. In this paper Multiple Linear Regression (MLR) Technique and Principal component analysis were derived for estimating average rice production for the Bharuch of district in south Gujarat. The weather indices were developed using correlation coefficient as weight to weekly weather parameters for the years from 1990 to 2012. The cross authentication of the developed forecast model were confirmed using data of the years 2013 to 2017. It was observed that value of Adj. R² varied from 70.90 to 77.20 in different models. The study discovered that high value of Adj. R² was obtained in the model and which indicated that it was appropriate forecast model than other models. Based on the outcomes in Bharuch district, MLR techniques found to be better than PCA for pre harvest forecasting of rice crop yield.

Key words: Weather indices; MLR techniques; PCA; Forecast

CHALLENGES IN DRUM SEEDING OF WET SEEDED RICE FOR SUSTAINABILITY IN EAST UTTAR PRADESH

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Rice being staple food, cultivation of rice has been unavoidable for the farmer in east Uttar Pradesh. The simple technique for rice cultivation commonly adopted by the farmers is nursery raising and thereafter transplanting. Both the processes water, labour, space as well as more time in order to get more production per hectare. There had been many techniques which prove to be used for getting higher yield. The farmers of east Uttar Pradesh are migrating fast to bigger cities due to unprofitable farming thus vacating villages in search of job. Therefore in order to increase farmers income for sustainability, it becomes essential to introduce those technological practices which are eco-friendly and cost saving too. Zero till machine sowing is useful for larger holdings and covers about 1.5-2 hectare depending on the size, speed of tractor, ambient temperature and moisture availability in the field. However for small and marginal farmers drum seeder is definitely helpful to sow paddy directly without much effort and within a short time. Good results have been achieved in farmers field in few districts of Uttar Pradesh where the drum seeder is being used. The paddy yield is more due to more tillers and cost of production is reduced drastically.

Key words: ambient temperature, drum seeding, eco-friendly, tillers, production, yield

LOWERING IN THE GREEN GOLD- BETEL VINE (*PIPER BETLE* L.)

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Betel vine (*Piper betle* L.) is a dioecious, evergreen creeper belonging to the family *Piperaceae*. It is native to Central and Eastern Malaysia and grows in moist tropical and subtropical regions of different countries such as China, Thailand, Philippines, India, Bangladesh, Sri Lanka and etc. In India, it is cultivated in an approximate area of 45,000 ha as cash crop and West Bengal is the largest producer of betel leaf with sixty-six per cent of total production. Everyday about 15-20 million people in the country consume betel leaves. Betel leaves have many medicinal properties and are used in Indian system of medicine to cure indigestion, stomach ache, diarrhoea, flatulence and to heal wounds, scales, burns, swelling and etc. Cultivation of betel vine is broadly divided into three major types viz. Gachh pan system, open system, semi-closed or closed system and a combination of these. Lowering of vine is one of the critical and important inter cultural operation in betel vine cultivation which is done when the growth of the vine is rapid during rainy season. Tying is also done at an interval of 20-30 cm when the vines trail up to a height of 2.0-2.5 m and touch the roof of the system, they are untied from the support and lowered down to the ground level by harvesting the lower leaves, keeping 4-5 leaves at the top. The stems which accumulate at ground level are sometimes covered with soil or allowed to remain coiled on the ground between the rows and sticks. This entire operation is known as 'lowering of vines' and in certain areas manuring is usually done after every lowering.

EFFECT OF DIFFERENT FEEDING COMPOSITION ON MILK PERFORMANCE OF MURRAH BUFFALO

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The present study has been done to evaluate the effect of various feed composition on milk yield of Murrah buffalo in Muzaffarnagar district of Uttar Pradesh. The objective of this study was to compare the performance of lactating buffaloes under traditional feeding system and feeding of Total Mixed Ration (TMR). Fifteen lactating Murrah buffaloes were divided into three groups in Randomize Block Design (RBD). Roughage and concentrate were fed separately in T1 group. Animals in T2 and T3 were fed TMR of different composition. Diet of animals consisted of paddy straw, sorghum fodder and concentrate mixture. The mean Dry Matter intake (DMI) was similar in three groups (11.51, 12.10 and 12.26 kg/d). Digestibilities of dry matter, organic matter, neutral detergent fiber and acid detergent fiber were increased in both T2 and T3 groups. The average daily milk yield was 7.25, 5.80 and 6.75 kg for T1, T2 and T3 respectively. The milk fat and total solids were higher in T2, while, and milk protein in T3 group.

Keywords: Milk yield, Total mixed ration, Dry matter intake.

WEED DYNAMICS UNDER CONSERVATION AGRICULTURE**KARTIK¹ AND ²RAJESH KUMAR² AND ³GOVIND**¹Department of Agronomy, CCS HAU, Hisar-125004, ²Department of Agricultural Meteorology, CCS HAU, Hisar-125004, ³College of Agriculture, Kaul, CCS HAU, Hisar-125004

Conservation agriculture is an ecological approach for sustainable crop production that is based on continuous minimum soil disturbance, maintaining permanent organic soil cover, and diversified crop rotations. Adoption of conservation agriculture changes weed dynamics and communities and therefore necessitates adjusting weed control methods. In conservation agriculture weeds expression, seed bank status, distribution, dispersal mechanisms, diversification, growing patterns and competition trends are complex and differ from conventional systems of agriculture. It is due to reduced tillage or no-till system of the soil and the flora that thrives in conservation agriculture. No-till systems accumulate seeds near the soil surface where they are more likely to germinate but are also exposed to greater mortality risks through weather variability and predation. It is observed that germinable seed banks under no-till decrease more rapidly than under conventional tillage. Also reduced tillage causes shift in weed flora from annuals to perennials. Soil surface temperature moderated by residue retention on soil surface and may extends the emergence of both crops and weeds. Restricted light availability, physical growth barriers and potential allelopathic effects from surface residue generally hinders the germination and growth of small seeded annual weeds. Crop rotations modify the weed dynamics due to allelopathic effect on weeds and alteration in timings of crop emergence and weed emergence and inhibition effect on growth of crop-bound weeds. Crop rotations should incorporate crops belongs to different botanical families, different nutrient requirements and required herbicides of different families for control of weeds. Other cultural practices for weed management under conservation agriculture includes alteration in date of sowing, selection of highly competitive cultivar, by adopting preventive measures, by change in plant geometry and densities, placement of fertilizers and microbial control of weeds. Integrated weed management compatible to cropping patterns and climatic conditions offers the best results in conservation agriculture.

ROCK PHOSPHATE-ENRICHED COMPOST AND MICROBIAL INOCULANTS FOR SOIL HEALTH**KASTURIKASEN BEURA*, AMIT KUMAR PRADHAN¹, GOUTAM KUMAR GHOSH², ANSHUMAN KOHLI¹ AND AJIT KUMAR PASWAN³***, ¹ Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur, Bihar-813210, ² Department of Soil Science and Agricultural Chemistry, Palli Shiksha Bhavana, Sriniketan, West Bengal-731236, ³ Krishi Vigyan Kendra, Jehanabad, Bihar-804432

Low grade rock phosphate deposits exist in India which are largely unexploited. Rock phosphate has good P content (28-30%) but cannot be put to direct use because of its poor release of plant available P. Rock phosphate can be used to improve the quality and overall efficacy of the compost which is a source of organic matter to soil necessary for sustaining its health and fertility. Microbial inoculants like mycorrhiza and beneficial soil microorganisms play a very impactful role in enhancing crop performance and maintaining soil health, which is indispensable for sustainability of agricultural ecosystems. Co-inoculation of mycorrhiza with rhizobacteria in presence of good quality enriched compost helps to enhance their efficacy and reliability for better plant performance and soil quality. Researchers have recorded higher yield, P uptake, enzymatic activity and microbial biomass carbon in soil under mungbean (*Vigna radiata*) due to addition of rock phosphate enriched composts in presence of *Aspergillus awamori*. It has also been observed that an additional positive effect of inoculation with mycorrhiza on plant biomass and soil nutrient content when closely related to colonization by microorganisms under application of biocompost. Composted low-grade rock phosphate along with organic material, phosphate solubilizing bacteria and other microbial inoculants have the potential to improve crop production and nutrient uptake. Composted rock phosphate can be a suitable alternative and viable technology to utilize low- grade rock phosphate and could be used successfully as cheaper and indigenous input for soil health sustainability.

Keywords: Rock phosphate, mycorrhiza, microbial inoculants, soil health, sustainability

SCREENING OF ADVANCED GERMPLASM OF MAIZE (ZEA MAYS) AGAINST SHOOT FLY (ATHERIGONA SOCCATA RONDANI)**KAUSHAL KISHOR, R.K. DWIVEDI, NEELAM YADAV, RAHUL**

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The present investigation of screening of fifty advanced **Germplasm** lines of Maize *Chilo partellus* (Swinhoe) along with three replications against shoot fly was carried out in randomized block design (RBD) at Student's Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur in Kharif 2016. The advanced **Germplasm** lines were screened on the basis of

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average percent dead hearts per plant at 14 and 28 days after emergence. Resistant checks viz., *Jaunpur local* and Prabal recorded significantly plant and also exhibited minimum average percentage of dead hearts.

EFFECT OF PRE & POST HARVEST TREATMENTS ON THE MANAGEMENT OF POST HARVEST LOSSES IN HORTICULTURAL CROPS

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Fruit and vegetables highly perishable in nature and they are lost their quality and nutritive value in shorter time of periods. The quality and nutritive value of these fresh commodities are reported at the time pre and post harvest due the improper handling and pre and post harvest treatments. The post harvest losses of horticultural crops in developing countries have been reported between 15 to 50 per cent with an estimated minimum of 20 per cent. Regarding individual commodities, in the case of fruits it was reported that it varies from a minimum of 14 per cent in case of apples to 100 per cent in the case of papaya. In the case of grapes post harvest losses are to the tune of 27 per cent and in the case of lime they vary from 20 per cent to 40 per cent. Post harvest management is a way to overcome these problems of losses and also to reported many other benefits. An experiment was conducted to study the pre harvest spray and post harvest dipping of fruit on shelf life and quality of papaya (*Carica papaya* L.) cv. Madhubindu was carried out at Fruit Research Station, Lalbaug and P. G. Research Laboratory, Department of Horticulture, JAU, Junagadh during 2013. There were two factors comprised of pre harvest spray i.e. water spray (S_1), GA₃ 15 ppm (S_2), Alar 500 ppm (S_3), GA₃ 15 ppm + Carbendazim 0.05% (S_4) and Alar 500 ppm + Carbendazim 0.05% (S_5) along with post harvest dipping i.e. water (D_1), CaCl₂ 1% (D_2) and Ca(NO₃)₂ (D_3). The pre harvest spray of GA₃ 15 ppm + Carbendazim 0.05% and post harvest dip in CaCl₂ 1% individually as well as their combination. GA₃ 15 ppm and CaCl₂ were found to be more effective in reducing physiological loss in weight, highest percentage of marketable fruits, highest shelf life. Similarly for biochemical parameters and organoleptic score, highest TSS, lowest acidity, highest ascorbic acid, vitamin A as well as organoleptic parameters like color, texture, taste and flavor were also found better in GA₃@ 15 ppm + Carbendazim 0.05% as per harvest spray and CaCl₂ 1% (D_1) as post harvest dip.

Keywords- Post harvest, Pre harvest, Horticultural crops.

PRECISION AGRICULTURE AS A TOOL FOR SUSTAINABLE AGRICULTURE

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Agriculture is the base of Indian economy. There is need to increase the production at low cost. This is possible through adopting precision agriculture (PA) approach which controls the over use or wastage of inputs or resources by application of inputs where they are needed, and when they are needed.. PA is a management approach to the cultivation of crops by considering spatially and temporal variation in soils, rainfall and adopting management techniques to reduce cost, efficient use of inputs and reduce environmental pollution. Three basic principles of PA includes (1) understanding the variability in time and space, (2) measuring and assessing the variability and (3) managing the variability with site specific agronomic recommendations. PA also termed as spatially variable crop production or site specific management. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other conditions. The site specific application of inputs such as seed, fertilizer and crop protection chemicals has the potential to reduce input costs, maximize crop yield and benefits the environment. PA can help in managing crop production inputs in an environment friendly way, thus PA promotes sustainable agriculture.

Keywords : Precision Agriculture (PA), site-specific, environment, spatially and temporal variability.

EFFECT OF INTEGRATED WEED MANAGEMENT PRACTICES ON YIELD AND WEED DYNAMICS IN SOYBEAN + PIGEONPEA INTERCROPPING SYSTEM

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A field experiment was conducted during 2015-16 and 2016-17 at Experimental Farm, Department of Agronomy, College of Agriculture, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani to study the effect of integrated weed management practices on crop and weed parameters. The soil of the experimental site was clayey in texture. pH was 8.0, low in available Nitrogen (160.7 kg/ha), medium in Phosphorus (11.7 kg/ha) and high in potassium (489.61 kg/ha). The experiment was laid out in randomized block design with

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three replications and ten different treatments. Results revealed that the minimum weed growth rate, density and dry matter production of weeds and the higher weed control efficiency were recorded with pre emergence application of Pendimethalin 30% EC @ 0.75 kg a.i./ha fb tank mix POE - Imazethapyr 10% SL @ 0.100 kg a.i./ha + Quizalofop ethyl 10 EC @ 0.075 kg a.i./ha supplemented with 1 Hoeing (40-50 DAS). The highest Soybean Equivalent Yield were obtained with the application of PEPendimethalin 30% EC @ 0.75 kg a.i./ha +1 Hoeing (30-40 DAS) + 1 Hand Weeding (40-50 DAS). The highest weed index was recorded under weedy check.

Key words: Dicot, Intercropping, Monocot, Pigeonpea, Soybean, SEY, weed.

K- MEAN DETERMINATION OF INDIAN MUSTARD GENOTYPES FOR MORPHO-PHYSIOLOGICAL TRAITS UNDER RAINFED CONDITION

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Under rainfed timely-sown condition an experiment was conducted predominantly cultivated crop *Brassica* species in Indian mustard (*Brassica juncea* L. Czern & Coss) for Principal Component Analysis and K-mean cluster analysis studies, in Randomized Complete Block Design (RCBD) accommodating 50 genotypes, from various Rapeseed & Mustard centres located across country, randomly in three replications during Rabi 2015-16 at Tirhut College of Agriculture, Dholi, Muzaffarpur research farm. In present investigation, only first principal component (PCA1) showed maximum Eigen value and cumulatively showed 84.22% variability. Based on PCA1, PCA2 and PCA3 scores cumulatively accommodating 94.95% variability, 3-D plotted for 50 Indian mustard genotypes, covering most important traits namely AS, AB, DFF, HFS, SS¹, RV, HFPB and RL which contributed maximum towards variability. Amongst the constituted eight clusters, the cluster VIII included four genotypes, Pusa Mahak, Varuna, Pusa Bold and Rajendra suflam followed by cluster VII with nine genotypes, reflected superiority for oil content and close for various morpho-physiological traits to cluster VIII. Most diverse genetic background was reflected by Cluster VIII (Rajendra Suflam, Varuna, Pusa Bold & Pusa Mahak); followed by Cluster III (TM-2, Divya and RH0406); Cluster V (Kanti); Cluster IV (Kranti) and Cluster VII (RH0819). Divergent cross combinations suggested namely Rajendra Suflam × Divya, Rajendra Suflam × Kanti, Pusa Mahak × Divya, Pusa Mahak × Kanti, Kranti × Divya, Kranti × Kanti, Pusa Bold × Divya, Pusa Bold × Kanti, Varuna × Divya, Varuna × Kanti, Rajendra Suflam × TM-2, Rajendra Suflam × RGN 13, Rajendra Suflam × RH 0406, RH0819 × Divya and RH0819 × Kanti involved cluster VIII × III, VIII × V, VII × III and VII × V involving divergent genotypes could through recombinants and utilized in heterotic breeding. Moreover, due to superiority for most of the yield attributing traits such combinations including root parameters also could be utilized for *Brassica* genetic enhancement under rainfed conditions of Bihar.

Key words: *Brassica juncea* L., Principal Component analysis, Genetic diversity, K-Mean clustering, Eigen value

IMPROVING TRADITIONAL APICULTURE PRACTICES TO DOUBLE FARMER'S INCOME

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In India, farmers having marginal landholding can be benefited by secondary activity like beekeeping. Presently, it is estimated that with 25.00 lakhs of bee colonies and 2.5 lakhs beekeepers harvested around 56,579 MT of honey. The paper enlists different strategies to increase honey production, quality and to increase adoption of apiculture by farmers for commercializing beekeeping by improving current beehive structures, proper bee hive management, *insitu*-honey extraction system. Different entrances like flap entrance, rotating door entrance, manually controlled entrances and electronic adjustable hive entrances (butterfly and helical entrance design) can be used to optimize hive entrance and provide scope for promoting better traffic flow, assist in proper ventilation of hives and exclude pests. The roof design is also taken care off. Non-white colors absorb more hot sunlight, increasing difficulty for bees to keep the hive cool. So, roofs are made from galvanized iron that absorb up to about 90% and white paint only absorbs about 30% of sunlight. Elevating the rooftops of hives, switching to other materials for construction of roofs and painting hive box with lighter colors can help in keeping hives cool thus reduces the drudgery of bees to maintain hive temperature and also improve production. The *insitu*-honey extraction type hive boxes with honey extraction and filtration unit with main working parts as hive box, lobed shaft, tap, screen and filters has proved to be effective for easy and quick honey extraction method. Vents are made to keep hive cooler. Aluminum or insulating thermoplastic is used inside the hive box. The handle is rotated to extract honey which after passing through a screen and filters can be collected through an outlet. Following the given strategies and further research in this area can help in increasing honey production and quality, and thus play important role in increasing farmers income through adoption of modern apiculture.

Keywords: Bee farming, Apiculture, Bee hive design, Bee hive management, Honey extraction

EFFECT OF PLANT NUTRITION IN INSECT PEST MANAGEMENT: A REVIEW**KIRAN BALA****CSKHPKV Palampur*

Nutrition concerns the chemicals required by organism for its growth, tissue maintenance, reproduction and necessary to maintain these functions. It may determine resistance or susceptibility to pests. Among several plant nutrients, only 17 are essential for proper growth and development of plants and each nutrient plays important role in their growth. These nutrients are required by insects for their growth, tissue maintenance, reproduction and energy. They fulfill their requirements through feeding on plants. Nitrogen has positive effects on individual insect performance, probably due to deposition-induced improvements in host plant chemistry. These improvements include increased nitrogen and decreased carbon-based defensive compound concentrations. *Potassium provides high resistance against insect pests.* High levels of potassium enhance secondary compound metabolism, reduce carbohydrate accumulation and plant damage from insect pests. Phosphorus also decreases the host suitability to various insect-pests. *Secondary macronutrients and micronutrients like calcium, zinc and sulphur also reduce the pest populations.* Among mineral elements, *silicon is involved in plant resistance against insect pest damage.* The indirect effects of fertilization practices acting through changes in the nutrient composition of the crop have been reported to influence plant resistance to many insect pests. The need for more healthful foods is stimulating the development of techniques to increase plant resistance to phytophagous insects.

ROLE OF ICTS AND SMALL-SCALE AGRICULTURE IN INDIA: A SCOPING STUDY**KIRAN RANA, RUCHI RANI GANGWAR, SHWETA CHAUDHARY***Department of Agricultural Communication, G. B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India*

ICTs are meticulous force of change for rural and agricultural growth. It provides development solutions and have been described as one of the main enablers of poverty reduction. They are well-organized implements for reaching rural and remote communities and improving agricultural productivity (Richardson 1997). ICTs include technologies and media that capture, store and disseminate data and information, and they include tools such as video, teletext, voice information systems, radio, mobile telephony, fax and computer-mediated networks among others (Warren 2002). ICTs can speed up the extension of development services in areas such as healthcare, education and agriculture (Van Audenhoove 2003). Further, they help strengthen partnerships and provide a framework for shared learning, and have led to increased use of networked information environment and development of platforms for better sharing and exchange of information and knowledge. This has helped to achieve competitiveness (Benkler 2006). Small-scale farmers need information on improved farming practices, technical information, technologies, credit, agro-processing, markets and marketing opportunities. There are a number of emerging ICTs being applied in small-scale agriculture including:- GIS, decision support systems, precision farming, market information system, distance learning, databases, land use planning, public access facilities, mobile applications, restructuring of extension and personal digital assistants. Geographical Information System (GIS) is an information technology that links activities in the field and the office, and allows for comparisons between different types of agricultural data. Although networked information economy cannot in itself solve poverty, hunger and disease, but it provides new avenues for offering a more attractive cultural production system, tapping economic opportunity and sharing and disseminating scientific outputs and innovative linkages between farmers, scientists and researcher. Technological changes have led to social, economic and cultural transformation. Therefore, in order to benefit the rural people, extensionists are grappling with the question of how to connect ICTs to improve rural livelihoods in order to contribute towards better information exchange and access. This paper aims to discuss role of ICTs in agricultural extension work for doubling farmers' income, identified various gaps such as inadequate skills in the use and application of ICTs, inadequate human resources with the capacity to generate, repackage and digitise local content that need to be bridged to enhance skills and facilitate the exchange and sharing of information and knowledge.

Key words: ICTs tool for rural change, Enhance skills, doubling farmers' income

DEVELOPMENT OF COMPATIBLE LIGNOCELLULOLYTIC FUNGAL CONSORTIUM FOR BIODEGRADATION RICE RESIDUE IN EASTERN INDO-GANGETIC PLAIN**KIRTISOURABH***ICAR-Research Complex for Eastern Region, Patna, Bihar*

Rice straw is one of the most abundant agricultural by-products in India. In Indo Gangetic Plains of India in situ burning of crop residues is practiced by majority of farmers' which deteriorates soil and environmental quality. Fungi have the potential for lignocellulose degradation and can be used for the in situ decomposition of crop residues. It contains high amounts of cellulose and lignin. The fungal strains were isolated from naturally decomposing sites of rice residues. Seven fungal strains were isolated and later these seven fungi were used for finding out their potential for the degradation of lignin and cellulose content of rice straw. Among seven fungi

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tested, four fungal strains showed lignocellulolytic activities. Hence, these four fungal strains were used for the decomposition of rice residue both individually as well as in various combinations. Inoculation of these lignocellulolytic fungi in rice residue accelerated the process of residue decomposition when compared to control. Significant reduction in lignin and cellulose content were observed in rice residue inoculated with mixed culture of *Aspergillusoryzae* + *Aspergillus fumigatus* + *Aspergillusniger* + *Aspergillusflavus* compared to other experiments. Mixed culture of four fungal strains reduced C:N ratio to 10:1 compared to 70:1 in paddy straw mixed with soil. It is evident from the results that the mixed culture of all the three lignocellulolytic fungi may be used for the degradation of rice residue. Hence we conclude that combination of four lignocellulolytic fungi viz., *A. oryzae*, *A. fumigatus*, *A. niger* and *A. flavus* can be recommended for the degradation of rice residues which would result in fast degradation of lignocellulosic biomass which may allow use of normal zero-till machine for timely sowing of wheat into combined harvested rice fields and avoid in situ burning of rice straw.

SMART FARMING THE FUTURE OF AGRICULTURE

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The application of smart farming and related technologies such as internet of things (IOT), precision farming, robotics and software for farm management and decision making (Smart Farming Technologies, SFTs) will bring many benefits, including more efficient use of inputs and a reduced impact on the environment ("more with less"). The goal of smart farming is to meet the food requirement in future of all human being. We inventoried SFTs that are available commercially by surveying manufacturers, providers of equipment and services, and agricultural consultants. Each SFT was described in terms of where it can be applied (which crops or cropping systems, geography, farm size, crop production stage), what benefits it is expected to bring (e.g. increased productivity, increased profitability, and how readily it might be expected to be adopted). Commercially available SFTs often target larger farms, while SFTs investigated in applied research projects are applicable on smaller farms as well as larger farms. **Food production must be increase by 70% in the year 2050 in order to meet our estimated world population of 9.6 billion people.** Smart farming has become not only an option for the future, it's becoming a necessity. So the main aim of smart agriculture is to obtain maximum production per unit area and per unit time.

Keywords: Technology, precision farming, robotics and software, etc.

PROTECTED CULTIVATION OF FRUIT CROPS- A NEW TECHNOLOGY TO PROTECT FRUIT CROP FROM NATURAL CALAMITIES, BIOTIC AND ABIOTIC STRESS

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Fruit crops are affected by different natural calamities, biotic and abiotic stress which affect the export potentiality, productivity and quality of fruits. In order to overcome disadvantages caused by local climatic conditions, and other factors (Pathogenic and non pathogenic) protected cultivation offers a great scope for production of fruits. protected cultivation is proving as a boon for marginal and small growers with limited land and water resources. It also helps in off season fruits production round the year. low cost green house is developed in many states of India like J&K, Uttaranchal, Himachal Pradesh, North Eastern states, Maharashtra and Karnataka for production of different kind of fruits. fruits crops like Peaches, strawberry, grape, cherry, apricot, Banana, guava, Plum etc. are cultivated to save the livelihoods of this zone of farmers. Therefore, it is a new height of technology adopted by the farmers to produce high quality, pest and disease free, fruits.

MARKER ASSISTED SELECTION FOR ZINC CONTENT AND YIELD IN FRENCH BEAN (*PHASEOLUS VULGARIS* L.) UNDER THE NILGIRI HILLS OF TAMIL NADU

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French bean is one of the nutritionally important leguminous crop grown for its tender pods as vegetables and dry seeds as rajma. It is a major source of dietary portions, carbohydrates, fibres and micro-nutrients specially iron and zinc. A large proportion of the population

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is at risk of zinc deficiency due to its low levels in other food ingredients. Zinc deficiency can be addressed by making it biologically available through bio-fortification. Apart from it, the vegetable having higher amount of zinc can also be included in diet. It is evident that there exist a wide variation in seed mineral zinc content in French bean necessitating the need to characterized the variability for seed zinc accumulation to meet the specific dietary needs of bean consumers. The present study was therefore, undertaken with seventy seven French bean accessions tested in RBD with three replications at Horticultural Research Station, Ooty, The Nilgiri Hills of Tamil Nadu. The study clearly revealed a positive correlation between zinc content with seed yield (0.425), seed iron content (0.422), no of primary branches (0.451), Pod weight/plant (0.646) and seed weight (0.742). Amongst the seventy seven accessions, black seed coat accessions had higher zinc content in IC 39067 accession (86.26 mg/kg) which was followed by , IC-271509, EC-271493, IC-41650 and EC-324986 accessions. Amongst forty SSR primers linked to zinc content Viz Bmd9, Bmd16, Bmd33, Bmd154, BM211 and BM170 gave encouraging results of selective amplifications. Four markers Viz. Bmd9, Bmd16, Bmd33 and BM139 were mono-morphic. The range of variation in zinc content among tested progenies was from 12.54 to 86.26 mg/kg in seed. Considerable genetic diversity among genotypes was also observed. The Seventy seven genotypes of the present study were grouped into 9 clusters, where cluster V registered more diverse genotypes. The contribution of nutrient content was more than other attributes towards genetic divergence and can be used for selecting parents from distinctly placed clusters to obtain high heterotic effects and transgressive segregants. Based on the study of genetic diversity the maximum inter cluster distance between cluster V and cluster IX indicating the possibilities of hybridization between the genotypes of these clusters for the development of high yielding varieties in frenchbean. The mean values revealed that accession No.EC- 324986, IC-311094, EC-324995 and FB - 8 for higher yield, while for higher zinc content, IC-271509, EC-271493, IC-41650 and EC-324986, accession respectively can be selected for breeding purpose. Narrow sense heritability was of an intermediate 57.5% to high 77.84% value and transgressive segregation. These results suggest that breeding for increased zinc content in the seeds of common bean can be quite successful.

BIOINFORMATICS IN CROPIMPROVEMENT

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Bioinformatic resources and web databases are essential for the most effective use of genetic, proteomic, metabolomic and phenome information important in increasing agricultural crop productivity. Bioinformatics are playing significant role in providing the information about the genes present in the genome of these species. These tools have also made it possible to predict the function of different genes and factors affecting these genes. The information provided about the genes by the tools makes the scientists to produce enhanced species of plants which have drought, herbicide, and pesticide resistance in them. Similarly specific genes can be modified to improve the production of meat and milk. Certain changes can be made in their genome to make them disease resistant. Key objectives for plant bioinformatics include: to encourage the submission of all sequence data into the public domain, through repositories, to provide rational annotation of genes, proteins and phenotypes, and to elaborate relationships both within the plants' data and between plants and other organisms. Bioinformatic also play role to allow efficient exploitation of plants as biological resources in the development of new cultivars with improved quality and reduced economic and environmental costs. This knowledge is also vital for the development of new plant diagnostic tools. Traits considered of primary interest are, pathogen and abiotic stress resistance, quality traits for plant, and reproductive traits determining yield. A genome program can now be envisioned as a highly important tool for plant improvement. Such an approach to identify key genes and understand their function will result in a "quantum leap" in plant improvement.

IFS WITH REFERENCE TO APICULTURE

KOMAL

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Honey bees are social insect belonging to order Hymenoptera, family Apidae and genus *Apis*. About 20,000 species of bees are present in the world. Only 8 spp are recognized as 'Honey bees' by entomologist. The important species of honey bees are *Apis dorsata*, *Apis cerana indica*, *Apis mellifera*, *Apis florae*, *Melipona irridipennis*. **Bee keeping/Apiculture** is the maintenance of honey bee colonies, commonly in hives by humans. A location where bees are kept is called an **apiary** or "**bee yard**." Bees collect nectar and pollen from plants. Nectar is the raw material for honey preparation & pollen is a rich food for the bees and in return honey bees have been offering services to the society through ensured pollination in cross pollinated crops. The advantages of integration of beekeeping with crops is that it does not require land to be owned and rented, feed is not an issue and bee keeping does not compete for other resources needed by livestock and crops. Crops that get benefit from pollination services are mustard crop, rapeseed, sunflower, apple, pear, plum, almond, litchi, asom lemon, cauliflower, carrot, coriander, onion, pigeon pea, berseem, alfalfa, cotton, sunhemp etc. The potential benefits due to bee pollination in the form of increase in yield of various crops. Unemployed youth can start this business with minimal funds (Rs 1-2

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lakh). Income from 100 Bee colonies is around Rs2.50- 3.00 lakh per annum. Export of honey products attracts foreign exchange. It also enrich the biodiversity, Hence bee keeping may be adopted as an enterprise by anyone after getting training on the subject.

Key words: Honey bee, *Apis*, nectar, pollination, crops, biodiversity.

ROOT GROWTH OF PHALSA (*GREWIA ASIATICA* L.) AS AFFECTED BY TYPE OF CUTTING AND ROOTING MEDIA
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The aim of this study was to determine the effects of different rooting media and Type of cutting on rooting of Phalsa (*Grewia asiatica* L.) stem cuttings. *This research was conducted to Root Growth of Phalsa as Affected by Type of cutting and Rooting Media Under Garhwal Himalayas during the Rainy season 2013-14 at Horticultural Research Centre, Chauras Campus. H.N.B. Garhwal University Srinagar, Garhwal Uttarakhand, India. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three main factor (Semi hardwood, hardwood and softwood cuttings) and three sub factors (Soil+Sand+FYM, Vermicompost and Soil+FYM). Results of the investigation showed that survival percentage of cutting (57.77), percentage of rooted cutting (56.66), number of primary root (14.48) and length of longest root (8.79cm) was recorded under H₂ (Hardwood cutting) with M2 (Vermicompost) rooting media.*

Keywords: Phalsa, rooting media, cutting type and rooting percentage.

VEGETATIVE PROPAGATION OF MULBERRY (*MORUS NIGRA* L.) THROUGH CUTTING
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*This research was conducted to Vegetative Propagation of Mulberry (*Morus nigra* L.) Through Cutting at Horticultural Research Centre, Chauras Campus. H.N.B. Garhwal University Srinagar, Garhwal Uttarakhand, India. Stem cuttings of the plant were subjected to different treatments; IBA concentration (1000ppm, 2000ppm and 0ppm) and rooting media (Sand+FYM, Vermicompost and Cocopeat). The experiment was laid out in Factorial randomized block design and replicated thrice. In case of IBA concentration, the maximum number of sprouted cutting (7.11), average number of sprouts per cutting (5.77), length of longest sprout (8.90 cm), diameter of thickest sprout (0.71 cm), number of leaves on new shoots (8.55), survival percentage (71.11 %), rooting percentage (70.00), number of primary root (10.77), length of longest root (10.22 cm) was recorded under 2000ppm concentration of IBA. In case of rooting media, the maximum number of sprouted cutting (7.11), diameter of thickest sprout (0.54 cm), number of leaves on new shoots (8.11), survival percentage (71.11%), rooting percentage (70.00), number of primary root (8.55), length of longest root (9.11cm) was observed under vermicompost rooting media.*

Key words: Mulberry, IBA, rooting media, cutting, rooting.

INTERCROP IN SUGARCANE FOR DOUBLING FARM INCOME
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Inter cropping system is an important approach of cropping system for increasing crop yield. Plant competition is an inevitable phenomenon in intercropping system that reduces intercrop productivity. Higher productivity in intercropping system is commonly achieved by minimizing competition and minimizing complementary use of growth resources. Intercropping increases crop yield per unit area by intensifying the use of land. It does not only contribute to increase the productivity, but also increases the farm income. Intercropping is a multiple cropping practices involving growing two or more crops in proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop. Sugarcane crop is a cash crop of western and mid plain of U.P. Sugarcane takes near about 14 months for maturing in northern plains. Keeping these views in mind Krishi Vigyan Kendra, Shahjahanpur conducted Front Line Demonstrations on intercrop in sugarcane in both planting seasons. The major area of intercrop in autumn planting covers lentil, toria, late sown mustard and potato and in spring planting covers blackgram, greengram groundnut and mentha crop. In findings the results showed that the mentha cultivation as an intercrop gave additional 78 mandays and increasing family income Rs 23400 in spring season. Potato cultivation with sugarcane found highest family labour income Rs 16800 followed by vegetable pea (Rs 15600), lentil (Rs 12600) and toria (Rs 9600) in autumn season. Finally I have concluded that Sugarcane + potato and Sugarcane + Lentil gave higher net return in autumn and Sugarcane + Mentha & Sugarcane + Groundnut in spring planting.

“CONVERSION OF TUBEROSE (*POLIANTHES TUBEROSA*) LEAVES AND BULBS WASTE INTO VALUE ADDED COMPOST UTILIZING CONSORTIUM”**KRISHAN PAL SINGH¹ AND LIVLEEN SHUKLA²***Division of Floriculture and Landscaping¹, Division of Microbiology², ICAR- Indian Agricultural Research Institute, New Delhi-110012*

Tuberose popularly known as Rajnigandha (in Hindi) occupies a prime position among commercial bulbous flower crops apart from its landscape beauty. It is commercially cultivated for utilization in different forms of cut and loose flowers trade and also for extraction of its highly valued flower spikes, bright white flowers, sweetness of blooms and delicacy of fragrance of tuberose, transform the entire area into a nectarine and joyous one. At the time of uprooting of tuberose plants and after use separated leaves and discarded bulbs and bulblets remained unused and the management of these unused flowers, cut spikes, separated leaves and bulb and bulblets become a severe problem as they are lying on roads or dumped in water bodies. Tuberose waste has a high moisture and high carbon content that attracts insects and microorganism which grow vigorously and decay the waste and leachate produced percolates into groundwater and become the cause of several water borne diseases. Therefore, a study was undertaken at ICAR-IARI New Delhi to efficiently utilize tuberose leaves and bulbs/ bulblets waste using pit method of composting with the application of effective fungal consortium consisting various efficient cellulolytic, pectinolytic, lignolytic fungi *Aspergillus clavatus*, *Aspergillus niger* and *Aspergillus awamori*. Tuberose plants waste along with substrate dried leaves mixed in 1:1 ratio was taken and 100kg total waste was added in the cemented pits.

Two treatments viz. T1 tuberose waste + Dried leaves (1:1) untreated and T2 tuberose waste + Dried leaves (1:1) + fungal inoculant treated. The results indicated that pH, EC, potassium and sulphur obtained were 7.2, 3.0, 0.1 and 0.2 respectively in untreated compost; while 7.3, 2.6, 0.5 and 0.18 respectively in treated compost. The final product after 45 days found rich in organic carbon and total nitrogen were reported to be 34.8% and 1.3% respectively in untreated compost; while 35.5% and 1.4% respectively in treated compost. The humus was 1.2% and 5% on untreated and treated compost respectively. Seed germination was reported 50% in untreated and 100% in treated compost, sowing non-phytotoxic nature of treated compost. In treated compost the cellulose activity ranged from 30 to 150 mg reducing sugar/kg dry matter/h, xylanase activity ranged from 26 to 135 mg sugar/kg dry matter/h and protease activity ranged from 89 to 160 mg/tyrosine/kg dry matter/h while in untreated compost the above activities were found 25 to 110, 22 to 120 and 80 to 132 respectively. The compost also carries aroma of tuberose flowers used. These result obtained indicates eco-friendly utilisation of tuberose waste with low cost efficient technology.

EFFECT OF *CERCOSPORA* LEAF SPOT DISEASE ON PHENOLS CONTENTS IN DIFFERENT PARTS OF FENUGREEK PLANTS**KRISHNA KUMAR¹, AKSHAY KUMAR², MANJEET KUMAR³ AND POPIN KUMAR¹***Department of Plant Pathology¹/ Department of Entomology², Department of Vegetable Science³, Narendra Deva University of Agriculture and Technology Narendra Nagar, Kumarganj, Faizabad, (U. P.) 224229, India*

Fenugreek (*Trigonella foenum-graecum* L.) is an annual legume crop belonging to the family Fabaceae which is often cultivated in regions of India, the Mediterranean region and North Africa (Acharya et al., 2011, 2010; Petropoulos, 2002). Seeds are used for the treatment of diabetes, dysentery, diarrhea and rickets. Diosgenin extracted from the seeds is used in synthesis of sex hormones. The seeds also contain a large amount of saponins and fibers that account for many health benefits. Fenugreek has neuroprotective, antimigraine, memory improving, antibacterial, antiviral and antitumor activities, because it contains a large amount of saponins, phenol, flavonoids and fibers that cause for many health fits. The healthy and infected leaves, stems and seed of fenugreek were collected in the months of March at maturity stage of crop form vegetable form, Narendra Deva University of Agriculture & Technology Kumarganj, Faizabad.

Folin & Ciocalteus phenol reagent, 2.0 The healthy and infected plant parts viz. Leaves, stem, seed and pods were directly selected from the field for the estimation of total phenol. One gram of dried sample was weighted, cut in to small pieces and then placed in smearing methanol until the green colour was extracted. Leaves tissues were homogenized after decanting the methanol. These homogenized tissues were again boiled in methanol for further 5 minute and then filtered. Residual material was washed with 80% acidified (0.1HCL conc.) methanol. Methanol was evaporated using a rotavapour and the aqueous layer was collected to adjust the final volume as ml/g of weight with distilled water. The aqueous portion of the extract was then washed with n-hexane to remove the green colour. Total phenols were estimated using Folin- Ciocalteu reagent, according to the modified method. Place the tubes in boiling water for one minutes allowed to cool and measured the absorbance at 550nm against a reagent blank. The standard curve was prepared using different concentration of catechol. The absorbance is measured in a spectrophotometer at 550 nm. **Calculation** From the standard curve find out the concentration of phenols in the test sample and express as µg phenols/g material. The total phenols are calculated by the following formula.

$$G.F. \times O.D. \times \text{Total volume}$$

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$$\text{Total Phenol } (\mu\text{g/g}) = \frac{\text{Aliquot taken} \times \text{Weight of sample} \times 1000}{\text{G.F.} \times \text{O.D.}}$$

G. F. = Graph factors

O.D. = observance density

The organic treatment increased the total phenol content in all plant parts. The increase was higher in healthy plant leaves (9.0 to 12.24 $\mu\text{g/g}$) in comparison to infected leaves (6.89 to 10.29 $\mu\text{g/g}$), stem (8.08 to 9.51 $\mu\text{g/g}$), pods (6.51-10.08 $\mu\text{g/g}$) and grain (3.35-6.38 $\mu\text{g/g}$). The total phenol content in healthy leaves found highest in seed treatment with cow urine (12.24 $\mu\text{g/g}$) followed by seed treatment with Vanaspativash (11.47 $\mu\text{g/g}$), seed treatment with panchagavya (11.39 $\mu\text{g/g}$), foliar spray with cow urine (11.47 $\mu\text{g/g}$) and seed treatment with cow dung slurry (10.08 $\mu\text{g/g}$). In infected leaves, it was maximum 9.29 μg in Vanaspativash, 9.48 μg in foliar spray of cow dung slurry and 9.34 μg in seed treatment with Vanaspativash. In case of stem, maximum phenol content was recorded in seed treatment with cow urine (9.51 μg) followed by foliar spray of cow dung slurry (9.44 μg), seed treatment with panchagavya (8.72 μg) and foliar spray of panchagavya (8.43 μg). Whereas in grain, total phenol content was significantly higher in seed treatment with cow urine (6.39 μg), foliar spray of panchagavya (5.50 μg), foliar spray of cow dung slurry (5.34 μg), foliar spray of cow urine (5.13 μg). In other treatment effect was not significant in comparison to control.

POST HARVEST STRATEGY: IMPROVEMENT FOR THE STORAGE QUALITY

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Post harvest diseases cause considerable losses to harvested fruits and vegetables during transportation and storage. Post harvest losses due to diseases, conservative estimates place losses to fruits and vegetables from spoilage. However, as harvested fruits and vegetables are commonly treated with fungicides to retard postharvest diseases, there is a greater likelihood of direct, human exposure to them than to other pesticides that are applied solely to protect foliage. There is clearly an urgent need to develop new and effective methods of controlling post harvest diseases that are perceived as safe by the public and pose negligible risk to human health and the environment. Synthetic fungicides are primarily used to control postharvest decay loss. However, the recent trend is shifting toward safer and more eco-friendly alternatives for the control of post harvest decays. Biological control has emerged as one of the most promising alternatives to chemicals. The microbial antagonists may have a greater potential for success when applied postharvest. Field application of biocontrol agents may enable early colonization of fruit surfaces, thus protecting from these infections. Moreover, pre-harvest applications can be an appropriate strategy for fruits and vegetables subject to damage in postharvest handling. Genetic engineering may also provide a useful tool in the enhancement of the biological control efficacy.

Keywords:- antagonist, Synthetic fungicides, Genetic engineering.

SITE SPECIFIC NUTRIENT MANAGEMENT IN SUGARCANE

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Sugarcane is an important commercial crop in the tropics and subtropics (35° N to 35° S) grown for sugar purpose on a variety of soils. Global production of sugarcane was 1.88 billion tonnes in 2015. Brazil ranks first (39.5%) followed by India (18.7%). India achieved production of 362 million tonnes in 2014-15. Sugarcane being a heavy feeder crop, balance fertilization is required for getting higher yield. The low yield of sugarcane being obtained due to the imbalanced nutrient application. For achieving a definite target yield of a crop, certain quantity of nutrients must be applied to the crop and this requirement of nutrients can be calculated by considering the availability of soil inherent capacity to supply nutrients and fertilizer nutrients for total uptake. This forms the basis for the fertilizer recommendation for targeted yield of crops. The nutrients managements of sugarcane crop requires a new approach, which enables adjustments in applying N, P and K to accommodate the field specific needs of the crop for supplemental nutrients. The site specific nutrient management (SSNM) provides an approach for need based feeding of the crops with nutrients. The SSNM approach aims at increasing farmer's profit by achieving the goal of maximum yield of crop. The opportunity for maximum economic yield and improved sugar recovery was ensured through application site specific nutrient management as it helps in better growth of yield and it's attributing characters like single cane weight, number of millable cane, number of internodes, cane length, cane girth and tillering in sugarcane. The increase in the cane weight was due to increase in the number and the length of the internodes. The SSNM provides the judicious use of nutrients with better efficiency and reduces the loss of nutrients which includes leaching and volatilization losses in compared to conventional application of fertilizer.

PHYTOPHTHORA DISEASES: A CURSE FOR CITRUS INDUSTRY**KULDEEPSINGH, R. M SHARMA, O. P. AWASTHI, SUNIL KUMAR, GURURAJ M. AND PRADEEP KUMAR***Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi-110 102*

Citrus is the third most important fruit crop of India with 13.7% production share next to banana and mango (NHB 2017). In spite of favourable soil and climatic conditions, productivity of citrus fruit in our country is very low (10.94 MT/ha) as against Indonesia (35.60 MT/ha) and in Turkey (28.99 MT/ha). Many biotic and abiotic factors have been reported to be the cause for low citrus productivity in our country. Among biotic factors, *Phytophthora* species (most importantly *P. nicotianae*, *P. citrophthora* and *P. palmivora*) are considered one of the most serious soilborne problems leading to considerable losses (10-30%) in citrus growing areas worldwide. It causes damping-off of seedlings, root and crown rot in nurseries, foot rot and fibrous root rot, and gummosis in the orchards. In central India, more than 20% citrus seedlings die due to *Phytophthora* in citrus nurseries where 7-9 million citrus plants are propagated annually. In foot rot, infection occurs on the bark near the ground level and produce lesions on the trunk or crown roots that can girdle and kill the tree. *Phytophthora* spp. infection on root cortex decays fibrous roots of susceptible rootstocks that causes decline and yield losses. Association of *Phytophthora* with other pathogens i.e. *Phytophthora-Diaporthe* (PD) complex and with the Huanglongbing (HLB) have also been reported to enhance damage symptoms. Management of *Phytophthora* requires an integrated approach as some *P. nicotianae* strains have developed heritable fungicide resistance. Control through essential oils, hypovirulent isolates of *P. nicotianae* and other biocontrol agents have shown success to some extent under laboratory and greenhouse conditions, but are difficult to commercialize. Integration approach like cultural practices i.e. production of disease-free nursery stocks, use of resistant rootstocks and irrigation management and chemical measures. Selection or breeding for *Phytophthora* resistance rootstock is considered to be the most efficient approach to managing this pathogen. This paper deals with the causes and management of *Phytophthora* rot in citrus.

FLOW ACCURACY OF EXISTING FLUTE DIAMETER (10 MM) FEED ROLLER FOR HIGH SPEED SOWING OF SOYBEAN**KUMAR MAND SHANIR K***Scientist, Agricultural Mechanization Division, ICAR-CIAE, Bhopal-462038*

The flow accuracy of existing fluted feed roller for high speed drilling of soybean was studied. In this study a 10 grooves fluted roller of 49 mm diameter, 10 mm flute diameter and 40 mm exposure length was tested for soybean seeds (JS-9560). In this study flow accuracy was measured at four fluted roll speed i.e. 20, 30, 40 & 50 rpm and three position of width of slot between the roller and the bottom plate of the feed unit (WS) at full exposure length of the rollers. In conclusion, fluted roll speed had a significant effect on the flow evenness. The metering mechanism can be used as a high speed metering mechanism. In this study, the best values for the seed flow accuracy were obtained for the flute speed of 50 rpm and WS at position 3.

Key words: Soybean seed, fluted roller, flow accuracy, CV.**EFFECT OF MULTITIER CROPPING SYSTEM IN IMPROVING SOIL HEALTH****KUMARI BEAUTY¹ AND VIJAY KANT SINGH²***¹Department of Silviculture and Agroforestry, Birsa Agricultural University, Jharkhand, ²Department of Soil Science, University of Agriculture and Technology, Pantnagar, Uttarakhand*

Multitier cropping system is an approach to increase land productivity in low-external-input, resource-limited situations. These systems have been developed over long periods of time based on agro-ecological conditions, plant diversity, farmer resources and needs. Multitier cropping system involved combination of plants with various morpho-phenological features to maximize the natural resource use efficiency and enhanced total factor productivity. It is self-sustainable system where solar energy can be harvested at different heights; soil resources are used efficiently and can increase cropping intensities. The system consists of three main components viz. main crops, filler crop and intercrops which occupy three different tiers in space of the production system. To ensure sustainable productivity and high returns from underutilized and stressed lands and to improve the soil characteristics multi-storey cropping system have been found successful in tropical rain forest, semi-arid and dry land conditions. Better utilization of natural resources i.e. water, nutrients, air, light, above and below ground space are the prime benefits of multitier cropping system along with improving nutrient cycling, enhancing soil water balance and reducing soil erosion. The presence of trees at different strata helps to conserve the soil moisture and prevent transpiration. At the same time the litter fall from different species helps in the soil enrichment. The different stories (above ground) of multitier system utilize light at different levels and thus make it available up to ground level story. Likewise, the root architecture under multitier system is effective to utilize the water and nutrients at different soil depths. So, the system provides opportunity to grow cereals

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as ground story and small to medium fruit tree as middle story and forest tree as top story. An additional story along the border of the field serves as surplus and can be used for fodder purpose. Thus, the multitier cropping system is the system by which natural resources are utilized efficiently to enhance productivity of main crops (15-20%) and high revenue realization per unit area (50-90%).

Keywords: Morpho-phenological, root architecture, soil enrichment.

EMBRYO RESCUE TECHNIQUE AN ALTERNATIVE TECHNIQUE OVER CONVENTIONAL BREEDING IN GRAPES KUNZANG LAMO

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Grapes are one of the most important fruit crops of the world. It has undoubtedly become the most lucrative fruit crop of the world with substantial increase in area of its cultivation. Grape is now bred for different purposes viz., table or dessert type, juice, wine, raisin, etc. besides these, grapes also contains ample amount of antioxidants like 'resveratrol', which has been positively linked to cure cancer, heart disease, degenerative nerve disease and viral infections. So, development of high yielding cultivars of good quality and large berry size are major objectives of grape breeding programmes in order to meet the market demand. In seedless grape fertilization takes place but embryo and / or endosperm development stops soon after anthesis and seeds abort at different stages of growth, which mainly depends upon the genotypes selected through the process of sternospermocarp. Furthermore, seed abortion occurs after fertilization primarily because the endosperm fails to develop properly. Therefore, Embryo rescue technique besides to its wide range of applications is used to overcome this problem and many researchers has reported that, this technique is a reliable technique in grape breeding. Generation of F1 through conventional breeding has resulted into very low success and time consuming. By using this technique, the percentage of seedless individuals in F1 population has raised up to 44.94%. Breeding novel grape cultivars through embryo rescue is still a challenging and long-term task, which requires persistent effort of grape breeders. Genotype, sampling/inoculation time and medium are the most crucial and well-studied factors affecting the success of grape embryo rescue. Besides, other factors, such as the culture methods and utilization of plant growth regulators are also important for grape embryo rescue. Thus far, embryo rescue was extensively applied in rescuing inherently weak grape embryos, breeding seedless grapes and triploid grapes, and distant hybridization between different Vitis species. Although grape embryo rescue has been widely investigated, the development of improved cultivars is few. Further, the efficiency can be improved by optimizing the concentration of growth regulators and other vitamins.

SOILLESS CULTURE: A NOVEL APPROACH FOR AGRICULTURE DEVELOPMENT

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Soil is usually most available growing medium for plant and it provides support, air, water and nutrients for plant growth. However, it has created some limitations for plant growth, at times. Some of them are presence of disease causing organisms and nematodes, unfavourable soil compaction, undesirable soil reaction, degradation due to erosion, poor drainage etc. Further, continuous cultivation of crops has resulted in poor soil fertility. Under such circumstances, soil-less culture can be introduced as a viable and successful alternative. Soilless culture is a broad term that includes all techniques for growing plants in solid media other than soil (substrate culture) or in aerated nutrient solution (water culture). It is a method of agriculture that grows plants without soil using a mixture of water and nutrient salts, commonly called a nutrient solution. There are various techniques of soilless agriculture have being recently used such as hydroponics, aquaponics and aeroponics. Soilless culture offers opportunities to provide optimal conditions for the growth of the plants and therefore, higher yields can be obtained compared to open field agriculture. These techniques use approximately 70-95% less water than soil cultivation. Keeping in it view, this study explores the applications of soilless cultivation technique and to reveal its future importance. For popularization of soilless culture at global level, it is very imperative to provide scientific proven technology to gardeners and create mass awareness in potential areas at global level.

Keywords: Aquaponics, Aeroponics, Soilless culture, Hydroponics, Nematodes

EFFECT OF CERTAIN NATURAL PRODUCTS AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID. CAUSING DRY ROOT ROT IN SUNFLOWER"

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Sunflower (*Helianthus annuus* L.) is an oilseed crop characterized with its short growing period, high yield potential, is being attacked by many fungal and bacterial diseases among which charcoal rot of sunflower is economically very important. Natural products like

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panchakavya mixture (15%) conc. totally inhibited the radial growth of the fungus, whereas turmeric powder extract and hydrated lime extract (25%) totally inhibited the mycelial growth of the *M. Phaseolina*. In pot trial studies, panchakavya mixture followed by turmeric powder were found significantly superior over control in respect of reduced disease intensity and increased yield attributes. Total and ortho-dihydroxy (OD) phenolic content was profoundly influenced by natural product treatments when compared to control.

Key words: Paanchakavya, ortho-dihydroxy phenols, hydrated lime.

EFFECT OF BIOFERTILIZERS ON SOIL HEALTH AND PRODUCTIVITY OF WHEAT (TRITICUM AESTIVUM L.)

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A field experiment was conducted during kharif season of 2017 on clay loam soil to study the effect of inorganic fertilizer and biofertilizers on soil fertility, yield and quality of wheat. On the basis of one year field experimentation, it can be concluded that under agro-climatic condition of U.P., application of npk fertilizer + Liquid biofertilizer is the better option for realizing higher productivity, content and uptake of nutrients and net returns of wheat and it is the better option for improved fertility status of soil with good soil health. Seed inoculation with liquid biofertilizer significantly increased the number of ears plant⁻¹, number of seeds spike⁻¹, seed, straw and biological yield, N, P, K, Cu, Zn, Fe and Mn content and uptake by seed and straw, number of total microbial population and net returns.

SOIL ORGANIC CARBON FRACTIONS AND SOIL MICROBIAL BIOMASS CARBON IMPACTED BY CROP ROTATIONAL DIVERSITY AND CONSERVATION TILLAGE

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Fractionation of soil organic carbon (SOC) is crucial for mechanistic understanding of soil organic matter decomposition and stabilization processes. It is often aimed at separating the bulk SOC into fractions with varying rates, but a comprehensive comparison of methods to achieve this is lacking. Tillage systems can change soil organic carbon storage (SOC) with soil depth and a significant accumulation at 0-20 cm depth. Across treatments, aggregate-associated C at a depth of 0-10 cm was higher in the conservation tillage than in the conventional tillage treatments. Soil total organic carbon (TOC), microbial biomass carbon (MBC), EOC, dissolved organic carbon (DOC) and labile organic C (LOC) fractions contents were significantly affected by soil depth. At 0-7 cm depth, soil MBC was significantly higher under plowing tillage than rotary tillage, but EOC was just opposite. Rotary tillage had significantly higher soil TOC than plowing tillage at 7-14 cm depth. However, at 14-21 cm depth, TOC, DOC and MBC were significantly higher under plowing tillage than rotary tillage except for EOC. Compared with conventional intensive tillage (CT) and no tillage (NT) treatments increased MBC by 11.2%, 11.5%, and 20%, and DOC concentration by 15.5%, 29.5%, and 14.1% of bulk soil, >0.25 mm aggregate, and <0.25 mm aggregate in the 0-5 cm soil layer, respectively. The importance of clay and silt sized particles (< 50 µm) for SOC stabilization was also confirmed. Particle size fractionation significantly outperformed aggregate size fractionation, due to the fact that larger aggregates contain smaller aggregates and organic matter particles of various sizes with different rotation diversity. In surface soil, the maximum (19.2%) and minimum (8.9%) proportion of total aggregated carbon was retained with >2 mm and 0.10-0.05 mm size fractions, respectively. Conservation agriculture practices secure good soil health by improving soil aggregation (53.8%) and increased energy output with respect to the conventional tillage.

Keywords: Microbial biomass, Conservation tillage, Organic matter dynamics

EFFECT OF DIFFERENT SOWING DATES AND VARIETIES ON THE GROWTH AND YIELD OF MAIZE.

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Maize is a tropical grass that gets well adapted to many climates and hence has wide-ranging maturities from 70 days to 120 days. Maize plants are erect and may grow as tall as 3m, with little tillering capacity. The scientific name of Maize is *Zea Mays*, also commonly known as Corn. The main aim of this research is to test the hypothesis that the impact of different dates of sowing on crop growth and yield of Maize. Best sowing dates provide favorable temperature to obtain maximum yield. Three varieties of Maize Pioneer P1844, Dragon

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NMH (NUZIVEEDU seeds), Swarn were selected and cultivated in Phagwara belonging to Punjab region. Early and late sowing is done to grow the Maize crop of different varieties at 10 days interval. Early sown crop mature early than those sown later. Early sown crop reduced from the different types of injuries like drought and diseases other environmental factor like rainfall, temperature humidity Dose of fertilizers like UREA AND DAP are used in 27 plots to enhance the yield and growth of Maize. On the behalf of this research work we conclude that the different dates of sowing like early sowing and late sowing give crop growth and yield of Maize.

KEYWORDS: Crop; Maize; Variety; treatment; fertilizer.

IN-VITRO EVALUATION OF FUNGICIDES, PLANT EXTRACTS AND BIOAGENTS AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID THE CAUSAL AGENT OF DRY ROOT ROT OF CHICKPEA

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In recent years cultivation of chickpea has been decreases due to major constraint of root rot disease. Chickpea (*Cicer arietinum* L.) also known as Bengal gram is one of the most important winter season pulse crop grown in India. The efficacy of various plant extracts and fungicides were evaluated against *Macrophomina phaseolina* (Tassi.) Goid causing dry root rot of chickpea. Six phyto extracts were evaluated *in vitro* by poisoned food technique against *M. phaseolina*. The extract of garlic cloves (*Allium sativum* L.) was proved excellent with maximum inhibiting (70.15 and 100 %) mycelia growth followed by Neem leaf extract (*Azadiracta indica*) (68.35 and 82.35 %) at 5 and 10% respectively. The fungicides were tested against *M. phaseolina* by poisoned food technique *in vitro*. Significantly maximum mycelium inhibition was recorded in Carbendazim (100%) followed by Carbendazim+ Mancozeb. Among bioagents tested, maximum inhibition was recorded in (*T. viride*) (80.20%) followed by *Trichoderma harzianum* (65.10%) compared to control.

KEYWORDS: bio- agents, fungicides, *Macrophomina Phaseolina*, plant extract, Root rot,

EFFECTS OF FRAME STRENGTH ON THE COMB AREA DAMAGE BY GREATER WAX MOTH, *GALLERIA MELLONELLA* IN STORED COMBS AND ITS CORRELATION WITH WEATHER PARAMETERS AT HISAR

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Experiment was carried out at Research farm of the Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, Hisar to examine the damaged area of combs. The damage area of combs (cm²) caused by *G. mellonella* larvae in stored combs of different frame strength (7, 8, 9 10 frame/ hive body) was recorded from June to October 2016 and 2017. Mean area damage was recorded highest in hive body having 10 frames (121.69 cm² and 123.94 cm²) followed by 9 frames (106.21 cm² and 108.14 cm²) and 8 frames (94.81 cm² and 97.33 cm²) while lowest was recorded in 7 frames (81.37 cm² and 83.42 cm²), respectively in year 2016 and 2017. Irrespective of the different frames strength, damaged area was found highest (195.11 and 172.00) in September followed by October (150.50 and 105.89), August (133.30 cm² and 113.95 cm²), July (77.94 cm² and 29.32 cm²) and June (19.35 cm² and 12.90 cm²) respectively, in 2nd and 1st fortnight except in October (1st and 2nd) during year 2016. Same trends were also observed in year 2017. There was a highly significant difference found between the time interval of different month and frames strength in the occurrence of damaged area. The correlation study indicated significant positive correlation of extent of damage with maximum temperature (r = 0.703 and r = 0.704), maximum humidity (r = 0.227 and r = 0.222) and negatively non-significant with minimum temperature (r = -0.512 and r = -0.475) and minimum RH (r = -0.267 and r = -0.315) respectively, in year 2016 and 2017.

Keywords: stored combs, *Galleria mellonella*, frame strength and area damage.

INTEGRATED PEST MANAGEMENT AGAINST RHINOCEROS BEETLE IN COCONUT

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Coconut *Cocos nucifera* L. is one of the important plantation crops of tropical world grown in more than 93 countries and supports the livelihoods of millions of people. In India, it is predominantly cultivated in coastal states and Islands. The Rhinoceros beetle *Oryctes rhinoceros* L. is an important pest reported from all the coconut growing countries of the world. Intensive agricultural practices relying heavily on chemical pesticides are a major cause of wide spread ecological imbalances resulting in serious problems of insecticide resistance, pest resurgence and pesticide residues. There is a growing awareness world over on the need for promoting environmentally

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sustainable agriculture practices. Integrated Pest Management (IPM) is a globally accepted strategy for promoting sustainable agriculture. IPM as a holistic approach of crop protection based on the integration of multiple strategies viz., cultural, physical, mechanical, biological, botanical and chemical. Over the years IPM underwent several changes, shifting its focus from damage boundary, economic injury to economic threshold. Hence IPM has been evolving over the decades to address the deleterious impacts of synthetic chemical pesticides on environment ultimately affecting the interests of the farmers to control rhinoceros beetle and enhance yield.

Keywords: IPM, Coconut and control.

ALLELOPATHIC EFFECTS IN PLANTS

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Allelopathy refers to the advantageous or damaging effects of one plant on another plant, both crop and weed species, from the release of bio-chemicals, known as allelochemicals, from plant parts by leaching, root exudation, volatilization, residue decomposition, and other processes in both natural and agricultural systems. Allelochemicals are a subcategory of secondary metabolites that are not required for metabolism i.e., growth and development of the allelopathic organism. Allelochemicals with negative allelopathic effects are an important part of plant defence against herbivorous i.e., animals eating plants as their primary food (Fraenkel 1959; Stamp 2003). Allelopathy reduces seed germination and seedling growth. Like synthetic herbicides, there is no common mode of action or physiological target site for all allelochemicals. Allelochemicals sites of actions include cell division, pollen germination, nutrient uptake, photosynthesis, and specific enzyme function. In velvet bean, 3-(3',4'-dihydroxyphenyl)-L-alanine (l-DOPA), indicated that the allelochemicals inhibition by this compound is due to adverse effects on amino acid metabolism and iron concentration equilibrium. Certain plant species releases allelochemicals into the surrounding soil to inhibit the germination and growth of other plants. This gives these plants a competitive advantage, both in the wild and on the land. Allelopathic effect can be used as a plant's advantage or to its detriment. Plant species with a stronger allelopathic ability compete with those with weaker allelopathic abilities, particularly during times when light, water, nutrients or space, were in short supply, such as during a drought.

Keywords: Allelopathy, Allelochemicals, Herbivorous

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH

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The agriculture based Indian Economy needs high agriculture income for the farmers who feed the 1.25 billion Indian population. Not only this like developed countries who despite having much lesser area under cultivation, export number of farm products, This will attract more and more people towards agriculture, the backbone of the country. The Prime Minister Narendra Modi said that his government has decided to double the farmers' income by 2022 when India would celebrate 75 years of Independence The goal is achievable if the farmers adopt and use modern technology in cultivation like drip irrigation as it will direct the maximum utilization of water with minimum quantity. The Prime Minister said "Water is like God, we have no right to waste it.". The focus will then be on "More crop per drop", "Hark khet ko pani" (water for every farm), "Doubling farmers' incomes". Laying the route map to double the farmers income, the Prime Minister said "Centre has decided to double farmers' income by 2022 by improving technology, increasing milk production, use of solar light, honey production. The NITI Aayog has already come out with its 'Three Year Action Agenda' a plan that covers a time period up to the 2019. In its chapter on agriculture titled 'Agriculture: Doubling Farmer's Incomes', the economic think-tank has put forth a 4-point action plan to double the incomes of India's farmers. A subsidy would be provided on targeted produce in case the price falls below MSP-linked threshold. One advantage of this, as highlighted by the action plan, is that it would spread price incentives to producers in all the regions and all the crops considered important for providing price support. NITI Aayog has also called for substantive investment in irrigation, seeds & fertilisers and new technology coupled with a shift into high-value commodities such as horticulture, poultry and dairying to double incomes.

Keywords : NITI Aayog, "Hark khet ko pani", "Doubling farmers' incomes", Indian Economy

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EFFECT OF DIRECT SPRAY OF INSECTICIDES ON MORTALITY OF HONEYBEE, *APIS MELLIFERA* L. (HYMENOPTERA: APIDAE) ON MUSTARD CROP (*BRASSICA NAPUS*)

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The effect of direct spray of insecticides on mortality of honeybee, *Apis mellifera* L. (Hymenoptera: Apidae) on mustard crop (*Brassica napus*) cultivar DGS-1 were studied at Jammu (India). Under field conditions the application of methyl-demeton resulted in 100 per cent bee mortality within one hour of spraying followed by imidacloprid (76.5, 100 per cent), acetamiprid (55.0, 62.5 per cent), diamethoate (47.5, 59.00 per cent) and thiamethoxam (42.5, 51.5 per cent) during 2014-15 and 2015-16 respectively. However, the per cent mortality of honey bee was not observed in treatment of control. Toxicity order of insecticides were methyl-demeton > imidacloprid > acetamiprid > diamethoate > thiamethoxam. After 3 hours of spraying the mortality was 100 per cent of methyl-demeton and imidacloprid followed by acetamiprid (77.5, 80.0 per cent), diamethoate (70.0, 79.0 per cent) and thiamethoxam (50.0, 56.5 per cent) whereas no mortality was observed in control treatment. Similar trend was obtained in all the treatments but with increased per cent bee mortality after 7 hours of spraying. After 12 and 24 hours of spraying the mortality was 100 per cent for all the treatments except thiamethoxam, which recorded (99.0, 97.5 per cent) during 2014-15 and 2015-16 respectively. It is thus evident that methyl-demeton followed by imidacloprid, acetamiprid, and diamethoate were more toxic to the honey bees forager and thiamethoxam having insecticidal properties was found to be less toxic of honey bees forager. Statistical analysis of the data revealed that effects of different insecticides at different hours of treatment on mortality of bees were highly significant.

Key Words: *Apis mellifera* L., *Brassica napus*, Insecticides, Direct mortality, Pollination.

INFLUENCE OF NITROGEN PHOSPHORUS AND POTASH ON GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH)

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The present investigation was conducted at Horticulture research farm J. V. College, Baraut, Baghpat. The experiment layout carried out following randomized block design with three replications of twelve treatment combinations including check three levels of nitrogen phosphorus and potash fertilizers application. In which Okra (*Abelmoschus esculentus* L. Moench) cv. Parbhani Kranti, was used to study on growth and fruits yield response of nitrogen (55, 80 and 105 kg/ha), phosphorus (40, 60 and 80 kg/ha) and (20, 40 and 60 Kg/ha) along with having control (0, 0), these doses were applied with check. Results also indicated that, nitrogen @ 105 kg/ha phosphorus @ 80 kg/ha and 60 Kg/ha significantly reduced the number of days to 50% germination and 50% flowering and increases maximum plant height, number of branch, leaf area, number of green fruits/plant compare to other treatment of nitrogen, phosphorus and Potash of Western Uttar Pradesh.

Keys Words: Parbhani Kranti, Nitrogen Phosphorus, Potash.

IMPORTANCE OF POST HARVEST TECHNOLOGY FOR VALUE ADDITION AND PRESERVATION OF HORTICULTURE CROPS

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Value addition is a process in which for the same volume of a primary product, a high price is realized by means of processing, packing, upgrading the quality or other such methods improve the profitability of farmers. Horticulture deals with the cultivation of crops which belong to us and possess great medicinal, nutritional, health promoting values. India as second largest producer of fruits and vegetables, only 10 per cent of that horticultural produce is processed, but other developed and developing countries where 40-80 per cent produce is value added. Horticultural crops provide varied type of components, which can be effectively and gainfully utilized for value addition like pigment, amino acids, oleoresins, antioxidants, flavors, aroma etc. Post harvest losses in horticultural produce is about 5 to 30 per cent which amounts to more than 8000 crore rupees per annum. If we subject our produce to value addition the losses can be checked. Horticultural crops are right material for value addition because they are more profitable, has high degree of process ability and richness in health promoting compounds and higher potential for export. There is a tremendous demand of novel and innovative processing and value-added products of international standards. Scope of minimal processing is also increasing with the increasing consumer demand for fresh and fresh-like foods. Nowadays people shifted to replace the use of preservatives with advanced packaging technologies and safer and healthier extraction technologies. Minimal processing and MAP and CAP, extruded fruit-based items, high pressure

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processing, vacuum drying of fruits and vegetables, osmo dehydration technology for making fruit bars, candies, ready to serve beverages, shift from loose to packaging/effective packaging of fruits and their products, health tonic/beverages. To empower the farmers and other weaker sections of society especially women through gainful employment opportunities and revitalize rural communities. To provide better quality, safe and branded foods to the consumers, reduce post harvest losses, increased foreign exchange, encourage growth of subsidiary industries and increase farmers' financial stability.

GROWTH AND DEVELOPMENT OF *CALLOSOBRUCHUS CHINENSIS* (LINN.) ON DIFFERENT PULSE GRAINS

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The present studies on the growth and development of *Callosobruchus chinensis* (Linn.) on different pulse grains were carried out at the Department of Agricultural Entomology, College of Agriculture, Latur during, 2015-2016. Result revealed that significantly shorter incubation period (4.17 days), larval-pupal period (22.21 days) and higher growth index (3.22) was recorded when *C. chinensis* reared on kabuli gram. The significantly lower egg hatch (80.00 per cent), growth index (1.71) and higher larval-pupal period (27.53 days) was observed when *C. chinensis* reared on kidney bean. The significantly higher life-cycle duration in male (32.05 days), female (32.29 days) and in general (32.17 days) was recorded on kidney bean and significantly lower life-cycle duration in male (26.31 days), female (26.45 days) and in general (26.38 days) was found on kabuli gram.

The significantly lowest percentage of adult emergence in male (26.00 per cent), female (29.00 per cent) and in general (55.00 per cent) was recorded on kidney bean. The significantly highest per cent adult emergence in male (41.00 per cent), female (44.00 per cent) and in general (85.00 per cent) found when *C. chinensis* reared on kabuli gram. The significantly highest longevity in male (8.82 days), female (8.70 days) and in general (8.76 days) was recorded when *C. chinensis* reared on kabuli gram. The significantly highest number of eggs (100.00 eggs) were laid by female of *C. chinensis* when reared on kabuli gram and lowest (64.96 eggs) by female when reared on kidney bean.

The net reproductive rate (R_0) of *C. chinensis* was 42.05, 31.34, 33.74 and 17.64 females per female per generation on kabuli gram, white tur, red tur and kidney bean, respectively. The mean length of generation (T) was maximum (33.76 days) on kidney bean and minimum (31.40 days) on white tur. On the basis of (r_m) values the descending order of food grains for *C. chinensis* was kabuli gram (0.1164), red tur (0.1120), white tur (0.1097) and kidney bean (0.085). The finite rate of increase in numbers (λ) was 1.30, 1.28, 1.29 and 1.21 females per female per day on kabuli gram, white tur, red tur and kidney bean, respectively.

On the basis of overall suitability of different pulses this indicated that kabuli gram was found to be most suitable for growth and multiplication of *C. chinensis* while, kidney bean was observed to be less suitable for the development of pulse beetle *C. chinensis*.

VERMI COMPOST & ITS SIGNIFICANCE

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Vermi composting is a method of using worms to transform organic waste into a nutrient rich fertilizer. It is a breaking down of organic material through the use of worms, bacteria & fungi. Vermi compost have higher level of available nutrients like calcium, nitrogen, phosphorous, potassium, carbon, magnesium derived from wastes. Wastes used include industrial, agricultural plant debris & domestic waste papers & cattle dung. Varieties of earthworms used include *Eudrilus eugeniae*, *Perionyx excavates* in vermi compost. The major advantage of vermi compost is that it can be used for all crops like agricultural, horticultural, ornamental, vegetable production at any stage of crop. Its benefit include, higher nutrient content as compared to traditional compost, improves soil structure, soil texture, aeration and water holding capacity and prevents soil erosion other main advantages as it minimises the pests and diseases in crop, and enhances the process of decomposition of organic matter in soil ideal conditions include Ph range should be between 6.5 -7.5 with moisture content of 60-70%, temperature range of 19-30 celsius is suitable for best production. This revealed that the organic waste can be converted into useable form with its excellent nutrient release. It is eco-friendly, cost effective method aimed ideal method for management and development of solid waste. It uses waste as raw material in building up of soil fertility and improving soil health for sustainable agriculture.

EFFECT OF ORGANIC, INORGANIC AND BIOFERTILIZER ON PLANT GROWTH ATTRIBUTING CHARACTERS OF CABBAGE (*Brassica Oleracea* var. *Capitata*) UNDER CHHATTISGARH PLAIN ZONE**MADANKUMAR JHA¹, BAHRTI JHA², RUDRANEE SINGH³, PASHYANTI URRAIYA⁴, MANJU RANISAHU⁵***Student of M.Sc. (Hort.) Dept. of Vegetable science, BTC CARS, Bilaspur (C.G.), Student of M.Sc. (Hort.) Dept. of Horticulture OUAT, Bhubneshwar (Odisha), Student of M.Sc. (Hort.) Dept. of Vegetable science, JNKVV, Jabalpur (M.P.), Student of M.Sc. (Hort.) Dept. of Vegetable science, JNKVV, Jabalpur (M.P.), Student of M.Sc. (Hort.) Dept. of Vegetable science, BTC CARS, Bilaspur (C.G.)*

The field experiment was conducted during Rabi season of 2016-17 at the Horticulture Research cum Instructional farm, BTC CARS, Bilaspur (C.G.). The treatments consisted of eleven combination of different agro input management practices viz., treatments 100 % RDF (Control) (T₁), 75 % RDF + 25 % N through FYM (T₂), 75 % RDF + 25 % N through VC (T₃), 50 % RDF + 50 % N through FYM (T₄), 50 % RDF + 50 % N through VC (T₅), 125% RDF (T₆), 100 % RDF + 25% N through FYM (T₇), 100 % RDF + 25% N through VC (T₈), 100 % RDF + 25% N through FYM + *Azotobacter* @ 2 kg ha⁻¹ + PSB @ 2 kg ha⁻¹ (T₉), 100 % RDF + 25% N through VC + *Azotobacter* @ 2 kg ha⁻¹ + PSB @ 2 kg ha⁻¹ (T₁₀), 100 % from organic FYM+VC+AZ+PSB (T₁₁). Significantly maximum plant height recorded 30.59 cm (T₃), 36.55 cm (T₃) and 42.47cm (T₃) at 30, 60 DAT and at harvest. The minimum plant height of 24.48 cm (T₁), 29.72cm (T₈) and 32.66cm (T₁₁) were recorded under at 30, 60 DAT and at harvest respectively. The maximum plant spread were recorded 47.27 cm (T₃), 56.13 cm (T₃) and 65.23 cm (T₃) over rest of the treatment at different stages i.e 30, 60 DAT and at harvest respectively. The minimum plant spread i.e. 37.51 cm (T₁₁), 47.28 cm (T₁₁) and 48.91cm (T₁₁) were recorded at 30, 60 DAT and at harvest respectively. Significantly Maximum **length of unfolded leaves plant⁻¹** were recorded 24.90 cm (T₂), 26.91 cm (T₂) and 31.84 cm (T₂) for different stages i.e. 30, 60 DAT and at harvest. The minimum **Length of unfolded leaves plant⁻¹** were recorded 20.10 cm (T₃), 20.50 cm (T₁₀) and 22.76cm (T₁₀) for different stages i.e. 30, 60 DAT and at harvest. The maximum **breadth of unfolded leaves plant⁻¹** were recorded 18.51 cm (T₄), 28.20 cm (T₄) and 33.38 cm (T₄) for different stages i.e. 30, 60 DAT and at harvest respectively. The minimum **breadth of unfolded leaves plant⁻¹** were recorded 14.34 cm (T₁₁), 19.30 cm (T₁₀) and 22.48 cm (T₁₀) for different stages i.e. 30, 60 DAT and at harvest. The maximum number of loose leaves plant⁻¹ were recorded 11.53 (T₅), 15 (T₅) and 15.47 (T₅) for different stages i.e. 30, 60 DAT and at harvest respectively. The minimum number of loose leaves plant⁻¹ were recorded 9.33 (T₁₀), 12.27 (T₁₀) and 12.43 (T₁₀) for different stages i.e. 30, 60 DAT and at harvest respectively

KEYWORDS: *Organic, Inorganic, Biofertilizer Combination, Azotobacter***“FERTILITY RESTORATION STUDY IN PEARL MILLET GERMLASM LINES”****MADANKAR KARTIK SAHADEO***Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India*

Pearl millet [*Pennisetum glaucum* (L.) R. Br.], an annual C4 crop, is the fourth most extensively cultivated cereal in India. Discovery of male sterility system and breeding of commercially viable male sterile lines is a land mark in pearl millet hybrid cultivar development. Genetic and cytoplasmic diversification of seed and pollen parents is very much needed to avoid parents and hybrids becoming susceptible to biotic stresses. Therefore, use of diverse male sterile and restorers lines having high combining ability is very important to realize heterosis in F1 hybrids. To achieve this, differentiation of germplasm for maintainer and fertility restoration behavior is an important initial step in pearl millet breeding programs. An experiment comprised of 3 male sterile lines and 25 germplasm lines of pearl millet. The 75 hybrids were made at ICRISAT, Hyderabad and evaluation of hybrid did at Pearl Millet Research Station, Department of Genetics and Plant Breeding, CCSHAU, Hisar, Haryana. The fertility restoration ability of 25 germplasm lines on different cytoplasmic sources was studied. Among the 75 hybrids studied, 70 hybrids were complete fertile and 5 hybrids were recorded sterile. Developmental variation in the male sterile and male fertile lines of pearl millet was studied in five developmental stages viz., PMC, dyad, tetrad, soon after microspore release and before dehiscence of anther and it was found that, break down of fertility in the sterile anthers of pearl millet was post meiotic, in specific soon after the release of tetrad in the developmental stage. Identification of restorers for male sterile lines opens up new avenues in pearl millet hybrid breeding program.

Keywords: pearl millet, germplasm lines, fertility restoration.

CISGENESIS STRONGLY IMPROVES INTROGRESSION AND INDUCED TRANSLOCATION BREEDING IN PLANTS**MADHU CHOUDHARY*, VARSHA SINGH, OMESH KUMAR***Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005*

Cisgenesis represents a step toward a new generation of GM crops. The lack of selectable genes (e.g. antibiotic or herbicide resistance) in the final product and the fact that the inserted gene(s) derive from organisms sexually compatible with the target crop should rise less

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environmental concerns and increase consumer's acceptance. The generation of a cisgenic apple plant by inserting the endogenous apple scab resistance gene Homologues of *Cladosporium fulvum* resistance genes of *Vf region* (HcrVf2) under the control of its own regulatory sequences into the scab susceptible apple cultivar Gala. In order to develop marker-free plants, the chemically inducible recombinase system in strawberry was applied to apple. Cisgenesis can be used to enhance the expression of an endogenous phytase gene in barley through the insertion of extra gene copies of the endogenous phytase gene isolated from barley itself. Phytases of the purple acid phosphatase (PAPhy's) group account for the majority of the phytases synthesized in barley. Two PAPhy types, termed *HvPAPhy a* and *HvPAPhy b*, have been identified. *HvPAPhy a* is preferentially synthesized during seed development and stored as preformed phytase in the mature grain, while *HvPAPhy b* is preferentially synthesized during germination. Gibberellic acid is a plant hormone with a wide variety of functions in controlling plant growth and development. Five different cisgenes (*GA20ox7*, *GA20ox2*, *GAI1*, *RGL 1_1*, and *RGL 1_2*) were studied, along with empty vector controls and non-transgenic controls. *GA20ox* is an enzyme that catalyzes the penultimate step in the biosynthetic GA pathway, and thus tends to promote cell division and elongation, whereas the other genes tend to repress or attenuate active GA actions.

Key words: Cisgenesis, Gene, Phytase, Resistance, Gibberellic acid.

EFFECT OF POTTING MEDIA INCORPORATED WITH PUSA HYDROGEL ON GROWTH AND PRODUCTION OF QUALITY FOLIAGE PLANTS OF *PHILODENDRON XANADU*

MADHU BALA,

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The efficacy of potting media incorporated with different concentrations of Pusa hydro gel was tested for production of quality foliage plants of *Philodendron xanadu* at the Research Farm of Department of Floriculture and Landscaping, PAU, Ludhiana during 2016-17. Potting mixtures consisted of soil: farm yard manure: sand (1:1:1) was incorporated with 0, 10, 20, 30 and 40 g concentrations of Pusa Hydrogel/ 5 kg of potting media. The media supplemented with different levels of hydro gel resulted in significantly improved growth characters of foliage plants. Among all the levels of gel, incorporation of Pusa hydrogel @ 40 g/5 kg potting media reduced the frequency of irrigation, quantity of water required. Further, improvement in foliage quality of plants with respect to plant height, plant spread, number of leaves per plants, leaf length, leaf width and longevity of leaves were observed. The maximum plant height (42.12 cm), number of leaves (29.16), leaf area (690.23 sq. cm), plant spread (48.20 cm), leaf longevity (20.50 days) and number of primary roots per plant (8.45) were recorded in media incorporated with Pusa hydrogel @ 40 g/5 kg potting media. The minimum plant height (30.22 cm), number of leaves (16.91), leaf area (489.77 sq. cm), plant spread (33.02 cm), leaf longevity (14.58 day) and number of primary roots per plant (5.5) were recorded in control where Pusa hydrogel was not added in the potting media. The addition of Pusa hydrogel with media resulted in efficient use of water by reducing irrigation frequency and improved the quality of plants produced.

SEARCHING OF PLANT INTERACTOR PROTEIN FOR XOPC2 T3SS EFFECTOR PROTEIN OF *XANTHOMONAS AXONOPODIS* PV. *PUNICAE* CAUSING BACTERIAL BLIGHT OF POMEGRANATE

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Bacterial blight of pomegranate, an important disease caused by *Xanthomonas axonopodis* pv. *punicae* (*Xap*), is a major threat to pomegranate cultivation. *Xap* secretes xanthomonas outer protein (xop) effectors via T3SS directly into the pomegranate cells during disease development. The T3SS effectors are mainly used by pathogen to suppress pathogen-associated molecular pattern (PAMP)-triggered plant immunity (PTI). Previously, we demonstrated the key role of XopC2 in the suppression of pomegranate immunity. Now it is pertinent to search its cognate interactor(s) in pomegranate. We employed Y2H system in identifying the interactors for XopC2 in pomegranate. Briefly, we constructed cDNA library of pomegranate in an activation domain vector pGADT7 in a way that protein encoded by the insert are fused to 3' end of Gal4 AD. The construct was transformed into Y187 strain of yeast. Similarly, bait construct was developed using XopC2 in DNA binding domain in *GAL4* DNA-BD vector pGBKT7 and transformed in Y2H gold strain of yeast. Bait toxicity was determined on different selective media along with controls. The XopC2 was observed to be non toxic to the yeast and was also not auto activating the reported genes present in the yeast. Thus the bait was direct used for identification of the plant interactor. The two stains (bait and prey) were mated and selected on selective media. After mating of two stains the interacting blue color colonies were screened confirmed using insert check PCR. The plasmid was isolated from positive and sequenced. The possible interactor(s) identified are being validated through various assays.

Key words: Pomegranate, Effectors, Xanthomonas, XopC2

2nd International Conference on "Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-2018)"**MUTATION BREEDING IN FRUIT CROPS****MAHANTHESHAM*¹, MAHANTESH K² NAVEEN KUMAR K L³ AND SANTOSH KORAV⁴***College of Agriculture, CCSHAU, Hisar, Haryana, India-125004, ³PhD Scholar, College of PG-Studies, CAU, Umiam 793103, Meghalaya, India*

Mutation is a sudden and heritable change of the nucleotide sequence of the genome of an organism, virus, or extra-chromosomal DNA or other genetic elements. Due to increasing the human population, reduced availability of cultivated land and climate change directly affects sustainability of fruit production. Among the various breeding methods, conventional breeding (limitations) and transgenic crops (controversies), mutation breeding is an emerging tool for developing new cultivars within a short period of time. In fruit crops, spontaneous mutation (Bud sports) are more common in citrus, grapes, etc. and induced mutation is widely adopted to bring variation and evolving new varieties or species. Mutations may result into deletion, inversion, translocation of chromosome and nucleotide base substitutions. Mutations can be induced by using mutagens (physical and chemical) such as gamma rays, X rays, EMS (Ethyl Methane Sulphonate) *etc.* Perennial nature, long juvenile phase, heterozygosity, polyploidy, parthenocarpy, seedlessness (less number of seeds per fruit), sexual incompatibilities in fruit crops limits their improvement through conventional breeding.

Key words: varieties, chromosomal aberration, mutagens, breeding methods

PEST MANAGEMENT IN ORGANIC FARMING FOR SUSTAINABLE AGRICULTURE**MAHESH KHILARI, UNDER SUPERVISION OF PROF. S.V.S. RAJU***M.Sc, Entomology And Agricultural Zoology, Institute of Agricultural Sciences, BHU, VARANASI*

Organic farming is a method of crop and livestock production that involves much more than choosing not to use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones. Organic farming sustains the health of soils, ecosystems and people. Principles of organic farming are crop rotation, green manure, composting, mechanical cultivation and biological control. Pest is anything which causes damage to the crops. Pest management in organic farming to minimize the crop losses, to minimize the environmental pollution, to approach towards sustainability, maintain quality as well as quantity of produce, nullify the negative effects of green revolution, ensuring food security, decreases bio-hazards created in the food chain due to presence of chemicals, controlling the pests getting resistant to chemicals. In organic farming allow the use of chemicals nothing but naturally occurring substances such as pyrethrin and rotenone. Avoid the use of broad spectrum synthetic pesticides, which promote the occurrence of secondary pest such as spiders, mites and BPH. Organic approach for pest management enhance habitat for beneficial insects to increase population, reduce stress on crop, use adapted varieties and use of non-chemical methods to control pests (Bt, hand picking, row covers, alternating planting dates, traps).

KEYWORDS: Organic Farming, Pest Management, Sustainability, Ecosystem.

INFLUENCE OF MICRONUTRIENTS ON GROWTH AND YIELD OF EARLY CAULIFLOWER**MAHESH KUMAR***Nalanda College of Horticulture, Noorsarai, Bihar Agricultural University, Sabour*

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is a heavy feeder of macro and micronutrients but most of the micronutrients found scarce in the crops which leads to low yield and poor quality of cauliflower. Injudicious use of chemical fertilizers is one of the major reasons for inferior quality and low productivity of cauliflower. Imbalanced fertilizer use has led to multi-nutrient deficiencies particularly of boron, and zinc resulting in poor yield. Therefore, for getting higher and economical yield, applications of boron along with zinc are essential. Keeping in view of the above fact, a field experiment was conducted during Rabi season 2016-17 in the experimental farm area of the Nalanda College of Horticulture, Noorsarai (BAU, Sabour) in R.B.D. factorial design with three replications comprising of 15 treatment combinations. The variety used in the experiment was- Sabour Agrium. From the results of the experiment it was found that **significantly higher plant height (cm), Curd diameter (cm), curd depth (cm), net curd weight (kg) and yield (152.22 q/ha)** were obtained with the application of boron @ 2.0 kg/ha + zinc 5.0 kg/ha which was at par the application of boron @ 3.0 kg/ha + zinc 7.5 kg/ha in respect of calculated yield (144.44 q/ha) of cauliflower.

EFFECT OF AMLA (*EMBLICA OFFICINALIS*) ON THE GROWTH PARAMETERS OF GRASS CARP FINGERLINGS IN TARAI CONDITIONS OF UTTARAKHAND**MAHIMA TAMTA* AND AMITA SAXENA***Department of Fisheries Resource Management, College of Fisheries, G.B.P.U.A.&T., Pantnagar*

Embllica officinalis, is also known as amla, has been used in Ayurveda, the ancient system of Indian medicine. Amla has been used for

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curing many disorders such as common cold, scurvy, cancer and heart diseases in humans. It is supposed that the major factor responsible for all these curing activities is Vitamin C (Ascorbic acid), which is contained in large proportion in the pulp of amla. The present study was conducted to study the effect of different concentrations of amla as a feed additive on the growth parameters of Grass Carp fingerlings. Four experimental diets, T0, T1, T2 and T3, were prepared with dried amla powder as a feed additive mixed @ 0% (Control), 1%, 5% and 10% of feed, respectively. The results showed that the all the growth parameters were better in all the fishes fed with T3 (10% dried amla per kg feed).

Keywords: vitamin C, *Emblca officinalis*, carps, , growth parameters.

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN DURUM WHEAT (*TRITICUM DURUM*)

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The experiment was carried out to assess genetic variability with respect to grain yield and its attributes with a set of 40 genotypes of durum wheat (*Triticum durum*) at Wheat Research Station, Junagadh Agricultural University, Junagadh during Rabi 2016-17 in randomized block design with three replications. The characters studied were days to 50% flowering, days to maturity, grain filling period, plant height, number of productive tillers per plant, ear length, number of grains per main spike, grain weight per main spike, grain yield per plant, biological yield per plant, harvest index and 100-grain weight.

The analysis of variance revealed highly significant differences among the mean square due to genotypes for all the characters studied. Grain weight per main spike recorded maximum phenotypic range of variation followed by grain yield per plant and number of grains per main spike. The values of phenotypic coefficient of variation were slightly higher than that of genotypic coefficient of variation for all the traits studied, indicating less effect of environment on the expression of characters studied. High genotypic and phenotypic coefficient of variation were observed for grain yield per plant followed by grain weight per main spike, number of grains per main spike, 100-grain weight, number of productive tillers per plant and biological yield per plant. High heritability coupled with high to moderate genetic advance expressed as per cent of mean were observed for days to 50% flowering, number of productive tillers per plant, plant height, ear length, grain yield per plant, biological yield per plant and 100-grain weight, which may be attributed to the preponderance of additive gene action and possessed high selective value and thus, more emphasis should be given to these characters for genetic improvement of grain yield.

Key words: Variability, heritability, genetic advance, *Triticum durum*.

MOLECULAR BASIS OF HOST PATHOGEN INTERACTION

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Plant pathogens have evolved numerous strategies to obtain nutritive materials from their host and plants in turn have evolved the preformed physical and chemical barriers as well as sophisticated to combat pathogen attacks. Understanding how plant and pathogen interact with each other is crucial for developing a sustainable agriculture. During the long history of co-evolution between host and pathogens, plant immune response has culminated in a highly defense system that is able to resist potential attack by microbial pathogens. As plants lack mobile defender cells and somatic adaptive systems; they must be relying on the innate immunity of each cell and on systemic signal emanating from infection sites. The perception of the pathogen is achieved through receptors, a surveillance system capable of recognizing both conserved molecular patterns and specific effector proteins and activation of the corresponding defenses. Rhizosphere colonization by certain bioagent like PGPF PGPR strains results in a state of heightened resistance in plants, locally and systemically, to subsequent pathogen attack. During the colonization process, a complex molecular dialogue is established between plants and the microorganisms in which signaling molecules (elicitors) play an essential role. Various molecules associated with the basic metabolism of microbes, such as cell wall glucans, chitin oligomers and glycopeptides have been described elicitor activity. One important outcome of some plant microbe interactions is the induction of plant defenses mediated by the activation of Induced Systemic Resistance (ISR) systemic acquired resistance (SAR) and Pathogen related proteins (PR) involved genes. An integrated approach based on the combined knowledge of the molecular basis of 'defense systems' used by the plant and the 'assault systems' used by pathogens will help us to design novel methods for plant disease management.

HIGH INTENSITY SOIL SAMPLING: A BOON TO SITE SPECIFIC NUTRIENT MANAGEMENT**MAMTA PHOGAT^{*1}, RITADAHYA², SUNIL KUMAR³ AND BHAWNA BABAL⁴**^{1,2,4}*Department of Soil Science, CCS Haryana Agricultural University Hisa-125004, ³Department of Soil Science and Agricultural University, SKRAU, Bikaner, Rajasthan-334006*

Presently the world is facing population explosion and it is one of the greatest challenges to ensure food security to the growing global population which is projected to rise to around 10 billion by 2050 to meet their nutritional needs. There is urgent need to increase farm productivity and total food production on sustainable basis without compromising on natural resources and environment. Now-a-days, due to intensive cropping, imbalanced use of fertilizers and cultivation of high yielding crop varieties leads to deterioration of soil health and increased air, soil and water pollution. The negative nutrient balance due to the imbalanced use of fertilization to the tune of ~810 Mt has been resulted in nutrient mining and hence decreased productivity of soil. As a way out to this dilemma, site-specific nutrient management is one of the best agriculture practices which is climate-compatible and it will help to meet the Zero Hunger Challenge. Variability of plant-available nutrients Within field often results in different fertilizer requirements across a field. Site-specific nutrient management takes into account various activities viz; measuring spatial variability, analyzing the data obtained from these measurements, using information gained from this analysis to effect changes in management practices, and determining whether the resulting benefits are cost effective. GIS (Geographical Information System), and GPS (Global Positioning System) are the best techniques for site-specific nutrient management for precision agriculture. GPS tools receive signals from a network of orbiting satellites and calculate them to give exact position of a point. GIS computes this background data of given locations to generate a complex view about the whole field. It provides opportunity to assess variability in the distribution of native nutrients and other yield limiting/improving soil parameters over a large area and to make valid decisions for site-specific nutrient management. This will result in low input yield optimization along with maintenance of soil health, soil quality and sustainable environment.

Key Words: Food security, Nutrient Mining, Spatial Variability, GIS, GPS, Soil health and quality

USE OF MODIFIED CLAY AND PILLARED CLAY FOR REMEDIATION OF HEAVY METALS**MAMTA, RAJENDRA BAIRWA, SUMAN LATA, DIPTI KUMARI***Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur- 813210*

Heavy metals contamination of the environment has become a serious problem due to their non-degradability and biomagnifications (Mapanda *et al.*, 2005; Kurniawan *et al.*, 2006; Singh *et al.*, 2010). Common methods that are available for the removal of heavy metals contamination include chemical precipitation, reverse osmosis, ion exchange, membrane separation, chemical oxidation and electro dialysis. Adsorption is the most preferred method for removal of heavy metals due to its simplicity and its high effectiveness (Gupta *et al.*, 1998; Gupta and Ali 2004; Shafaei *et al.* 2007; Sdiri *et al.* 2011). The High metal adsorption capacity of clay minerals (because of their large specific surface area and reactive functional groups) makes one of the most common amendments for metal adsorption/stabilisation. There are various modifications like acid activation, thermal treatment, clay-rubber complex, treatment with cationic surfactant and pillaring by different type of poly (hydroxo metal) cations etc. that increase the metal loading capacity of clay minerals. Pillared clays have emerged as potential adsorbents for the removal of heavy metal ions due to their large surface area and the abundance and low cost of clays that it used as raw material, as well as to the fact of being tunable in terms of properties. PILCs exhibit multi-charged centers, large area, high interlayer space and thermal stability. Characterization of these properties was carried out by using of different technique like XRD, FTIR, SEM, DTA/TGA and zetametry. Amending the soil with Al-bentonite at 2.5% resulted in 16, 36 and 16% reduction in EDTA extractable Zn, Cu and Ni respectively and also reduced the content of Zn, Cu and Ni in amaranth shoot by 24%, 31% and 53% respectively (Kumararaja *et al.*, 2017).

Key words - Heavy metals, Adsorption, Pillared clay.

ASSESSMENT OF AVAILABLE MICRONUTRIENTS AS AFFECTED BY AGRICULTURAL LAND-USES IN SOUTH WESTERN PLAINS OF PUNJAB, INDIA**MANDALAGNIVA^{1*} AND DHALIWALS²***Department of Agricultural Chemistry and Soil Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741252, INDIA, Department of Soil Science, Punjab Agricultural University, Ludhiana 141004, Punjab, INDIA*

To study the impact of agricultural land-uses on distribution of available micronutrients in soil, samples were collected from semi-arid sub-tropical region of Punjab, in and around Dhanaula (30°18' N, 75°27' E); district Barnala, Bhucho (30°15' N, 75°03' E) and Phul (30°19' N, 75°14' E); district Bathinda, under three land-uses viz. cropland, horticultural and uncultivated land and were analyzed. The results indicated that soils were slightly saline in nature and sandy loam to loamy sand in texture. The DTPA extractable contents varied

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from 0.19-4.07 mg kg⁻¹ for zinc (Zn), 0.16-1.24 mg kg⁻¹ for copper (Cu) 1.45-15.43 mg kg⁻¹ for iron (Fe) and 1.09-4.16 mg kg⁻¹ for manganese (Mn) irrespective of land-uses and soil depths. The values of available micronutrient contents were recorded highest under horticultural land followed by cropland and uncultivated land. Gradual decrease along the depth was observed almost under all three land-uses. Uncultivated lands were expected to be deficient in micronutrients due to prolonged erosional loss and lack of input. But croplands were also found deficient in available Zn, Cu and Mn. Widespread Zn deficiency under cultivation which might be attributed to crop removal and low carbon content as highest variability of Zn was found ($R^2 = 0.822$, $P = 0.001$) with respect to soil organic carbon (SOC). Cropland exhibited medium to sufficient range in terms of available Fe. Overall sufficiency was noticed under horticultural land regarding the availability of all four studied micronutrients which might be due to comparatively finer soil texture and greater addition of organic matter in the form of leaf litter fall and root deposition. Significant positive relations of micronutrients with SOC and finer particles (silt, clay and silt plus clay) might be the plausible reason behind it. Hence, assessment micronutrient availability under different land-uses is imperative to evaluate the potential of soils as well as for better selection of land-uses for achieving sustainability.

Key Words: Land-use, DTPA extractable available micronutrients (Zn, Cu, Fe and Mn), Soil fertility, Soil sustainability.

DOUBLING OF FARMERS INCOME TILL 2022

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Income is the most relevant measure to assess farmers' economic well being and sectoral transformation. The crises and distresses plaguing the sector endanger the very livelihoods and welfare of the farmers. Indian Government with the intention giving enough policy thrust on income security, proposed to double the farmers' income by 2022, platinum jubilee year of the Indian independence. The present study analysed the current status of farmers' income across holding size and regions and attempted to decipher the scope and pathways for doubling income through potential drivers. The spatial and temporal trends in farm household income from crop production, livestock farming, wages and non-farm activities have been analysed for better understanding of the present scenario. The study tracked the farmers' household income across regions and holding size between 2003 and 2013 using the countrywide situation assessment survey data collected by the National Sample Survey Office (NSSO) and deciphered the scope and potential for doubling the farmers' income (DFI) by 2022. The findings from the NSSO data indicated that the share of income has increased drastically from 5 per cent to 12 per cent in the case of livestock farming, 45 per cent to 48 per cent in crop production, while that of the wages and non-farm have declined between 2003 and 2013. The challenges faced by the farming community in the coming years have been highlighted for devising relevant pathway and strategies to enhance the income.

Key word:- farmers' income, production, farming etc.

SUSTAINABILITY IN AGRICULTURE: A REVIEW OF POLICIES

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The new policy seeks to introduce economically viable, technically sound, environmentally non-degrading and non-hazardous and socially acceptable use of natural resources of the country for promoting the concept of sustainable agriculture. In order to fulfill this strategy, the following measures are suggested in the new policy: To use unutilized barren wastelands for agriculture and afforestation. To contain biotic pressures on land and to control indiscriminate division of agricultural lands for non-agricultural uses. To enhance cropping intensity through multi-cropping and inter-cropping. To emphasize rational use of ground and surface water so that over-exploitation of ground water resources can be checked. To adopt better technologies such as drip and sprinkler irrigation system so as to arrange more economic and efficient use of water. To adopt vigorously a long-term perspective plan for sustainable rain-fed agriculture by adopting watershed approach and water harvesting method for development of two-thirds of cropped area of the country which is dependent on rainfall. Involvement of farmers and landless labourers will be sought in the development of pastures/ forestry programmes on huge public wasteland by providing adequate financial incentives and entitlement of trees and pastures.

Key Word:- sustainable agriculture, afforestation, etc.

IMPACT OF VARIOUS TYPES OF FERTILIZERS ON MORPHO-PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS OF OKRA**MANIKABALI*, TINU ANAND KAIN, SHAHID UMAR***Department of Botany, School of Chemical and Life Sciences, Jamia Hamdard, New Delhi-110062*

Okra, a member of the Malvaceae family, is one of the oldest cultivated crops in the world, dominantly found in tropical, sub-tropical and warm temperate regions of the world. Its native origin is Ethiopia and Sudan and is widely consumed in India. It is well-known fact that dosage and composition of fertilizers affect the crop growth and yield. To investigate the influence of inorganic, organic fertilizers and bio-fertilizers on morpho-physiological characters of okra, field experiments were conducted at the Jamia Hamdard, Delhi during Kharif season (July-Sept) in the year 2018. The experiment was carried out in a randomized complete block design with nine treatments each with three replicates utilizing fertilizers available in the market such as dung compost, *Azospirillum*, P.S.B., VAM, Biochar, *Azotobacter*, *Azospirillum*. The experimental results showed considerable variations among the treatments in respect of morphological characters such as plant height, number of leaf per plant, number of pods per plant, and physiological characters like fresh weight and dry weight. The plants were also tested for biochemical parameters like chlorophyll content, protein content, phenol content, sugar content. The result of biochemical parameters also showed a significant difference, varying in different treatments. We found that maximum yield could be achieved by rational application of combinations of fertilizers.

KEYWORDS: Okra, fertilizers, VAM, bio-fertilizers.**HIGH-THROUGHPUT PHENOTYPING: A NEW FRONTIER APPROACHES FOR CROP BREEDING AND CROP ARCHITECTURE****MANISH KUMAR CHOUDHARY*, GAYATRI KUMAWAT, MUNNESH KUMAR, ASHOK SINGAMSETTI,***Department of Genetics and Plant Breeding, Institute Of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, U.P. India*

Constraints in field phenotyping capability limit our ability to dissect the genetics of quantitative traits, particularly those related to yield and stress tolerance (e.g., yield potential as well as increased drought, heat tolerance, and nutrient efficiency, etc.). precise phenotyping is the new frontiers approaches. The development of effective field-based high-throughput phenotyping platforms (HTPPs) remains a bottleneck for future breeding advances. However, progress in sensors, aeronautics, and high-performance computing are paving the way. Here, we review recent advances in field HTPPs, which should combine at an affordable cost, high capacity for data recording, scoring and processing, and non-invasive remote sensing methods, together with automated environmental data collection. Laboratory analyses of key plant parts may complement direct phenotyping under field conditions. Improvements in user-friendly data management together with a more powerful interpretation of results should increase the use of field HTPPs, therefore increasing the efficiency of crop genetic improvement to meet the needs of future generations.

PRECISION FARMING IN VEGETABLE PRODUCTION**MANISH KUMAR, ADITYARANJAN AND DEEPAK MAURYA***Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural University, Sabour, Bhagalpur, Bihar*

Precision farming is a new concept and very popular as well as fastest growing technology in vegetable production. It is a technique of cultivation which minimizes waste of inputs and resources to maximum higher production and productivity. The system takes into account efficient management of resource through location specific intervention. It promotes in deploying variable management practice within a field according to site conditions. Global positioning system (GPS technology implies accuracy when dynamic in the field, providing navigation and positioning capability anywhere on earth, anytime under any all conditions), Geographic information system (GIS), remote sensing, yield monitoring device, soil, plant and pest sensors, variable rate technologies for application of inputs are enabling in precision production system. Micro-propagation, micro-irrigation, fertigation, mulching, protected cultivation, organic farming, integrated nutrient, water, pest and disease management, use of modified crop varieties, hi-tech post harvest handling etc. form the part of vegetable production in precision farming. If these technologies sensibly implemented, farmers could be benefited in different ways. In the short term, growers can use remote sensing which forecast and give estimation of intensify problems such as water stress, nutrient deficiency and pests/diseases more efficiently. Database building **benefits will be in the form of accurate farm document keeping** for effective management of inputs, property, machinery and labor, and efficient monitoring of environmental quality through recording the amounts and location of input during applying at exact locations that produce maximum profit margins. Precision farming techniques also **increase opportunities for skilled employment** in farming, and provide new tools for evaluating multifunctional character (including non - market functions) or agriculture and land.

NOURISH THE SOIL NOT TO PLANT: A KEY OF SUSTAINABILITY**MANISH YADAV, GOPAL LAL DHAKAR AND JITENDRA CHOUDHARY***(Department of Soil Science And Agricultural Chemistry) SKN Agriculture University, Jobner, Jaipur Rajasthan 303328*

Today's Indian agriculture becomes a chemical oriented and soil health declines day by day with this view need of sustainable agriculture becomes essential. Harmful effects of chemical fertilizers on soil health, environmental quality, biodiversity and self-reliance of farming system are serious concerns. Soil health is continuously decreasing due to use of synthetic chemical fertilizers, to overcome this problem we should go for organic farming. Addition of farm yard manure is very helpful. Agricultural chemicals are replaced by use of organic manures is better way for maintaining soil health by improving soil structure, water holding capacity and nutrient binding to the soil. To sustain Indian agriculture integrated farming system should be followed in long term and waste lands should be brought under cultivation according to their land capability. Continuous degradation of soil suggest us that "Feed to the soil not to Plant". A balance nutrition to the soil is very essential for maintaining the Soil health and quality.

Key words: Soil health, Organic farming, Soil fertility, Sustainable agriculture.

STUDIES ON EFFICACY OF PRE-MIX PENOXSULAM + PENDIMETHALIN ON ECONOMICS OF DIRECT SEEDED RICE**MANISHA URAON¹, G.K. SHRIVASTAVA² AND MADAN JHA***Dept. of Agronomy, IGKV, Raipur (C.G.), Dept. of Agronomy, IGKV, Raipur (C.G.), Dept. of vegetable science, BTC CARS, Bilaspur (C.G.)*

The present investigation entitled "Studies on efficacy of pre-mix penoxsulam + pendimethalin on weed growth, yield and economics of direct seeded rice" was carried out at Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during *kharif* season of 2015. The soil of experimental field was sandy loam in texture (*Inceptisols*), neutral in pH and has 0.44 % organic carbon, low nitrogen, medium phosphorus and high potassium content. Experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments consisted of fourteen different weed management treatments viz, T₁ Penoxsulam + Pendimethalin (10+240 g/l) SE @ 20 + 480 g a.i. ha⁻¹, T₂ Penoxsulam + Pendimethalin (10+240 g/l) SE @ 22.5 + 540 g a.i. ha⁻¹, T₃ Penoxsulam + Pendimethalin (10+240 g/l) SE @ 25 + 600 g a.i. ha⁻¹, T₄ Penoxsulam + Treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha⁻¹ (T₅) fetched the maximum net return (Rs 46914.13 ha⁻¹) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha⁻¹ (T₆) (Rs 45753.13 ha⁻¹) and Penoxsulam 24% SC @ 25 g a.i. ha⁻¹ (T₇) (Rs 43905.13 ha⁻¹). While, the highest B:C ratio (2.05) was noted under the application of Penoxsulam 24% SC @ 25 g a.i. ha⁻¹ (T₇) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha⁻¹ (T₅) (2.00) and Hand weeding at 20 & 35 DAS (T₈) (1.57). (10+240 g/l) SE @ 50 + 1200 g a.i. ha⁻¹, T₉ Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha⁻¹, T₁₀ Penoxsulam 24% SC 20 g a.i. ha⁻¹, T₁₁ Penoxsulam 24% SC @ 22.5 g a.i. ha⁻¹, T₁₂ Penoxsulam 24% SC @ 25 g a.i. ha⁻¹, T₁₃ Pendimethalin 30% EC @ 540 g a.i. ha⁻¹, T₁₄ Pendimethalin 30% EC @ 600 g a.i. ha⁻¹, T₁₅ Pendimethalin 30% EC @ 1000 g a.i. ha⁻¹, T₁₆ Pendimethalin 30% EC @ 1500 g a.i. ha⁻¹, T₁₇ hand weeding at 20 and 35 DAS and T₁₈ untreated check. Rice The rice variety MTU-1010 was tested under different combinations of herbicide and maintaining the recommended nutrient (N:P:K) doses of 100:50:30 kg ha⁻¹. Rice seed was direct seeded on June 27th, 2015 with a spacing of 20 x 10 cm and harvesting was done on October 29th, 2015. Treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha⁻¹ (T₅) fetched the maximum net return (Rs 46914.13 ha⁻¹) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha⁻¹ (T₆) (Rs 45753.13 ha⁻¹) and Penoxsulam 24% SC @ 25 g a.i. ha⁻¹ (T₇) (Rs 43905.13 ha⁻¹). While, the highest B:C ratio (2.05) was noted under the application of Penoxsulam 24% SC @ 25 g a.i. ha⁻¹ (T₇) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha⁻¹ (T₅) (2.00) and Hand weeding at 20 & 35 DAS (T₈) (1.57).

EFFECT OF DIFFERENT SHADE NET STRUCTURES ON REFERENCE CROP EVAPOTRANSPIRATION**MANISHA JAGADALE¹, MAHESH JADHAV¹, NANDINI THAKUR², SHAILENDRA GADGE³***ICAR-Central Institute of Agricultural Engineering, Bhopal, 462038., ²SRF, ICAR-Central Institute of Agricultural Engineering, Bhopal, 462038. Department of IDE, ASCAE, MPKV, Rahuri.*

Shade net structures provide favorable environment for the crop growth there by for achieving greater yield and high quality produce. Accurate irrigation scheduling in protected cultivation structures is one of the important factors in achieving higher yields and avoiding loss of quality. Stevenson's screens were installed to monitor the different climatological parameters *i.e.* maximum and minimum temperature, relative humidity, vapor pressure in shade net houses as well as open field. An investigation was carried out to evaluate the effect of red and green (35, 50 and 75% shade) shade net houses as well as open field cultivation condition (control) on reference crop

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evapotranspiration (ET_r) during kharif, rabi and summer season using *Hargreaves-Samani* method. Study showed that the ET_r at different structures was reduced by about 11.47, 15.84, 22.61 and 24.31% in red and green with 35, 50 and 75% shades, respectively in comparison to control. The ET_r values during the study period were varied from 5.41 to 7.3 mm for red, 4.69 to 7.30 mm for green (35%), 4.20 to 6.85 mm for green (50%) shade and 4.11 to 7.05 mm for green (75%) shade net house, while the same was 6.03 to 7.67mm for the control plot.

DISPERSAL AND ETHNOBOTANY OF WEEDS IN HARYANA**MANISHA¹ AND RAJBIR SINGH KHEDWAL²**

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Ethnobotany is studying the beneficial aspects of weeds or wild plants towards utilization in a number of ways for humans and society as whole. Haryana which is situated in north India, have immense richness in biodiversity and ethnobotanical uses of noxious, objectionable and other weed flora. Rice, cotton, bajra, cluster bean, wheat and mustard are main crops in Haryana. Dominant weed flora of kharif crops are *Echinochloa* spp., *Digitaria sanguinalis*, *Commelina benghalensis*, *Dactyloctenium aegyptium*, *Celosia argentea*, *Cyperus rotundus* and *C. iria* etc. Dominated weed flora in rabi crops are *Phalaris minor*, *Chenopodium* spp., *Euphorbia hirta*, *Rumex dentatus*, *Coronopus didymus*, *Orobancha aegyptiaca* etc. *Argemone mexicana*, *Parthenium hysterophorus*, *Calotropis procera* are mainly found in uncultivated land and on roadside.

Traditional uses of these weeds cure many diseases and give vital importance in routine life. *Amaranthus viridis* is a good source of iron and used as vegetable. *Anagallis arvensis* treat leprosy and; hydrophobia and use as cattle feed to expel out leeches. Flower and latex decoction of *Argemone mexicana* can treat jaundice and skin problems. *Calotropis procera* cure leucoderma. Roots of *Chenopodium album* are used for liver infection and jaundice. Weeds like *Rumex dentatus* and *P. minor* used as a fodder for cattle. Mixture of fruits and roots of *Tribulus terrestris* with boiled rice is remedy for urinary troubles. Roots decoction of *T. portulacastrum* treat asthma and may be practiced as an antidote to alcohol poisoning. *P. hysterophorus* cure dysentery and skin disorders. Dry tuberous roots of *C. rotundus* are aromatic and; used in perfumes and incense. *Cynodon dactylon* is a good soil binder. Plant extract of *Coronopus didymus* is used for bone disorders. *Cirsium arvense* is a noxious weed of wheat and cure worms in children. It may be concluded from the above mentioned study that Haryana have valuable wealth of flowering plant as well as a rich traditional and folk knowledge of ethnobotanical uses of weeds. Marginal farmers may draw away an additional source of income from this folk knowledge.

Key words: Ethnobotany, Haryana, medicinal use, weed dispersal

VEGETABLE CROPS FOR FOOD AND NUTRITIONAL SECURITY**MANJEET KUMAR,¹ C.N. RAMSHARVAN KUMAR,¹ AND KRISHAN KUMAR²**

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Last decade of the twenty century was a witness to series of enormous reformation and changes in all aspects of life including social and economic upheavals necessarily. Have ramification for present and future generations. Food and nutritional status is a measure of health condition of an individual as affected primarily by intake of food and nutrition security. Health is not only the absence of disease but is state of complete mental and physical well-being in relation to the productivity and performance of an individual. Good nutritional status can only realized and sustained when individuals with in families and communities are food secure. Food security has been defined as access by all people at all times to the food needed for a healthy life. Nutrition plays a critical role in human resource development since deficiencies, in essential nutrients lead to malnutrition, which affects an individual mental and physical state, ensuring in poor health and poor work performance. In addition, a hungry, malnourished child may have mild to serious learning disabilities, resulting in poor school performance; a sick, poor nourished individual will not respond well. Losses and waste occur throughout the food system from primary production of agricultural commodities and fish catch to food intake. These losses and waste may be caused by the practice and behavior of farmers, consumers, trader, processors and others in the food systems or by existing socio-economic losses to societies and individual agents in the food system. Quality food is incomplete in the absence of vegetable from the diet and availability of good quality food is also depends on the proper functioning of ideal agro techniques, proper management of the agro produce and marketing channels which highly responsible for sufficiency in food security. Vegetable including tuber crops plays pivotal role in fulfilling the one of the said objective of national food security mission because they are the better source of minerals, vitamins and carbohydrate as a source of energy.

EVALUATION OF SELECTED BOTANICALS FOR THEIR EFFICACY AGAINST MAYDIS LEAF BLIGHT OF MAIZE UNDER FIELD CONDITIONS**MANJEET SINGH AND RAKESH MEHRA***Department of Plant Pathology, CCS Haryana Agricultural University, Hisar-125004*

Maize (*Zea mays* L.) is the third most important food grain in India next to wheat and rice and is popularly known as queen of cereals. About 65 pathogens infect maize and out of these, maydis leaf blight (MLB) caused by *Bipolaris maydis* (Nisikado and Miyake) Shoemaker is considered as one of the most serious diseases. The disease is widely distributed in India during *kharif* season. Maydis leaf blight appears every year with incidence ranging from 20-85 per cent in Haryana. The disease has the potential to reduce the grain yield up to 41 per cent in susceptible cultivars. Keeping in view of environmental pollution and ecological imbalance caused by the use of chemical fungicides, an effort has been made in the present experiment to control the maydis leaf blight by using **botanicals**. Twelve **botanicals** (Garlic clove, neem leaves, onion bulb, eucalyptus leaves, aonla leaves, aak leaves, tulsi leaves, turmeric rhizomes, congress grass, Acacia leaves, jamun leaves and datura leaves) were **evaluated** at 20 per cent concentration against maydis leaf blight under field conditions during *kharif* 2015. All the **botanicals** were sprayed at initiation of the disease followed by second spray at 15 days interval. In the present study, all the botanicals showed significant reduction in per cent disease intensity of maydis leaf blight in comparison to control. Among the various **botanical extracts** tested, Garlic clove was found to be most effective as it showed minimum per cent disease intensity, maximum disease control and maximum grain yield followed by neem leaves. The other **botanicals** in descending order of efficacy were turmeric rhizomes, tulsi, onion, aak, datura, eucalyptus, aonla, congress grass, jamun, *whereas* acacia was least effective **and** which gave maximum per cent disease intensity, minimum disease control and minimum grain yield as compared to control. These findings will be helpful in developing integrated disease management strategies for the control of maydis leaf blight of maize.

INNOVATIVE APPROACHES AND CHALLENGES FOR DOUBLING FARMERS INCOME BY 2022**MANJU LOURA* AND POOJA PANWAR** AND SUMAN GHALAWAT******Deptt. of Business Management, CCS Haryana Agricultural University, Hisar, Haryana., Deptt. of Business Management, CCS Haryana Agricultural University, Hisar, Haryana., Deptt. of Business Management, CCS Haryana Agricultural University, Hisar, Haryana*

Agriculture, with its related sectors, is indisputably the largest livelihood provider in India, more so in the massive rural areas. All the nations facing problems of poverty, hunger and malnutrition will need to accelerate their agricultural growth for achieving sustainable development goals. The present paper focusses on need, challenges, and innovative approaches for doubling farmers' income. To ensure that the mission of doubling farmers' income moves in the right direction and is accomplished within the stipulated period, it is important that accurate information on key indicators of agricultural performance is generated and made available to policymakers and other stakeholders for their effective monitoring and corrective action. The major challenges for doubling farmers' income are climate change, Cost saving, post-harvest losses and less developed infrastructure. The Government of India has taken appropriate measures to increase farm income, stabilize production and, consequently, improve small farm productivity. Innovative approaches include: Quality seeds and optimum use of fertiliser are important pillars of growth in productivity, need of increasing power supply to agriculture sector. Attention should be paid to good policy framework for farmers to provide them better support. The target of doubling farmers' income by 2022, though apparently not easy yet a very laudable goal, augurs well of Government's intention to help farmers. It is also clear that if concerted efforts, as per suggested action plan, are made in a Mission Mode, chances of making agriculture an engine of national economic growth and for smallholder farmers a respectable profession are indeed much brighter. . It is also a fact that India will remain predominantly an agricultural country during most of the 21st century.

Keywords: sustainable development, innovative approaches, post-harvest losses and predominantly**CHALLENGES AND FUTURE PERSPECTIVES OF PLANT BIOTECHNOLOGY****MANJU* ANITA** OMPRAKASH*****Department of Biotechnology* Department of Horticulture**, College of Agriculture-Bikaner, SKRAU-334006*

Advances in understanding plant biology, novel genetic resources, genome modification, and omics technologies generate new solutions for food security and novel biomaterials production under changing environmental conditions. New gene and germplasm candidates that are anticipated to lead to improved crop yields and other plant traits under stress have to pass long development phases based on trial and error using large-scale field evaluation. Therefore quantitative, objective, and automated screening methods combined with decision-making algorithms are likely to have many advantages, enabling rapid screening of the most promising crop lines at an early stage followed by final mandatory field experiments. The combination of novel molecular tools, screening technologies, and economic evaluation should become the main goal of the plant biotechnological revolution in agriculture.

Keywords- Crop biotechnology, Abiotic and Biotic stress tolerance, Transgenic plants, Food security, Bio-materials, Molecular breeding etc.

IMPACT OF POLLUTED HINDON RIVER WATER IRRIGATION ON SOIL HEALTH AND ASSESSING RISK IN RELATION TO TRANSFER OF METALS TO HUMAN FOOD CHAIN

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The present study was carried out with the objective of assessing the impact of polluted river water irrigation on soil health and assessing risk in relation to transfer of metals to human food chain. In all, 45 paired soil and plant samples (Mustard, Rice, Pumpkin, Cucumber, Spinach, Turmeric, Brinjal, Marigold, Pearl millet, Mung bean, Carrot and Pigeon pea) were collected from river irrigated soils covering Makreda, Rewari, Nithari, Kinauni, Barnawa, Parsi villages of Western U.P. As per the geo-accumulation indices (I_{geo}), PI, IPI and PLI, all the river water irrigated soils were loaded with high level of metals (Zn, Cu, Ni, Pb and Cd) and required immediate intervention to ameliorate metal contamination. Among the river water irrigated soils, least value of soil quality index (SQI) was recorded in Nithari and Barnawa (PCA-SQI = 0.28). Based on PCA-SQI, the extent of soil health deterioration due to metal contamination follows the order: Nithari (0.28) = Barnawa (0.28) > Makreda (0.30) > Rewari (0.38) > Parsi (0.39) > Kinauni (0.44). All the plants grown on river water irrigated soils accumulated much higher amount of Zn, Cu, Ni, Pb and Cd compared to plants grown on tubewell-irrigated soils. Taking all the crops together, relative orders of transfer of metals from soil to plants grown on river water irrigated soils were Zn > Cu > Ni > Cd > Pb. The values of hazard quotient (HQ) for intake of trace toxic elements by humans through consumption of rice grain, vegetables (spinach, carrot, cucumber, pumpkin) and mustard grown on river water irrigated soils were well within the safe limit.

“PRECISION FARMING FOR SUSTAINABLE CROPPRODUCTION”

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Precision farming is site specific farming, smart farming and GPS based farming. Application of principles and technologies to manage spatial and temporal variability associated with all aspects of agricultural production for the purpose of improving crop performance and environmental quality. It includes precision farming gadgets such as chlorophyll meter (SPAD), Green Seeker, laser land leveler etc. With the help of GIS, GPS, RS, yield monitors, variable rate of application of agricultural inputs can be done precisely resulting in the reduction of over dose of inputs, reducing environmental pollution. With the help of site specific nutrient management (SSNM), soil test crop response (STCR), etc. the yield of the crops can be significantly increased in comparison with farmer's conventional practices. Nitrogen fertilizer wastage in cereals can be minimized and yield can be enhanced when N is applied based on the Green Seeker based NDVI values and when it is applied in split doses. With the help of satellite images, one can predict the yield of crops. Leaf area index, biomass and yields, etc. of different crops can be estimated using satellite images. Laser land leveler is one of the successful precision farming instruments in India. Leveled land increases the yield of crops by ensuring equal distribution of all inputs and amount of water requirement also gets reduced significantly resulting in the higher water use efficiency. We can draw the conclusion as, with added advantage of PF it has to be promoted in order to reap its fullest potential. Due to PF technology being sophisticated and high cost, its feasibility under Indian condition seems to be virtual reality but time being, it can be included in agriculture research. Affordable PF gadgets has to be developed for Indian farmers.

Keywords- Precision farming, environment, variable rate, satellite, water use efficiency

EFFECT OF MINERAL MIXTURE TO ENHANCE MILK PRODUCTION AND RETARDED STERILITY

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U. P. is the largest contributor to the national milk production contributing around 18 % of total milk production in the country. It has got the second highest cattle number and highest number of buffalo in the country. Bulandshahr district is known as “Milk Belt” of Uttar Pradesh. The production of district milk has increased to 233.00 lakh ton in 2013 as against 189.00 lakh ton in 2007-2008. A survey was conducted in Bulandshahr district of western U.P. during 2014 - 2016 to find out the constraints faced by dairy farmer in adoption of improved milch animal husbandry practices. Total 120 animal keepers, Blocks namely Bulandshahr, Gulaothi, Lakhaoti and Sikandrabad were selected through random sampling technique. All animals selected were of same age group of 5 to 6 years. 50-60 gram of mineral mixture per day was given to each cow for 120 days. Among different health parameters relating to milk fever problem of animals in village Ginora Sheak, the effect of mineral mixture was of high significance (83% decrease) and milk increased at the lower rate (5%) per animal in village Jainpur. From the study it can be concluded that mineral deficiency is one of the major cause behind the different

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problems faced by cows with respect to health and physical parameters followed by decreased milk production, fertility and repeated breeding. In the study it was found the all the assessed parameters concluded significant results. Thus mineral mixture was found to be very effective in improving different health aspects of cow.

Key words: Mineral mixture, milch animal, infertility, milk production

INTEGRATED NUTRIENT MANAGEMENT ON FRUIT PRODUCTION

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Integrated nutrient management helps in the improvement of fruit quality and reduces environmental pollution. It brightens the prospects of export of fruit. INM in fruit crop is not new to our country. For almost the last fifty years fruit cultivation is mainly concentrated on increasing production, productivity and area of fruit crop. Plant nutrient can be supplied from different sources viz. Organic manures, crop residues, Bio-fertilizer and chemical fertilizers. For better utilization of resources and to produce fruit crops with less expenditure integrated nutrient management is best approach. Continuous use of synthetic fertilizer causes ill effect on soil, fruit crop as well as human health the area where chemical fertilizer is used lacking in organic matter, Change in soil structure and chemical fertilizer pollute air and water as well as Chemical fertilizer leave residue in fruits. The major objectives of INM to reduce the cost of production, produce fruit with nutritional quality and to minimize physiological disorder which is suffering from micronutrient deficiencies. Component of INM Organic Manure, Vermicompost, Green manure, Fertilizer, Bio-fertilizer, Nano-fertilizer. Sufficient and balanced application of organic and inorganic fertilizers is a major aspect of INM. INM is the only option for sustainability of soil health improvement in quality of fruits, reduced environmental hazards, increase farm income and also for rural employment generation and ultimately maintains the health of human.

INTEGRATED PEST MANAGEMENT IN HORTICULTURAL CROPS

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Integrated pest management (IPM) is a coordinated system of controlling pests. IPM uses information about the biology of the pest to optimise control measures. IPM focuses on cultural and biological control methods as the first line of defence. This means that the need for chemical pesticides is reduced. Different control and management practices are utilised in IPM with the objective of achieving long term results - Such as (i) Identification of threshold pest level at which action needs to be taken (ii) Monitoring and identification of pests (iii) Prevention the use of management practices to reduce the likelihood of pests (iv) Control once the pest has been correctly identified, monitoring has shown it has reached a threshold level, and preventative measures are no longer appropriate, control measures will be used. Measures with the lowest associated risk are used first. Threshold pest levels are based on a combination of the likelihood of damage; the costs / consequences of damage; and the costs / consequences of control measures. Sometimes a low level infestation by a pest likely to cause minor damage with no significant loss to either crop quality or quantity close to the time of harvest might not warrant any further action. At a different stage in the production cycle, for example when the crop is further away from being harvested, the same infestation might require action. Consideration also has to be given to nearby and following crops is either the pest, or the remedial action going to have a consequence for the following crop. Monitoring of pests is done by regular crop walking and inspection, sticky traps are often used to monitor flying insects. The correct identification of pests is crucial and is not always easy. Cultural control measures include things like crop rotations to prevent the build up or carry over of problems; removal of infected / damaged plants; companion planting to either deter pests or as sacrificial crops to attract pests away from the commercial crop. Biological control measures include the use of: predatory mites which feed on the pest but do not damage the crop e.g. the use of *Phytoseiulus persimilis* to control red spider mite; IPM aims to ensure the most efficient use of control methods to: minimise crop damage and losses; costs of control measures; and negative environmental impacts. IPM makes good business sense. IPM is not the routine use of chemical control measures that is seen in many commercial crop production protocols.

Keywords: Integrated pest management, Horticultural Crops

EFFECT OF MICRONUTRIENTS AND PLANT GROWTH REGULATORS ON YIELD AND QUALITY OF LITCHI (LITCHI CHINESSONN.) CV. PURBI

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The present investigation was carried out at Horticulture Garden, Bihar Agricultural College, Sabour to assess the effect of micronutrients and plant growth regulators on yield and quality of litchi cv. Purbi. Foliar spray of ZnSO₄ (0.4 and 0.8 per cent) and borax (0.2 and 0.4 per cent) was done on litchi trees before emergence of panicles, while GA₃ (10 and 20 PPM) were sprayed after completion of fruit set. The experiment was laid out in Randomized Block Design (Factorial) and replicated thrice. Maximum fruit set (42.50 per cent),

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length of fruit (3.72cm), diameter of fruit (2.90 cm), average weight of individual fruit (20.91), number of fruit per tree (5422) and fruit yield per tree (123.10kg) was obtained with the application of borax (0.4 per cent) while interaction between borax (0.4 per cent) and GA, (20 ppm) resulted in the highest fruit retraction retention of 24.64 per cent, borax (0.2 and 0.4 per cent) also produced maximum aril percentage of 71.55 and 70.38, respectively. Various treatments of micronutrients and plant growth regulators had no marked effect on TSS content of litchi fruits. However, GA (20 ppm) and ZnSO_4 (0.4 per cent) were found most effective treatment to increase the content of reducing sugar and total sugar being the highest of 11.13 per cent and 15.90 per cent respectively. The ascorbic acid content of pulp was maximum 52 mg with ZnSO_4 (0.4 per cent) were found most effective treatment to increase the content of reducing sugar and total sugar being the highest of 11.13 per cent and 15.90 per cent, respectively. The ascorbic acid content of the pulp was maximum 52mg with ZnSO_4 (0.4 per cent) and 51.55mg with 2.4 D (10 ppm).

Thus borax (0.4 per cent) was provided to be the most efficacious treatment for increasing fruit yield of litchi while ZnSO_4 (0.4 per cent), GA, (20ppm) 2, 4 D (10 ppm) may be used as a tool for quality improvement of litchi fruit.

EFFECT OF NITROGEN ON SPINACH LEAF PRODUCTION**DR MANOJ KUMAR SINGH***Department of Horticulture, kulbhaskar Ashram Post Graduate College, Allahabad.*

Experiment was carried out at the Department of Horticulture, kulbhaskar kulbhaskar Ashram Post Graduate College, Allahabad during 2015-16. On spinach cultivar Pusa Harit. Nitrogen was applied in the form of Urea . Three levels that is one percent, 1.5 per cent, 2 % of Urea and three stages that is 10, 20 , 30 days after sowing were tried to increase biomass of spinach. Higher level of Urea at all the three stages increase the maximum leaf lamina but chlorophyll was observed disintegrated and instead of dark green , the leaf become pale green colour which is uneconomical for marketing purposes. 1.5 percent urea at all the three stages proved best with higher biomass and intense green colour. One percent urea at all three stages could not result as better as 1.5% urea at all the three stages. Control was worst in terms of yield and quality both .

EFFECT OF CORN FLOUR AS LOW COST GELLING AGENT FOR MICROPROPAGATION OF STRAWBERRY (FRAGARIA × ANANASSA DUCH.)**MANOJ KUMAR* MANOJ KUMAR*****Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P)*

Strawberry (*Fragaria × ananassa* Duch.) is a natural hybrid of *Fragaria chiloensis* and *Fragaria virginiana* which belongs to the family *Rosaceae*. The berry is delicate in flavour and rich source of vitamins particularly vitamin-C, vitamin-B1, vitamin-B2 and minerals such as calcium, potassium, copper, iron. It is a rich source of natural antioxidant which is used of hour to scavenge the free radicals as oxidants flowing in our blood to cause injurious effect to one or other organ of the body. Totipotency is a capability indicating that plant cells, in different times, may express the potential to form a new multi cellular individual. Micro-propagation technique is being exploited for many fruit crops. Corn flour, a processed (gelatinized) edible starch obtained from a plant called maize (*Zea mays*) was successfully used as a gelling agent in culture medium. Corn flour provided a firm gelling surface through out the entire culture period, and fostered optimum plantlet growth in terms of shoot height and number of leaves. The present study was undertaken in the Tissue Culture Laboratory, Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P) concentrations of corn flour as gelling agent viz; 10, 20 & 30 gm/litre. The efficacy of corn flour-gelled (30 gm) medium was studied in strawberry variety Chandler during micropropagation and minimal growth conservation. The study showed that corn starch could be used as a substitute to agar in culture medium to substantially reduce the medium cost.

EFFECT OF INTERGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF ONION (ALLIUM CEPA) CV. AFLR**MANOJ PANDEY, YOGESH SINGH AND OMPAL SINGH***Department of Agricultural Chemistry and Soil Science, Raja Balwant Singh College, Bichpuri, Agra (U.P.) 283105*

Onion (*Allium cepa* L.) belongs to the family alliaceae is one of the most important commercial vegetable crops grown in India. Increasing productivity of onion with high quality is an important target by the onion growers. Onion has culinary, dietary and medicinal importance in daily life of Indian people and due to its export trade, it is also a major vegetable crop to gain foreign currency. In recent years it has been realized that judicious application of nutrients including chemical fertilizers, organic manures along with bio fertilizers (INM) are essential for quality yield and production of the crop which also overcome the problems of ecological imbalance and high cost of production. Keeping, these facts in mind the present experiment was carried out at the research farm of Raja Balwant Singh College, Bichpuri, Agra during 2016 - 17 under- semi arid and tropical climate with hot dry summer and hardy cold winter having sandy loam, slightly alkaline soil (7.85 pH). The experiment was laid out in randomized block design (R B D) having eight treatment combinations

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i.e. T₁, recommended dose of fertilizer (R D F) 100 : 50 : 50 kg N P K per hectare, T₂-100% R D F + Azotobacter, T₃- 100% R D F + F Y M, T₄-100 % R D F + Azotobacter + F Y M, T₅- 80% R D F + Azotobacter + F Y M, T₆- 80% R D F + F Y M, T₇- 80% R D F + Azotobacter and T₈- control which was replicated thrice. The 45 days old seedlings of onion variety Agri found light red (A F L R) were transplanted at the distance of 15 x 10 cm (row x plant). On the basis of the data recorded during experimentation it was found that the vegetative growth, yield and quality of onion were significantly improved by application of different treatment combinations as compare to control. The maximum plant height (50.14 cm), no. of green leaves (6.25), fresh weight of bulb (84.32 g), bulb yield (339.58 q / ha) as well as bulb diameter (6.90 cm) were recorded with application of 100% R D F + Azotobacter + F Y M (T₄) followed by T₃ (100% R D F + F Y M) and T₅ (80% R D F + Azotobacter + F Y M). Whereas, the minimum values of above observations were found under control (T₈). The maximum net return and cost benefit ratio (1 : 2.24) was also calculated with T₄ treatment combination. Hence, it is concluded that combined use of 100% RDF + FYM + Azotobacter was the most appropriate nutrient management for higher productivity and profitability of onion under Agra region.

GROWTH AND PHOTOSYNTHETIC PIGMENTS OF BROCCOLI AS INFLUENCED BY FOLIAR APPLICATION OF MELATONIN

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Investigation was carried out at the division of Basic Sciences and Humanities during 2017 to investigate the effect of foliar application of melatonin on plant growth and photosynthetic pigments in broccoli. Thirty days old and uniform seedlings of broccoli cv. Palam Samridhi were transplanted in the field at a spacing of 45 × 45cm. Different concentrations of melatonin, viz 0, 20, 40, 60 and 80ppm were sprayed on the plant foliage at 15 days after transplanting (DAT) replicating each treatment four times. Growth and growth analysis parameters in terms of plant height, plant dry weight, NAR, AGR, RGR, CGR and LAI were recorded at specified time intervals. Treatments were also evaluated for photosynthetic pigments viz. leaf chlorophyll and carotenoid contents. Results indicated that foliar application of different concentrations of melatonin significantly improved the growth and photosynthetic attributes wherein Mel 60ppm resulted in highest plant height (25.0 and 36.5cm), plant dry weight (24.7 and 42.5g/plant) and leaf carotenoid (0.025 and 0.028mg/g) at 30 and 60DAT. However, leaf chlorophyll content was maximum (0.69 and 1.43mg/g) with Mel 80ppm at respective days. Mel 60ppm again recorded better LAI (2.6), NAR (0.10g/cm²/day), AGR (0.47g/day) and CGR (3.84g/m²/day) compared to other levels. Present study concluded that foliar application of melatonin in broccoli played significant role in improving the plant growth, photosynthetic pigment contents and photosynthesis measured in terms of net assimilation rate. Among various concentrations Mel 60ppm proved as the best concentration for improving growth and photosynthetic pigments in broccoli cv. Palam Samridhi and increased melatonin level above 60ppm in broccoli may not be fruitful.

RESPONSE OF BIO-FERTILIZERS ON THE PERFORMANCE OF SUGAR BEET (BETA VULGARIS L.) CV. DETROIT DARK RED.

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The Sugar beet (*Beta vulgaris*) belongs to the family *Chenopodeaceae* which is a herbaceous biennial and winter vegetable crop. It is native to central and southern Europe and has now spread all over the world. It is a newly introduced modified root crop in our country. Sugar beet has considerable nutritive value compared to other cole crops that we commonly use in our daily diet. The fleshy root and young leaves are the main edible portion. Keeping these importance's the present study was under taken at the Department of Horticulture Raja Balwant Singh College, Bichpuri, Agra during 2017-2018.

The experimental variety D.D.R. was sowing at the distance of 40 X 10 cm. The trails have 8 treatment combinations viz. T1(Control No organic No fertilizer), T2(Full dose of RDF), T3(50%RDF+FYM), T4(50%RDF+ FYM+Azotobacter), T5(60%RDF+FYM), T6(60%RDF+FYM+Azotobacter), T7(80%RDF+FYM) and T8(80%RDF+FYM+Azotobacter). The experiment was conducted under Randomized Block Design which was replicated three times.

On the basis of data recorded during experimentation it was found that significant effect among treatment and maximum inhance in plant height (17.66 cm), total no. of leaf per plant (13.22), the number of fully opened leaves per plant (9.89), length of the largest leaves (22.67cm), width of the largest leaf (9.9cm) and fresh weight of leaf per plant (9.86) at harvest. Besides, the fresh weight of root (356.66gm), length of the whole root (10.04cm), diameter of storage root the shoulder point (7.38cm) and total root yield 364.27 Q/ha. Were recorded under T8 (80%RDF+FYM+Azotobacter) followed by T6 (60%RDF+FYM+Azotobacter).

LAND SUITABILITY ANALYSIS FOR AGRICULTURAL CROPS**MARIYA*, QURAT SHEIKH, ASIF YOUSUF WANI, RAHEEBA-TUN-NISA, MAKHDOOMI FARAH***¹Division of Soil Science and Agricultural Chemistry, FOA, Wadura, SKUAST-K*

Soil is a very important natural resource that supports various life systems therefore, it needs to be harnessed keeping in view its potential. Soil provides nutrients and also acts as a store of water for plant growth. Crop productivity highly depends upon the soil conditions. There are many soil health indicators that measure various physical, chemical and biological attributes which relate to functional soil processes. Hence an evaluation needs to be carried out to assess the performance of land for specific use. Land has now become one of the limited resources as the productivity of soils has decreased worldwide. The challenge is thus being faced not only of increasing productivity on sustainable basis, but also of preserving and maintaining of soil resource bases for prosperity. The ability of land to produce is limited and also affected by various factors. Despite the significant growth in production, the sustainability of some cropping systems has been showing signs of fatigue. Therefore, different measures have to be adopted and executed according to the capability of a particular soil. The resources need to be managed and used in such a way that without diminishing their potential for future use they meet the needs. Comprehensive account of our land resource ascertaining its potential and problems towards optimising land use on sustainable basis is necessary. In recent past, concept of land based holistic development has emerged as one of the potential approaches which can lead to a higher productivity and sustainability in agricultural production. Soils need to be interpreted in terms of their suitability for alternative land use especially in respect of their land capability and suitability for crop growth. The research focuses on addressing uncertainty in the process of land suitability analysis for agricultural crops using remote sensing and GIS techniques.

Keywords: suitability, capability, sustainability, land, productivity

PERFUSION OF ZNO NANOPARTICLES FOR THE MANAGEMENT OF PHOMOPSIS VEXANS AND RALSTONIA SOLANACEARUM ON SOLANUM MELONGENA**MASUDULLAKHAN, M. R. KHAN, L. AHMAD AND Z. A. SIDDIQUI***Section of Plant Pathology and Nematology, Department of Botany, Aligarh Muslim University, Aligarh-202002*

Effect of zinc oxide nanoparticle (ZnO NPs) was observed on *Phomopsis vexans*, *Ralstonia solanacearum* and on the growth of brinjal in pot experiment. Perfusion of plants with 10 ml solution of ZnO NPs with 250, 500 and 1000 ppm concentration caused a significant increase in chlorophyll, carotenoid and plant dry weight over control. Inoculation of plants with *P. vexans* and *R. solanacearum* caused a significant reduction in plant growth and dry weight over uninoculated control. Perfusion of plants with 250, 500 and 1000 ppm ZnO NPs and subsequent inoculation with *P. vexans* and *R. solanacearum* caused a significant increase in plant growth and dry weight over plants inoculated without perfusion of ZnO nanoparticles. Treatment of 1000 ppm ZnO NPs caused a greater increase in plant dry weight of *P. vexans* and *R. solanacearum* inoculated plants followed by 500 ppm and 250 ppm. Blight indices and wilt indices were reduced to 4, 3 and 2, respectively, when plants with *P. vexans* and *R. solanacearum* were treated with 250, 500 and 1000 ppm ZnO NPs. This study shows that the use of ZnO nanoparticles is useful for the management of *P. vexans* and *R. solanacearum* on brinjal.

Key words: *Phomopsis vexans*, *Ralstonia solanacearum*, ZnO nanoparticles, *Solanum melongena*.

MOLECULAR AND PHENOTYPIC ANALYSIS FOR YELLOW RUST IN WHEAT VARIETIES**MEDHAVI VASHISTH***Department of Molecular Biology, Biotechnology and Bioinformatics, CCS Haryana Agricultural University, Hisar (Haryana)-125004, INDIA*

Stripe rust is one of the most destructive diseases of wheat. Breeding for resistance is the most economical and environmentally acceptable means to control stripe rust. The present investigation "Phenotyping and microsatellite marker analysis for yellow rust in WH711 × WH542 F₂ population of wheat (*Triticum aestivum* L. em. Thell)" was carried out to evaluate F₂ population derived from WH711 and WH542 varieties of wheat for traits contributing to yield and to identify presence of markers linked to yellow rust. WH542 (resistant to yellow rust) × WH711 (susceptible to yellow rust) derived F₂ population when screened against yellow rust reaction, showed a ratio of 9:3:3:31 suggesting the additive gene effect controlling the respective trait. Correlation analysis revealed that biological yield (0.891) had the highest direct contribution towards grain yield per plant followed by number of tillers per plant (0.816). Out of 50 SSR markers used, 39 showed amplification, of which 17 SSRs were polymorphic while 22 were monomorphic. Microsatellite marker data was generated using 17 polymorphic SSR markers (including 3 Yr specific markers). However, none of the SSR markers used in the present study showed any association with yellow rust resistance. This indicated that resistance in WH542 may be either due to different genes or different mechanisms or new combinations of these which require further investigation.

PERFORMANCE OF WHEAT UNDER VARIOUS COMBINATIONS OF PHOSPHORUS APPLICATION IN RICE-WHEAT CROPPING SYSTEM IN GOBRAILA, KAILALI, NEPAL**MEENA KUMARI POUDEL, AGRICULTURE AND FORESTRY UNIVERSITY, RAMPUR, CHITWAN, NEPAL 2018**

A field experiment was conducted at Gobraila, Kailali during winter season of 2017/18 to study the performance of wheat under various combinations of phosphorus application in rice-wheat cropping system. The experiment was done in Randomized complete block design having four replications and five treatments. The experiment consisted of various combinations of phosphorus application (kg ha^{-1}) in rice followed by wheat as P_{50-0} , P_{0-50} , P_{50-50} , P_{25-25} and P_{0-0} with recommended dose of nitrogen and potassium fertilizer application. Vijay variety of wheat was used in the study. Phosphorus application in both rice and wheat either full dose or half dose significantly increased plant height, NDVI and number of grains per spike of wheat over control and also caused the early heading of wheat. However, grain yield of wheat was not significantly influenced by various combinations of phosphorus application in R-W cropping system. Indeed, yield advantage of 17.10 percent and 16.45 percent in wheat grain was recorded from 50 kg P ha^{-1} and 25 kg P ha^{-1} application in both rice and wheat over control plot. Similarly, from the comparative economic analysis done between half dose and full dose of phosphorus application, yield obtained from 25 kg P ha^{-1} application in both rice and wheat was found to be economic optimum dose. Hence, half dose of phosphorus application in both rice and wheat exhibited better performance of wheat in Gobraila, Kailali under R-W cropping system.

Keywords: Phosphorus, R-W cropping system, Grain yield, Yield attributes

INTEGRATED NUTRIENT MANAGEMENT IN RICE: A STEP TOWARDS SUSTAINABILITY**MEENAKSHI RATHI¹ AND ANNIE KHANNA²**

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Rice is the most important human food crop, directly feeding more than half of the population of world. Global rice production more than tripled between 1961 and 2010, with a compound growth rate of 2.24% per year due to introduction of dwarf varieties which are more responsive towards fertilizer dose. States like Punjab and Haryana use a very high amount of synthetic fertilizers in rice-wheat rotation, as both of these crops are high nutrient consumers and leave soil exhausted. In such condition Integrated Nutrient Management can be best option. INM refers to the maintenance of soil fertility and plant nutrient supply at an optimum level through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. Bajpai *et al.* (2006) found that grain yield of rice was highest, when 50% of nitrogen was supplied through green manuring (GM) whereas when 50% of N was supplied through farmyard manure (FYM), the yield was same as when 100% of NPK had been applied through chemical fertilizers. Incorporation of organic sources considerably improved the soil properties such as decrease in bulk density and increase in infiltration rate and available NPK status of the soil for the wheat crop in rabi season. Inclusion of short duration pulse crop (mungbean) in the system not only produced 11.0 q ha^{-1} additional income before rice transplanting but also substituted for 50 per cent of recommended NPK fertilizers in rice (Bhandari *et al.* 1992). Quantity of nitrogen and phosphorous fertilizers can be reduced to half of the recommended dose with the application of *Azotobacter* and phosphorous solubilizing bacteria (PSB) along with FYM or vermicompost or green manuring. Application of FYM, green manuring, vermicompost and rice residue in combination with biofertilizers supplemented by NPK fertilizers improved the soil fertility and maintained higher sustainable productivity (Singh *et al.* 2008). All these studies show that instead of using only synthetic fertilizers, INM can help us to maintain the productivity as well as soil health for a sustainable development.

STUDY ON BIOLOGY OF RICE WEEVIL, *SITOPHILUS ORYZAE***MEGHA. G**

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The rice weevil, *Sitophilus oryzae* (Coleoptera: Curculionidae), is one of the most destructive pests of stored cereals. Knowledge of the life history and biology is important for the development of an integrated pest management program. Investigation includes egg incubation, oviposition periods, and larval instar development under ambient temperature of $28 \pm 2^\circ \text{C}$ and $75 \pm 5\%$ relative humidity. Maize seeds with rice weevil are reared, eggs so obtained will be maintained in a plastic container for incubation. Daily 20 grains, from the day of oviposition to egg hatching will be observed to determine the incubation period. On hatching the larvae of rice weevil are allowed to feed inside the seed. 20 grains per day will be dissected to observe the different stage of larvae. Larval instars are determined by the presence of moulted skin and range of head capsule width. Dissection of the maize seeds will be continued till the appearance of pupal stage. Twenty seeds with eggs of rice weevil obtained will be dissected out daily till the emergence of adults. Pupal period will be determined by subtracting incubation and larval period. Ten pairs of adults will be released individually in plastic container (10 cm diameter) to observe pre-mating and mating period. The mated females will be taken and kept in a plastic container (10 cm diameter) along with the maize seeds to know the pre-oviposition and oviposition periods. The life span of rice weevil adults will be observed by enclosing male and female adults in a plastic container.

CORRELATION AND PATH COEFFICIENT ANALYSIS IN FINGER MILLET (*ELEUSINE CORACANA*(L.) GEARTN) MAHANTHESHAM^{*1}, M. SUJATHA² ASHOK KUMAR MEENA³ AND S. R. PANDRAVADA⁴

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A field experiment was conducted to carry out yield component analysis through correlation and path analysis. Forty eight genotypes of finger millet were sown in a randomized block design with three replications, during *kharif* 2014 at National Bureau of Plant Genetic Resources research field, Rajendranagar, Hyderabad. The objective of the experiment was to assess the nature of interrelationships and direct and indirect effect of different yield contributing traits towards grain yield. From correlation studies it was observed that grain yield per plant has exhibited significant positive association with total no. of basal tillers per plant, productive tillers per plant, total fingers on the main ear, finger length and finger width. Path analysis revealed that maximum positive direct effect on grain yield per plant was exhibited productive tillers per plant followed by Finger length, Finger width. Therefore, it is emphasized to lay attention on traits like productive tillers per plant followed by Finger length, Finger width while selecting for improvement in grain yield of finger millet.

Key Words: Finger millet, correlation, path analysis, yield contributing traits.

USE OF SEED BIO-PRIMING FOR PLANT DISEASE MANAGEMENT.

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Soil contamination and environmental hazard from the indiscriminate and excessive application of agrochemicals on crops have been key issues for the present-day agriculture. Additionally, the risk to human health has also led to stringent regulatory framework around the use of synthetic chemicals in agriculture. Bio-inoculants have emerged as the most feasible eco-friendly solution to these issues and have been gaining considerable consumer acceptance since the time they were first introduced. Bioagents are substances containing living microorganisms which promote plant growth and maintain the soil and crop health by increasing the supply or availability of primary nutrients to the host plant. Bio-priming which involves seed priming in combination with low dosage of beneficial microorganisms is becoming a potentially prominent technique to induce profound changes in versatility of plant performance, encourage desired attributes in crop growth, and stabilize the efficacy of biological agents in the present fragile setup of agriculture by reducing dependency on chemical inputs and offers an attractive option for resource-poor farmers being an easy and cost effective method. The most prominent contributors in fungi and bacteria which are used extensively in bio-priming include *Trichoderma*, *Pseudomonas*, *Glomus*, *Bacillus*, *Agrobacterium*, and *Gliocladium*. Bio-priming has a great potential for improving crop growth and nutrient use efficiency.

QUALITY PARAMETERS OF CARMEN PEAR AS AFFECTED BY FOLIAR APPLICATION OF SALICYLIC ACID AND CALCIUM CHLORIDE

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Salicylic acid and Calcium chloride was applied through foliar spray and physio-chemical quality of Carmen variety of pear was assessed. The experiment was carried out on five year plants of Carmen pear grafted on Quince C rootstock at Experimental Farm of Division of Fruit Science, SKUAST-Kashmir, Shalimar campus, Srinagar (J&K) during 2017. Treatments consisted of four levels of salicylic acid (0, 1 and 2 ppm) and four levels of calcium chloride (0.2, 0.25 and 0.3 %) constituting total sixteen treatment combinations. The experiment was laid out in Randomised Complete Block Design with factorial arrangements and replicated thrice. The treatments were applied as foliar spray at 3, 6 and 12 weeks after petal fall. Results revealed that the exogenous application of salicylic acid had significant effect on physico-chemical quality of the pear. Maximum fruit weight (168.44g), fruit volume (146.00), fruit length (10.03cm), fruit breadth (6.70 cm), firmness (10.16 kg/cm²), TSS (14.04° Brix), ascorbic acid (9.41 mg/100g), reducing sugars (11.04%) and total sugars (12.97 %) and acidity (0.54%) was recorded with salicylic acid @ 200ppm. Calcium chloride 0.3 per cent also enhanced the physico-chemical quality of the fruits compared with control, wherein maximum fruit weight (165.00 g), fruit volume (145.42), fruit length (10.00 cm), fruit breadth (6.67 cm), firmness (10.18 kg/cm²), ascorbic acid (9.42 mg/100g), and acidity (0.52%) was recorded with calcium chloride 0.3 per cent. It is therefore concluded that the salicylic acid @ 200ppm and calcium chloride @ 0.30% improved fruit quality.

ROLE OF PLANT GROWTH REGULATORS IN TEMPERATE FRUITS UNDER HIGH DENSITY PLANTATION**MEHNIGAR HAMID, ANGREJ ALI*, AMIT KUMAR, SUMAYAMUMTAZ, SHABNAMAHAD AND SHAHIDAASHRAF***Division of Fruit Science, FOH, SKUAST-Kashmir, Shalimar Campus, Srinagar (J & K), *Division of Horticulture, FOA, SKUAST-Kashmir, Wadura Campus, Sopore (J&K)*

Plant growth regulators (PGR) include naturally occurring plant growth substances or phytohormones, as well as synthetic compounds which are mostly chemical analogs, materials that alter hormone levels and materials that alter hormone sensitivity. Since 1940's both natural and synthetic growth regulators have been used in horticulture with increasing incidence to modify crop plants by controlling plant developmental processes, from germination to post harvest preservation (Basra, 2000). The concentrations, time and method of application plays an important role in determining the effect of these chemicals on various fruit crops and now are used in High Density Orchards for various aspects like control of vegetative growth, fruit set, thinning, mitigate alternate bearing, good fruit quality and post-harvest management. Plant bio-regulators helps in formation of good architecture which will enhance better quality fruit production. Some growth retardants like SADH, CCC, MH, Prohexadione calcium, paclobutrazol can be used to control vegetative growth and some PGRs like Promalin induce branching. Prohexadione calcium significantly decreases the shoot growth in apple cv. Gala. Auxins, cytokinins, gibberellins and some growth retardants are reported to increase fruit set. Gibberellins increase fruit set, fruit number and yield in pear cv. Beurrue Bosc and Triumf. Plant Growth Regulators viz. 6-Benzyladenine and naphthalene acetic acid reduces the crop load in Golden Delicious and increase fruit size > 70 mm size. Auxin in dose 0.7 l/ha at the beginning of pit-hardening stimulated cell enlargement in the mesocarp of 'Regina' cherry fruit, which in turn, caused a significant improvement in fruit size. Salicylic acid treatments significantly retained firmness, total soluble solids, ascorbic acid content and weight loss in Jonagold apple compared to the control. Therefore, detailed knowledge and understanding of hormone biosynthesis, transport, mechanism of action, rate, time and method of application are required to predict any specific response in fruit crops in different climatic conditions.

ANALYSIS OF GENETIC COMPONENTS OF IMPORTANT TRAITS IN OKRA (*ABELMOSCHUS ESCULENTUS* (L). MOENCH.)**MEKALASRIKANTH*, S.K DHANKHAR AND MAMATHAN.C***¹Department of Vegetable Science, CCSHAU, Hisar, Haryana.*

The experiment was carried out during *kharif* season 2015, spring summer and *kharif* seasons of 2016, at the Vegetable Research Farm of the Department of Vegetable Science, CCS HAU, Hisar. *Four F₁ hybrids namely*, Hisar Naveen x Varsha Uphar, HB 25-2 x HB-32, HB-40 x HB-27 and HB-1157 x Pusa Sawani *developed and sown in Compact Family Block Design to evaluate them for growth, yield and its traits*. During present study, most of the crosses for all the yield traits showed low magnitude of dominance and higher environmental variances, revealing lower estimates of narrow-sense heritability. The additive component contributed a large proportion of the variation for plant height in cross HB-40 x HB-27, fruit diameter in cross Hisar Naveen x Varsha Uphar and for number of fruits per plant in cross HB-1157 x Pusa Sawani. The average dominance ratio was more than unity for plant height, first fruiting node and number of fruits per plant (Hisar Naveen x Varsha Uphar and HB-25-2 x HB-32), for inter-nodal length (Hisar Naveen x Varsha Uphar and HB-1157 x Pusa Sawani), for fruit length (Hisar Naveen x Varsha Uphar, HB-25-2 x HB-32 and HB-1157 x Pusa Sawani), for fruit weight in all four crosses, for fruit yield per plant (Hisar Naveen x Varsha Uphar and HB-40 x HB-27), which showed the importance of the dominance gene effects that is in agreement with low narrow sense heritability for these traits. Narrow sense heritability was observed low to high for all traits and ranged from 0.59 to 68.04 depending on the trait and cross combination. Estimates of narrow sense heritability indicated that additive effects were primarily responsible for the genetic variation in these hybrids.

Key words: Additive, dominance, heritability and variance

AGRICULTURE AND UN SUSTAINABLE DEVELOPMENT GOALS**MOHDASHAQ MALIK***Department of Botany, Govt. PG College, Rajouri, J&K -185131*

Based on the success of Millennium Development Goals, the United Nations on September 25th, 2015 adopted a new set of 17 Sustainable Development Goals (SDGs) with 169 targets and 304 indicators. The global goals which together are called Agenda 2030 officially came into force on 1 January 2016. The Goals that universally apply to all nations, will mobilize efforts to end all form poverty, hunger, fight inequalities and tackle the alarming climate change and bring overall peace and prosperity as well as equitable and sustainable development of people on planet over next 15 years. Although the SDGs are not legally binding, countries were expected to take ownership and establish national frameworks for the achievement of these Goals.

As per the SDGs report 2018, progress has been recorded on several fronts, yet a large number of areas where comprehensive efforts are required to achieve the goals. The rate of extreme poverty has fallen rapidly: but as per latest global estimate 11 per cent of the world

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population, or 783 million people, lived below the extreme poverty threshold in 2013. World hunger is also on the rise again: 815 million people were undernourished in 2016 which are up from 777 million in 2015. Aid to agriculture in developing countries totalled \$12.5 billion in 2016, falling to 6 per cent of all donors. Conflict, drought and climate change are the key factors to increase world hunger and food insecurity. Agriculture is central to all the goals so far sustainable peace and development is concerned. No doubt, more than any other sector, agriculture is the common thread which holds the 17 SDGs together. If investigated diligently in Agriculture by improving plant health, and mobilising scientific, technological and social movements, the challenges of extreme poverty and hunger can considerably be reduced by world society. In the present study an attempt has been made to investigate, how investing in the agricultural sector can address the challenges of not only hunger, malnutrition and poverty but also disease, illiteracy, clean water, energy, sustainable production and consumption, and climate change.

Keywords: United Nations, Sustainable development Goals, SDGs, Agriculture, Poverty, Hunger, Climate Change, Health, Food security,

PERFORMANCE OF VARIETIES AND ROW SPACING ON YIELD, QUALITY AND ECONOMICS OF SAFFLOWER (*CARTHAMUS TINCTORIUS* L.)

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A field experiment was conducted during the *rabi* season of 2015 at AICRP on safflower, V.N.M.K.V., Parbhani with a view to find out the suitable row spacing for safflower on seed yield, oil content, oil yield and economics of safflower. The experiment was laid out in factorial randomized block design with five spacing S_1 -30 cm x 20 cm, S_2 -45 cm x 20 cm, S_3 -60 cm x 20 cm, S_4 - 75 cm x 20cm, S_5 - 90 cm x 20 cm. and two varieties Annegeri -1 (V_1) and NARI- 38 (V_2) in three replications. Each experimental unite was repeated three times 5.4 x 4.0 m² size in gross plot and it was of 4.5 x 3.6 m² size in net plot. From the result of experiment can be concluded that among different varieties of safflower Annegeri -1 produced significantly higher yield attributes, higher gross monetary returns, net monetary returns and B: C ratio followed by NARI-38 (V_2). The variety Annegeri-1 (V_1) produced significantly higher yield and yield attributes, higher gross monetary returns, net monetary returns and B: C ratio when sown with S_2 -45 cm x 20 cm. Sowing of safflower at S_2 -45 cm x 20 cm spacing was found better for higher yield and economics was followed by S_1 -30 cm x 20 cm. The interaction effects of varieties x spacings were found to be non- significant.

IMPACT OF SAFFLOWER (*CARTHAMUS TINCTORIUS* L.) VARIETIES UNDER DIFFERENT ROW SPACING ON GROWTH AND YIELD

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A field experiment entitled "Performance of safflower (*Carthamus tinctorius* L.) varieties under different row spacing" was conducted during the *rabi* season of 2015 at AICRP on safflower, V.N.M.K.V., Parbhani with a view to find out the suitable row spacing for safflower on growth, seed yield, oil content and oil yield of safflower. The experiment was laid out in factorial randomized block design with five spacing S_1 -30 cm x 20 cm, S_2 -45 cm x 20 cm, S_3 -60 cm x 20 cm, S_4 - 75 cm x 20cm, S_5 -90 cm x 20 cm. and two varieties V_1 - Annegeri -1 and V_2 - NARI- 38 in three replications. Each experimental unite was repeated three times 5.4 x 4.0 m² size in gross plot and it was of 4.5 x 3.6 m² size in net plot. From the result of experiment can be concluded that among different varieties of safflower Annegeri -1 (V_1) produced significantly higher growth characters and yield followed by NARI-38 (V_2). The variety Annegeri -1 (V_1) produced significantly higher yield when sown with S_2 -45 cm x 20 cm. Sowing of safflower at S_2 -45 cm x 20 cm spacing was found better for higher yield was followed by S_1 -30 cm x 20 cm. The interaction effects of varieties x spacings were found to be non- significant.

INTEGRATED PEST MANAGEMENT IN ORGANIC FARMING

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One of the greatest challenges of the 21st century is the need to feed a growing population. Integrated Pest Management and organic production methods can work together to address this vital challenge. A definition adopted by the International federation of Organic Agriculture Movements in 2008; organic agriculture is "A production system that sustains the health of soils, ecosystems and people. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. Application of fertilizers either in organic or inorganic form influences the host plant growth and also exerts considerable influence on diseases, insects and their natural enemies. Organic manures supply both macro and

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micronutrients and helps in build up of resistance of plants to insect attack. The use of organic amendments in pest management is considered an ecologically viable proposition which avoid environmental pollution. It affects the quality and marketable yield of many agricultural crops. Sources of organic products are Mustard cake, Neem cake, Niger cake, Pungam cake, Rape seed cake, Safflower cake, Sesame cake, Castor cake, Coconut cake, Cotton seed cake, Dhupaka cake, Ground nut cake, Decorticated Under corticated Jambo cake. Karanj cake. Linseed cake and some Insecticides permitted in organic agricultural Vermi compost produced through the breakdown of organic matter by earthworms and microorganisms can be used as an amendment to strengthen the plant and reduce pest levels. Vermicompost is high in microbial diversity, contains considerable amount of humic substances and increases host plant resistance to pests, including aphids, Mealybugs, and spider mites. Organic crops that are grown in fertile soils with high organic matter and active soil biology generally exhibit a lower abundance of several pests due to lower nitrogen content. Some microbial insecticides containing the bacteria *Bacillus thuringiensis*. Three main strains of these bacteria are used in insect control. Botanical insecticides, such as rotenone, are also permitted in organic agriculture, but they are often too expensive to use on large acreages. For pest control beneficial organisms, dormant oil, diatomaceous earth. Plant-derived pesticides, soap, natural and synthetic insect pheromones which disrupt the insect's development. and commercial insect vacuums can be used. Various naturally occurring substances and products e.g. Neem, Pongamia, NPV, *Trichogramma*, *Trichoderma* etc. Herbal extracts should be used only as a final remedy only after utilizing practicing all the above said methods in organic farming.

Keywords : Integrated Pest Management, Organic Farming, Botanicals

INCREASING ECONOMY AND FARMER'S INCOME BY CONTROLLING THE EFFECT OF BIOTIC AND ABIOTIC FACTORS ON SHELF LIFE OF KANGRA TEA

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Tea, *Cammelia sinensis*, is one of the oldest and non-alcoholic beverages used in the world. It is available for consumption in six main variants, based on the oxidation/fermentation technique applied during processing. Black and green tea is the most common form of made tea. Basically commonly known but completely ignored problem of tea i.e. the effect of different packaging material (Flipovic. et al., 2009) on the shelf life (Debnath *et. al* 2012) of the Kangra tea and seasonal impact on tea. This study proves to be quite useful in respect of variety, durability, cost, production and economic status of the tea. As we aware, that tea is used worldwide as a beverage once or thrice a day. Shelf life is the important aspect on the storage of tea because quality and also the large quantity of stored made tea available at home get spoiled due to the non-availability or lesser knowledge about the best packaging material of tea against different seasonal variations and packaging problems (Gimenez et al., 2003). If this problem is solved then it is a better solution for society and also it strengthens the economy of India. The study is planned with objectives *viz.* 1. To study the impact of different packing material on the shelf life of Kangra Tea. 2. To study the seasonal impact on the shelf life of Kangra tea. and 3. Isolation and identification of different biotic factor responsible for the degradation of packed tea. Research work will be carried out through site selection, sample collection, from Palampur tea cooperative factory at three different growing seasons of tea in a different type of packaging materials. Various microbial parameters shall be tested in the laboratory of Crop Research laboratory of Agronomy department of CSKHPKV, Palampur and Natural Product Laboratory of IHBT CSIR Palampur of Kangra district (H.P.).

IMPACT OF LONG-TERM BALANCED AND IMBALANCED USE OF FERTILIZERS ON SOIL QUALITY AND PRODUCTIVITY IN RICE-WHEAT CROPPING SYSTEM

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In a continuing long-term fertilizer experiment initiated in 1984 with rice-wheat crop rotation at the A₂ block of the Norman E. Borloug Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar, the impact of balanced and imbalanced fertilization for 29 years on soil quality indices and productivity of the system was evaluated during 2013-2014. Different combinations of N, P, K, Zn and FYM treatments have been maintained in fixed layout since the beginning of the experiment in a Randomized Block Design with four replications. Rice (var. Pant Dhan 4) and wheat (var. UP-2425) crops were taken during *kharif* and *rabi*, respectively. The N, P and K as per treatment details were supplied through urea, single super phosphate and muriate of potash, respectively. The treatments having FYM was received it only in rice crop i.e during *kharif*. To achieve the objectives of the study soil samples were collected from each plot from 0-15 & 15-30 cm depth after harvest of rice and wheat crops. At the end of season the yield of rice and wheat were recorded. Continuous cropping and fertilization alone and with FYM for 29 years increased the soil pH (8.16-8.19 unit), EC (0.28-0.34 dSm⁻¹) and reduced bulk density (1.28-1.39 g cm⁻¹) from their initial values of 7.9, 0.120 dSm⁻¹ and 1.33 g cm⁻¹, respectively. The

status of cation exchange capacity, organic carbon, available N, P, and K, decreased due to long-term application of inorganic fertilizer alone compared to initial status at inception of experiment, while application of NPK along with FYM maintained their status in soil. The highest organic carbon, available N and P in both the surface and sub-surface soil layers was maintained with $N_{180}+P_{80}+K_{40}+Zn(F)+FYM$ which was followed by $N_{120}+P_{40}+K_{40}+FYM$ and $N_{120}+P_{40}+K_{40}+ZnF+FYM$. Addition of FYM along with NPK also increased the level of micronutrients in soil. The highest microbial population, population of *Azotobacter* and PSB, dehydrogenase, phosphatase activity and potentially mineralizable nitrogen in both the surface and sub-surface soil layers was supported due to $N_{180}+P_{80}+K_{40}+Zn(F)+FYM$ followed by $N_{120}+P_{40}+K_{40}+Zn(F)+FYM$ and $N_{120}+P_{40}+K_{40}+FYM$. The combined use of inorganic fertilizer along with FYM for twenty-nine years significantly improved the bulk density, water holding capacity, hydraulic conductivity, mean weight diameter and aggregate stability in both the surface and sub-surface soil layers. However, the highest bulk density and particle density were obtained under control. An application of $N_{180}+P_{80}+K_{40}+Zn(F)+FYM$ supported the highest water holding capacity, hydraulic conductivity, mean weight diameter and aggregate stability while the lowest under control. As a result of improved physical, chemical, and biological quality indices of soil due to combined application of balanced dose of inorganic fertilizer and FYM for twenty-nine years, the highest productivity of rice and wheat (6747 kg ha⁻¹ and 3254 kg ha⁻¹, respectively) was recorded due to $N_{180}+P_{80}+K_{40}+Zn(F)+FYM$ followed by $N_{120}+P_{40}+K_{40}+FYM$ and $N_{120}+P_{40}+K_{40}+Zn(F)+FYM$ which was statistically at par with each other but significantly different from other fertilizer treatments. During the present investigation various physical, chemical and biological indices of soil quality after 29 years of balance and imbalanced fertilization alone or with FYM found to be significantly correlated with each other as well as productivity of rice and wheat crops. From the present investigation it can be elucidated that the combined use of chemical fertilizer along with FYM for twenty-nine years of rice-wheat cropping system is a sustainable nutrient management practice because of improved soil physical, biological and chemical indices of soil as well as their interrelationship with each other and crop yield.

STUDIES ON THE EFFECT OF TILLAGE, VARIETIES AND WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF LENTIL CROP

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A field experiment conducted during Rabi 2013-2014 at Students Instructional farm, Department of Agronomy, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.). To find out studies the effect of tillage, varieties and weed management practices on growth and yield of lentil (*Lensculinaris* Medick.) In case of Tillage use as two tillage practices like as zero tillage and conventional tillage. Second factor use of two variety like as KLS-218 and KLB- 320 and Third factor is used of weed management practices viz. different comparison of weedy control plot and second one two hand weeding (30 and 45 DAS), Third weed management practices used pendimethalin @ 1kg ai/ha in different plot. All factors are presented in double split plot design. In case of Tillage practices conventional tillage is gives more yield and low weed populations zero tillage gives as more weed population and low yield and in case of variety KLS- 218 gives higher yield comparison to KLB-320. In case other management practices, two hands weed ing gives superior results comparison to all of the factors and also give better yield potential followed by application of pendi methal in @ 1 kg ai/ha give lower yield comparison to two hand weeding. Practices where variety KLS -218 and conventional tillage along with two hand weed gnaws done give higher grain and straw yield comparison to all. Other treatments also recorded higher net income and B: C Ratio. This experiment was done where soil was sandy loam in texture. Organic carbon was about 0.5% and nitrogen content was low, medium in phosphorus and potassium availability. The P^H 7.7 indicates that the soil was slightly alkaline in reaction.

MITIGATION OF SPOT BLOTCH OF BARLEY (*HORDEUM VULGARE* L.) THROUGH AGRICULTURAL PRACTICES FOR MAXIMIZATION OF THE SEED QUALITY

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Barley (*Hordeum vulgare* L.) belonging to the family Poaceae, is an annual monocotyledonous herb, tribe *Triticeae*. Barley is evolutionarily closely related to two other small-seeded cereal species, wheat and rye. India has about 7.57 lakh ha area with production of 14.72 lakh tonnes and productivity of 19.44 q/ha. In UP, barley occupied an area of 2.86 lakh ha with a total production of 6.38 lakh tonnes with productivity of 22.25 q/ha. Uttar Pradesh alone contributed more than one fourth of India's total production of barley during 2016-17. We are still below the world average in its productivity level as it is cultivated under minimum input management conditions. The demand for the malt barley from industry is on the rise which is presently nearly 18-20 per cent of the total barley production of the country. A good quality seed should maintain the viability and germination till the next sowing season. Germination of quality seed lot should be high for obtaining the desired crop stand in the field. Vigour of quality seed should be high as the vigorous seeds will stand better in the field in adverse condition. All these qualities of seeds are affected by various factors including various seed borne pathogens.

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Spot blotch disease caused by the fungus *Bipolaris sorokiniana* (teleomorph *Cochliobolus sativus*) is one of the most important fungal disease of barley. Many factors including climate conditions (Rainfall, temperature and humidity) and agricultural practices influence the development and spread of disease and thus affect the seed crop. Considering quantum of losses, the investigations on management of spot blotch, for maximizing the seed quality, experiment were conducted at CRS, Masodha and Students' Instructional Farm and Seed Pathology Laboratory at Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during 2016-17 and 2017-18. Effect of date of sowing, organic and chemical amendments on disease severity was quantified during the present investigation. Effect of different nitrogen levels and treatment with Plant Growth Promoting Rhizobacteria on disease severity was studied. Also the disease management through seed treatment and fungicidal foliar sprays was tried to recommend a management schedule for bring down the disease severity, maximize seed yield and its quality. Minimum seed infection of *Bipolaris sorokiniana* (5.5%) was recorded through the crop sown in mid-November with recommended dose of fertilizers + FYM @ 5t/ha plus paddy straw mulching followed by two sprays of zinc sulphate and KCl. This treatment resulted in maximize the viability, germination, seedling length and vigour index also. Nitrogen @30 Kg/ha with seed treatment of Azatobacter plus PSB was found best for minimizing the disease and optimizing the seed quality attributes. Seed treatment with Vitavax Power @ 2.0 g/kg seed and two foliar sprays of Propiconazole @ 0.10% (first at tillering and second after 15 days) in minimizing the spot blotch severity with highest seed quality traits. This treatment also resulted in 40.64 per cent yield increase as compared to untreated and water sprayed plot.

CONSERVATION AGRICULTURE: MITIGATION AND ADAPTION OF CLIMATE CHANGE

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Ever increasing global population, particularly in many developing countries requires increased supply of food, fibre, oil, which poses a grave challenges before the agriculture scientists to produce more and more from limited, shrinking and degraded land and water resources. Tilling soils continuously without adding organic matter has adverse effects on soil health and quality of the produce. Conservation agriculture (CA) is the integrated management of the available natural resources such as soil, water, flora, and fauna with partial outside inputs which increases the efficiency of natural resource use. It provides sustainability in farming production through maintaining the quality of natural resources by stable or semi-stable organic cover to soil. Zero or minimum tillage or no-till (NT) and minimum disturbance of soil along with varying rotation of crops are a must for future prospects. CA is an integrated approach to agriculture cultivation that helps enhance food security, allay poverty, conserve biological diversity, and preserve ecosystem services. CA practices are also helpful in making farming systems more resilient to recent climatic changes. CA can comprise wide-ranging practices such as management of forage and farm animals, fallows improvement, combined cultivation of agricultural crops and trees as agroforestry, management of watershed, and management of areas which are reserved for village and community people. Then the potential of CA as a source to alleviate and acclimatize to climate change will be examined for climatically affected environment (FAO 2011). CA is the best management of natural resources like soil, water, vegetation, and biodiversity for sustaining the future prospects. CA have potential to decrease the effects of changing climate by optimizing crop productivity and advantages while maintaining a coordination among agricultural, monetary, and ecological benefits (FAO 2011a ; Giller *et al.* 2009). The CA practices can also add to making farming systems more flexible to climate change. In several cases, CA has been demonstrated to reduce agricultural systems' green-house gas (GHG) emissions and increase their job as carbon sequestration. As an estimate, nearly 1.5 MT plant nutrient are being lost due to burning annually (Jain *et al.* 2014). Residue burning also kills the beneficial microorganisms present in the soil required for different biological processes. Release of different greenhouse gases leads to increase in atmospheric CO₂ which is the ultimate cause of the changing climate (Chivenge *et al.* 2007). The CAPs is a powerful mechanism to adapt to climate change by increasing resilience to drought and increasing water and nutrients use efficiencies (WUE and NUE). Climate change is believed to have a great impact on soils. Increasing temperature would increase oxidation of the organic carbon in soil. Its levels will go down further. Incidence of runoff or wind erosion may increase due to increase in extreme events. These changes may reflect themselves in poorer soil fertility, loss of soil biota, water stress, and groundwater depletion (FAO2011a, b). The ecological benefits from CA are operationally defined as "increase in soil fertility," "retention of soil moisture," "long-term yield increase," "decreasing yield variations," "greater food security," "increased growing time of an area," and "production per hectare" (Pittelkow *et al.* 2015).

SCREENING OF SELECTED SPINACH CULTIVARS FOR THEIR RESPONSE TO THE ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA*.

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The Root-knot nematode, (*Meloidogyne incognita*) is the most damaging pathogens of vegetables, especially in the tropical and

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subtropical regions. Increasing restrictions of chemical nematicides have given rise to growing attention and interest in alternative nematodes management. Among the non-chemical methods available to nematodes control, the use of resistant cultivars can be one of the most effective and environmentally safe alternatives over chemical control. An investigation was carried out to assess the level of resistance in five selected spinach cultivars viz., All green, Green Flavour, Kantedar, Pure green and Super green against *M. Incognita* under greenhouse condition. The nematode development and host damage were evaluated by recording the nematode infestation parameters and percent reduction of plant growth. All the tested cultivars varied significantly in causing reductions in growth parameters over their controls. Similarly, all the cultivars behaved differently regarding the formation of galls and egg masses and the nematode development. It was observed that none of the tested cultivars was immune or highly resistant. The cultivar Kantedar was found moderately resistant against *M. Incognita* as it showed minimum root gall index and reduction in growth parameters while cultivar All green was found highly susceptible showing the highest root-knot index and reduction in growth parameters. Similarly, the cultivar Green flavour and Pure green were susceptible; the cultivar Super green was moderately susceptible against the nematode damage. A significantly negative correlation was found between the number of galls and plant growth parameters.

Keywords: *Meloidogyne incognita*, Screening, Spinach, Resistance.

ORGANIC FARMING: EFFECTS ON CROP PRODUCTIVITY, FOOD QUALITY AND ENVIRONMENT

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The green revolution has increased the food grain production of our country to a state of sufficiency due to use of high yielding varieties, fertilizers, pesticides and other inorganic inputs. But this intensive cultivation has not only led to pollution of soil, water bodies, underground water and the environment but also affected the human beings. Further with increased demographic pressure and shrinking resource base due to enhanced industrialization and urbanization, it seems difficult to feed the future population in a sustainable manner with environmental protection. So, there is a need to go for a truly sustainable farming system on a wide scale to meet this challenge and ensure food and ecosystem security. A system is called sustainable only if it gives sufficient amount of quality food, increases the natural resource base, protects the environment, is economically viable and contributes to the wellbeing of farmers and their community. In this regard, organic farming seems to be the better alternative to conventional farming. Organic farming is a production system that promotes environmentally, socially and economically sound production of food and fibres and excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, livestock feed additives and genetically modified organisms. The overall goal of organic farming is to provide food of high quality with minimum environmental impacts in a sustainable manner. It is often called as organic agriculture, ecological or biological agriculture. Many researchers believe that organic farming is ideologically driven and inefficient, and in comparison to conventional farming, it requires more area to produce the same amount of food as conventional agriculture.

Keywords: Green revolution, sustainable farming, organic farming, productivity.

SOIL MOISTURE CONSERVATION TECHNIQUES

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Soil Moisture is a key factor that impacts on the productivity of the soil. Soil moisture losses affects on the metabolic function of crops and crop production as well as population and activities of soil microorganism. Therefore, importance of soil moisture conservation much more needs especially in dry land areas as well as there where irrigation facilities very difficult. Three main factors affect soil moisture content: (a) How well the soil can absorb water; (b) How well the soil can store moisture; and (c) How quickly the water is lost or used. These factors controls used by following techniques: (1) Cover the soil after sowing and harvesting of crops by the crop residues left, (2) Deep and opposite of slope ploughing of soil in the summer season before onset of monsoon, (3) Made bunds around field in monsoon season, (4) Uses of contour farming practices in the hilly areas, (5) Organic resources and fertilizers apply in the field, (5) Minimized losses of moisture by the different type natural and artificial mulches involved in the cultivation of crops, (6) Used different type of anti-transpirant chemicals on the crops for mitigate the process of transpiration, (7) Intercropping and mixed cropping of farming techniques to minimize soil moisture losses by the evaporation, (8) Crop rotation practices involve in cultivation because deep rooted and shallow rooted crops that make use of previous unused soil moisture, as plants draw water from different depth level within the soil (9) green manuring such as growing of leguminous crops with the sole, purpose of adding to the soil for improved organic matter and improves water retention capacity.

Key words: Soil moisture, moisture conservation technique, ploughing, mulches and green manure.

WATER MANAGEMENT IN SMART AGRICULTURE**¹MOHD. SALIM MIR, ¹UMMAISA REHMAN ²ZAKIR AMIN, ²SHIFASHOWKET, ³ASHAQ AHMAD,***¹Division of Agronomy, SKUAST, Kashmir; ² Division of Plant Pathology, SKUAST, Kashmir; ³ Division of Soil science and Agricultural Chemistry, SKUAST, Kashmir*

Due to irregularity of rainfall and decreasing water level, it has become very necessary now that due to the intervention of water management, the excess consumption of water consumed in agriculture should be fulfilled in such a way that only the small amount of water in the tab to get the full water of their needs, first we have to collect rain water. Use the water on the collection as follows: Use water to reduce the amount of water used Waste so that we can use the rest of the water in other works. Interventions in water management Smart Agriculture: Interference with natural water (1) Land collation by laser: The technique of colloquialization by laser is a new technology in which the role of tractor driver is zero, the action of collagenation is done by laser itself. Studies have shown that 10% of the paddy fields coated in laser and 10 in the field of wheat 20 percent water can be saved. (2) Use of crop change or drip: The profitability of the paddy wheat crop cycle is decreasing day by day, along with the cultivation of vegetables and fruits, if drip irrigation is also provided, then more water can be saved, one big benefit of drip irrigation it is also possible that underground saline water found in dry or semi-arid areas can be used. (3) Groundwater recharge: Excessive emphasis should be given on the use of ground water recharge rather than draining the water into the drains, the following measures can be taken. Excavation and renewal of old ponds: Recharged on the roof by cultivating water or roof water, Use of surface and underground drainage, Construction of potholes on the banks of fields and construction of pits for water harvesting on the shore.

Keywords: Irregular rainfall, Ground water recharge, water harvesting

ADAPTABILITY PERFORMANCE OF VARIOUS EXOTIC POTATO VARIETIES AT HIGH ALTITUDE RESEARCH STATIONS OF GILGIT BALTISTAN**MUHAMMAD SHAH ZAMAN, FAZAL RAHMAN, SHAKIRULLAH, MUHAMMAD KHALID AND ZULFIQAR AHMAD**

Directorate of Agriculture Research Gilgit Baltistan, GB A trial of nine potato varieties (Bartina, Sante, Pameela, Melanto, Lady Rosetta, Roko, Asterix, Koruda and Zena Red) was conducted at two different locations of Gilgit Baltistan (GB) at Horticulture Research Station Yaseen Ghizer and Agriculture Extension Farm Phandar at an altitude of above 7000 feet from the sea level. Potato and vegetable Research Station Naltar Gilgit and Potato Research Station Babusar. A same lay out plan was used in both Research stations where raised ridges were prepared with 5 m length having plant into plant distance (15 cm) whereas the row into row distance was kept at 75 cm. Initial dose of Nitrophos @ 25 kg/kanal was applied during sowing time of seed potato and Urea @ 10 kg/kanal was applied at three different stages. The whole experiment was replicated three times and the data was collected and analyzed using Completely Randomized Block Design (RCDB). In our study the var. Roko, Lady Rosita and Bartina showed 100% germination at Yaseen followed by Melanto, Asterix and Sante (99%) while, the least germination rate was recorded in the var. Zena Red in three locations (Yaseen and Phandar). The varieties with high germination rate would be selected to proliferate in the area during the current potato growing season. Maximum plant height was recorded in Pameela in all locations with highest plant height in Yaseen region (100.3 cm). Maximum number of stems (05) was recorded in Bartina at Naltar followed by Lady Rosita (4.4) and Roko (4) stems plant-1. Minimum (1.4 and 1.8) number of stems plant-1 was noted in Zena Red in Yaseen. Similarly the maximum (12.8) number of tubers plant-1 was recorded in Melanto followed by Lady Rosita at the same location of Yaseen. Our experiment depicted highest yield by Roko that produced 30.9 mt/ha at Yaseen. The var. Sante and Zena Red emerged as the least adaptive potato variety with 12.0 mt/ha and 8.9 mt/ha at same locality of Yaseen respectively. On basis of the field adaptability test the high yielding and most suitable varieties of Potato will be grown in the research stations / farms and further be proliferated to boost the seed potato industry in the area through progressive farmers in collaboration of Agriculture Extension Department of Gilgit Baltistan.

Key word: Potato, Solanum, tuberosum, Seed Potato, adaptability, yield.

ASSOCIATION STUDIES IN MAIZE (*ZEAMAYS L.*)**MOHIT & B. R. KAMBOJ***Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004*

Maize (*Zea mays L.*) is a cereal crop of global importance, belonging to the grass family *Poaceae*. It is the third most important cereal crop in the world after rice and wheat. As it has yield potential far higher than any other cereal, it is also referred as the '*Miracle crop*' or the '*Queen of Cereals*'. The consumption pattern for maize produced in India at present includes poultry feed, human food, animal feed, starch, brewery and seed. The present investigation was carried out at Research area of Regional Research Station, Karnal, Chaudhary Charan Singh Haryana Agricultural University, Hisar during *Kharif* season to estimate the magnitude of comparative performance of different methods of establishment on yield. Positive and significant correlations of grain yield, cob length, diameter and 100- grain weight was found in hand dibbling as compared to sowing with zero till drill machine.

Key Words: Maize, Zero till, Association, Yield

OPTIMIZATION OF DYEING PROCESS OF ONION SKIN DYE FOR BIOPOLYMER TREATED COTTON FABRIC

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Textile dyeing and printing industry is one of the most polluting sectors from an ecological point of view. There is need to approach new strategies, methods, material for dyeing treatment of cotton fabric with natural dyes using environment benign route. To achieve the objectives of the study, different biopolymer and natural dyes were tried and one was selected on the basis of colour properties of dyed fabrics. Standardization of chitosan treatment and dyeing process for selected onion skin dye was done on the basis of colour properties i.e. dye absorption colour strength and wash fastness for different concentrations and conditions. It was found that the chitosan treated onion skin dyed fabric showed higher dye absorption (66.17%), colour strength (16.52), wash fastness rating than alum treated dyed fabric (55.98%, 12.21 k/s, 4/5) respectively. Thus it is concluded that chitosan treatment enhanced colour properties without using any harsh chemicals and is capable enough to replace the use of salts and alkali in dyeing with natural and synthetic dye. The chitosan treatment along with onion skin dye imparted the multi-functionality to the cotton fabric in terms excellent protection against UV radiations, antibacterial and crease resistant properties effectively with environmental friendly manner, reduced the pollution load on environment and save resources.

Key Words: Chitosan, Onion Skin, Natural Dyes, Cotton

DOUBLING FARMER'S INCOME: AN INITIATIVE TO EMPOWER FARMERS IN INDIA

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Sustainable Development Goals (SDGs) are a plan and also one roadmap for alleviating poverty and improving the living condition of the local community. More than 53 per cent Indian people are engaged in Agriculture as the main occupation. A new and innovative agricultural productivity enhancement of technologies and capacity building of Agriculture farmers provide a natural push for SDGs. The Government of India has set up the panel of doubling Farmer's Income by the year 2022. The Government has initiated various agricultural reforms such as enhancing productivity, improving profitability, encouraging organic farming and many other efforts. Doubling farmer's income is a very big task as farmers are facing many problems like climate change, soil degradation and lowering of water level etc. Agriculture plays an important role in Nation's economy in India. India's 54.6 percent of the population is engaged in agriculture and allied activities (census, 2011). According to FAO, by 2042, the world will have nine thousand million hungry people to feed, India alone accounting for 1650 million of those. As per the provisional estimates released by the Central Statistical Office (CSO) on 31st May 2016, the agriculture and allied sector contributed approximately 17 percent of India's Gross Value (GVA) at current prices during 2015-16. If we want to remove the problem of malnutrition in India, we need to increase food production by 80 percent. To overcome the farming related problems, enhancing Agricultural productivity and improving farmers' income is a big challenge. For this, we have to analyze how they are doing farming and what more can be done to improve their farming ways and agriculturally related income through knowledge interventions and training. Agriculture plays a pivotal role in SDGs, like food security, overcoming the problems of hunger and poverty alleviation is closely linked to it. Total 78 percent of the world's population is dependent on agriculture not only for their food but also for their livelihood and Agricultural Development.

Keywords: Agriculture, Development, Farmer's income, and Livelihood.

DEVELOPMENT OF SUITABLE PACKAGE FOR MANAGEMENT OF LATE BLIGHT OF POTATO AND ITS IMPACT ON CROP GROWTH AND YIELD

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Late blight of potato caused by *Phytophthora infestans* (Mont.) de Bary is one of the most serious diseases of potato. Several management practices have been adopted so far to minimize the disease. But in present investigation based on laboratory and glass house condition revealed that tuber seed dressing with bio-fertilizer provided good protection against late blight and also stimulate the germination. The data showed that the plant height of potato was maximum in treatment T₇ (soil application of mustard cake + tuber treatment and foliar spray with *T. viride*) with the value of 11.16cm at 30 day age of plant. Growth promoting effects of the bio-fertilizer were also perceived. The bio-fertilizers were found to increase the plant length over control. Foliar spray with the bio-fertilizers after pathogenic inoculation protected the plants against infection resulting reduced disease severity. The minimum disease severity (7.82%)

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was reported from *treatment where treatments were given as treatment T₇* (soil application of mustard cake + tuber treatment and foliar spray with *T. viride*) treated plants against 96.0% disease severity in case of control. Plant treated with bio-fertilizers after the challenge inoculation sensitized the plants to produce increased levels of soluble protein. The maximum increase in protein content was found in treatment T₇ (Soil application FYM @150gm/pot + mustard cake @ 150gm/pot + tuber treatment with *T. viride* + foliar spray with bio-formulation of *T. viride*) after 15 days of pathogenic inoculation. A high content of phenol was also recorded in treated leaves which were maximum in treatment T₆ (Soil application FYM @150gm/pot + tuber treatment with *T. harzianum* + foliar spray with bio-formulation of *T. harzianum*). The correlation coefficient between disease severity with total soluble protein and total phenol content showed negative correlation in both the cases.

ECO FRIENDLY MANAGEMENT OF DISEASES AND PESTS IN SEED SPICES THROUGH PLANT PRODUCT MSANNU¹, MOHIT KUMAR²

Department of Extension Education and Department of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner

The productivity of most of the seed spices is considerably low in Rajasthan due to various infestation by plant diseases and pests is major factor. Several seed spices of pathogens, insects, mites and nematodes attack these crops in the field and during storage. Several plants extracts, synthetic, microbial compounds and organic pesticides have been used extensively to reduce yield loss and increase crop profitability without chemical residues in the produce. Chemical control produce harmful side effects on beneficial organisms, mortality of pollinators, environmental pollution. Since seed spices are high value and export oriented commodities, levels of pesticide residues are to kept well below tolerance limits in view of the stringent standards set by the importing countries thus the growing concern over pesticide misuse has led to the development of IPM schedules for sustainable management of pests and diseases in recent years. Plant products form an important component in the development for IPM schedules. Among indigenous plant species like neem, garlic, ginger and onion have been extensively studied for bio-active constituents in different plants parts. Farmers use local traditional preparations such as neem seed kernal extract, neem leaf extracts, neem oil, neem cake for the management of various diseases and pests. These plant extracts have great potential for ecofriendly management of diseases and insect pests of seed spices crops. These products act as antifungal and antibacterial against different diseases causing pathogens and also inhibitor of sporulation, development of hyphae of fungal pathogens. antifeedant, growth regulator, repellent action against various pests of seed spices crops. These above mentions characteristics in plant extracts that help to reduce the diseases and pest infestation without create any health hazardous and residues effects and also eco-friendly for environmental view

HORTICULTURE INNOVATIONS AND ENVIRONMENT CONSERVATION MUDASIR IQBAL, MOHSIN IQBAL AND ***NAVEED HAMID

*Division of Fruit Science, Division of Plant Pathology, Faculty of Agriculture, Main Campus, Chatha, ***Ministry of Agricultural Cooperation and Farmer's Welfare, New Delhi, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, J&K-180009, India, Key Words: Horticulture, Environment, Management, Conservation, Mitigation*

Horticultural production basically involves the intensive use of natural and artificial resources, such as land, water, labour and inputs such as fertilisers, pesticides and horticultural implements. The use of these resources in a temporal basis has the potential to negatively impact on the local environment and worker welfare. In addition the transport of horticultural produce over long distances, particularly by air transport, and reported in term of food miles, is known to have a negative contribution to the global environment. The use of technologies that have been used to mitigate the impact of horticultural production on the environment are highlighted including greenhouse technologies, soil protection and conservation, optimal fertiliser use and Integrated Pest Management. The past decade has seen an increasing awareness of man's activities on the planet's environment. The horticultural value chain has affected virtually every aspect of the environment. In addition we have seen greater advances in quantifying the impact of horticultural activity on the environment. By understanding and measuring, then scientists and growers themselves have been able ways to minimise their effect on the environment through the use of technology and management strategies. This is likely to be an on-going scenario. Climate change and variability will affect horticulture system substantially, requiring orchardists to adapt at the same time that they are called on to reduce emissions at the orchard level. Choosing effective adaptation and mitigation strategies will represent a key challenge for farmers over the coming decades. However the climate change we are seeing currently is as a result of practices totally outside horticulture and in future global warming and the environmental impact on horticultural production may be more important than horticulture's impact on the environment.

OPTIMIZING DRIP IRRIGATION SYSTEM DESIGN FOR ONION CROP USING DIDAS SOFTWARE**MUKESH KUMAR MEHLA¹, KHYATI SINGH²**¹Department of Soil And Water Engineering, COAE&T, CCS Haryana Agricultural University, Hisar- 125004, ²Department of Vegetable Science, Maharana Partap Horticultural University, Karnal- 132001, *Corresponding author- Mukesh Kumar Mehla

Water is a key limiting factor in crop production. Use of drip irrigation system for growing vegetable crops can help in sustainable use of water. In close growing crops like onion which has shallow root zone depth (i.e. 8 inches) designing drip irrigation system which will cover the crop water requirements effectively becomes important. DIDAS software is used in design of drip irrigation systems and irrigation scheduling of various annual crops and trees at various soils and evaporation conditions. DIDAS's drip system design tool can be used for optimizing design of drip irrigation system which is based on steady irrigation and water uptake processes to study the effect of geometrical attributes on water use efficiency. Geometrical attributes includes distances between emitters along driplines and between driplines, the depth of emitters for subsurface systems and the size and depth of root systems. It performs computations based on analytical solutions of the relevant linearized water flow and uptake problems. Design tool is based water uptake rate criterion (RWUR, ratio between water uptake rate and irrigation rate) assuming no plant-atmosphere resistance to water uptake based on three input parameters describing the soil texture, the size of the root zone and the potential evaporation. The design tool compute the RWUR and its output is the RWUR as a function of the radius of the root zone(r_r) for different emitter or dripline spacings, depending on the chosen scenario. The program was run for different spacings, it evaluated relative water uptake rate (RWUR) as a function of root zone radius (r_0), and best spacing was selected based on results.

Keywords: Irrigation management, Trickle irrigation, Water use efficiency, Drip irrigation,

ROLE OF SALINITY STRESS ON PHYSIOLOGICAL, BIOCHEMICAL AND YIELD CHARACTERS OF MUNG BEAN *VIGNARADIATA*(L.)**MUKUL KUMAR¹ & UMAKANT SINGH²**

Deptt. of Botany & Plant physiology, M.B.A.C. Agwanpur, Saharsa (B.A.U., Sabour. Bhagalpur, Bihar), Horticulture (Vegetable Science) Department of Horticulture, Regional Research Station, Agwanpur, Saharsa, B.A.U., Sabour. Bhagalpur (Bihar)

Mung beans were first domesticated in India, where they grew as wild plants. Archaeological evidence shows that mung beans were growing in the Harappan civilization. The present study was aimed at evaluating salinity stress tolerance status of the recently released variety. Physiological parameters like membrane injury of leaves and roots, and leaf succulence increased with salinity stress, while converse was true for chlorophyll fluorescence, relative water content, aerial biomass and harvest index. Soluble sugars, amino acids and proline content of fully expanded leaves increased significantly, while protein and starch content decreased with the increasing level of salinity. Number of flowers per plant, stamen length, number of pollen per flower, pollen size and their fecundity, pistil length and number of ovules also decreased with salinity, while the values for percent fertilized ovules remained unchanged. Similar to decline in starch, protein and guar gum content of seeds, seed yield and number of pods per plant also decreased with salinity, thereby indicating deterioration of seed quality.

Keywords--Salinity, Stress, Reproduction, Pollen, Yield, mung bean.

TOLERANCE AND BIOACCUMULATION OF HEAVY METALS (CD AND PB) BY ENDOPHYTIC FUNGI**N.P. NAVNAGE¹*, ASIT MANDAL², VINAY SAMADHIYA¹, J.K. THAKUR², A. SINGH², M.C. MANNA², ASHOK K. PATRA²**¹Department of Soil Science and Agricultural Chemistry, Indira Gandhi Krishi Vishwavidyalaya, Raipur 492012 C.G., ²Division of Soil Biology, ICAR-Indian institute of soil science, Bhopal 462038, MP*

Global modernization, industrialization, urbanization have resulted in increased contamination of our environment by heavy metals. A long persistence of heavy metals in nature has in turn resulted in development of metal resistance microbial strain. Microorganism plays a significant role in bioremediation of heavy metal contaminated soil. In this study, an attempt was, therefore made to test a strain of *Penicillium* Sp. (EN1) isolated from root of *Amaranthus spinosus* spices were collected from contaminated site of Bhanpur Bhopal (MP) has been studied for tolerance to heavy metal (Cd and Pb) and for its capacities to uptake heavy metals. Endophytic fungi were isolated and identified as *Penicillium* sps by morphological and biochemical study. It was found that endophytic fungi capable of surviving on media containing graded level of heavy metal concentration of cadmium and lead. Tolerance ability of fungus to heavy metal was determined by culturing on potato dextrose agar at concentration ranging from 0-20 ppm. The tolerant growth were studied for removal of heavy metal with respect to Cd and Pb which showed the maximum uptake of lead (Pb) of 85.7% and least uptake of cadmium (Cd) of 39.1% at increasing concentration (0-20ppm). This indicated that potential of these endophytic fungi as bioaccumulation of heavy metal from contaminated site containing higher concentration of heavy metals which make them attractive potential candidate for bioremediation agent. The result of this study could provide a basis for exploring the role endophytic fungi for an environmentally friendly and economically feasible decontamination of heavy metal. Finally the result indicated that *Penicillium* could be a prospective candidate to increase the phytoremediation efficiency of plant and play important role in decontamination of pollutant area.

Keywords: Heavy metal, tolerance, bioaccumulation, endophytic fungi, soil contamination

FIELD AND LABORATORY LIFE TABLE OF OKRA SHOOT AND FRUIT BORER (*Earias vittella* FABRICIUS) ON OKRA

N. S. RODE^{1*}, M. F. ACHARYA² AND P. S. WADASKAR²

MGM, NK College of Agriculture, Aurangabad (MH), Junagadh Agricultural University, Junagadh (GJ)

Investigations on life table of *Earias vittella* (FABRICIUS) on okra was carried out at Sagdividi Farm of Junagadh Agricultural University, Junagadh. Field life table indicated that egg stage of contributed 20 per cent mortality mainly due to egg sterility. Key mortality factors operating under field conditions for mortality in younger and older larval group was viral, bacterial and fungal infections and *Cotesia* sp. The value of generation survival and trend index was found 0.44811 and 0.0166, respectively. In immature stages the maximum mortality was recorded during pupal stage while, lest mortality was observed in the older larval group. The age specific life table showed that the survival of *E. vittella* up to 35 days whereas, age specific survivorship decreased from 1 to 5 day. Life expectancy was high in the beginning of the age and remained the same with slight fluctuation up to 13 day. The stage specific life table indicated that maximum values of apparent mortality, mortality survival ratio and indispensable mortality were observed in pupal stage. Whereas, the highest survival fraction was recorded at 4th instar stage. Pupal stage exhibited highest K's value whereas minimum was observed at 4th instar stage. The mean length of generation was 33.01 days with potential fecundity 136.35 eggs per female. Net reproductive rate 68.214, hypothetical F2 female 4653.18 females/ female and intrinsic rate of increase 0.1479 females/ female/ day, finite rate of increase 1.14 and annual rate of increase 2.34×10^{20} were recorded.

PERFORMANCE OF DIFFERENT GENOTYPES OF GAILLARDIA (*GAILLARDIA PULCHELLA* L.) IN RESPECT OF YIELD AND QUALITY ATTRIBUTES

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The present investigation was carried out during the year 2015-2016 at Modibaug garden of Horticulture Section, College of Agriculture, Pune. Significantly more number of flowers per plant was recorded in the genotype MG-2-2 (288.35) followed by the genotypes MG-7-1 (263.23) and MG-9-1 (242.43). The genotypes MG-9-1 and MG-7-2 recorded significantly maximum weight of 100 flowers (333 g). The weight of flowers per plant, yield of flowers per plot and yield of flowers per hectare were recorded significantly highest in MG-9-1 (631.00 g, 12.02 kg and 33.30 tonne) respectively. The Aureolin flower colour was observed in two genotypes viz., MG-4-3 and MG-7-3 two genotypes. The Lemon Yellow flower colour was observed in twelve genotypes viz., MG-3-1, MG-5-1, MG-5-3, MG-6-2, MG-8-1, MG-9-2, MG-10-1, MG-10-3, MG-10-5, MG-12-2, MG13-1 and MG-14-1 genotypes. The Buttercup Yellow flower colour was observed in twelve genotypes viz., MG-1-3, MG-1-4, MG-2-2, MG-3-2, MG-3-4, MG-4-2, MG-4-4, MG-5-4, MG-7-2, MG-8-2, MG-9-4 and MG-12-1 genotypes. The Indian Yellow flower colour was observed in fourteen genotypes viz., MG-2-1, MG-3-3, MG-4-1, MG-5-2, MG-5-5, MG-6-1, MG-7-1, MG-9-1, MG-9-3, MG-10-2, MG-10-4, MG-11-1, MG-12-3 and the Local check. The shape of petals of genotype MG-4-2, MG-5-3, MG-6-2, MG-7-2, MG-10-1 and MG-10-5 of gaillardia had narrow with blunt tip and remaining genotypes had shown narrow with pointed tip. The genotype MG-6-1 and MG-14-1 had dense pubescence. The genotypes MG-2-1, MG-3-1, MG-5-4, MG-7-1 and MG-10-2 had medium pubescence. The remaining 33 genotypes had comparatively low pubescence.

Key words: Gaillardia genotypes yield and quality attributes.

HEALTH ENHANCING PROPERTIES OF ORNAMENTAL EDIBLE FLOWERS

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On a global scale people are demanding for more attractive, tasty and healthy foods. Both quality and aesthetic aspects contribute to the acceptance of foodstuffs. Ornamental edible flowers with high pigment are found to enhance the aesthetic as well as the nutritional value of food. The ornamental edible flowers those which are non poisonous and does not cause any negative reaction in body or in other words edible flowers are those which contains alkaloids showing pharmacological activity. Edible flowers are abundant natural resources found worldwide and most of them contain numerous phytochemicals with health benefits which has attracted more and more attention. The edible flower contains major phytochemicals such as carotenoids, phenolics, alkaloids, nitrogen-containing compounds, and organosulfur compounds. These phytochemicals makes edible flowers as anti-free radical, antitumor and anti-inflammatory and antimicrobial functional foods. The most part of the antioxidants in the edible flowers are pigments such as anthocyanins and carotenoids often present in high concentration. Edible flowers are playing the role of nutrition as they are rich source of nutrients like carbohydrates, proteins, vitamins, minerals, fatty acids, dietary fibres and organic acids. Common edible flowers like *Nelumbo nucifera* (lotus), *Borago officinalis* (borage), *Rosa* spp. (rose), *Crocus sativas* (saffron) and *Taraxacum officinale* (dandelion) for their nutrient content, their

disease curing properties and other uses. Edible flowers are also an excellent source of minerals, especially of phosphorus and potassium. The consumption of crops rich in potassium is recommended for the prevention of cardiovascular or oncogenic diseases. Polyphenols are common constituents of the human diet, present in most foods and plant materials. They are known to contribute to the prevention of various diseases, including cancer, neurodegenerative diseases, osteoporosis and cardiovascular diseases. Many of the ornamental edible flowers were traditionally used to cure diseases. The growing interest in nutraceuticals and functional foods will increase the new foods production are beneficial to health. Exploration of indigenous ornamental edible flowers which may ultimately boost the acceptability of these flowers for health protection also as well as promotion.

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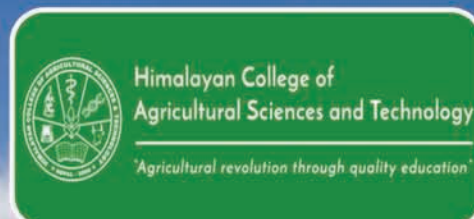


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INTEGRATED WEED MANAGEMENT IN SUGARCANE**NAKKASOWMYA¹ JNANABHARATI PALAI²***M S Swaminathan School of Agriculture, Centurion University, Paralakhemundi, Gajapati, Odisha, Dept. of Agronomy, M S Swaminathan School of Agriculture, Centurion University, Paralakhemundi, Gajapati, Odisha*

Sugarcane (*Saccharum officinarum* L.) is an important cash crop occupies an important position in Indian agriculture. Sugar industry is the second largest agro based industry after textile industry located in rural areas in India. Sugarcane is a long duration crop which takes longer time for germination due to which crop faces tough competition with weeds between 60 to 120 days of its planting which causes heavy reduction in cane yield ranging from 40-67%.. This low productivity is mainly due to heavy weed infestation. Widely spaced crop of sugarcane allows wide range of weed flora to grow profusely in the interspaces between the rows. Frequent irrigations and fertilizer application during early growth phases increase the weeds menace by many folds in the crop. There are several weeds infesting sugarcane fields in India, the predominant among them are *Cyconodon doctylon*, *Cyperus rotundus*, *Echinochloa* spp, *Saccharum* sp among narrow leaved and *Chenopodium album*, *Solanum nigrum*, *Convolvulus aremins* *Trianthema* sp. *Digera arvensis*, *Anagallis arvensis*, *Fumaria* sp. etc. among broad leaved weeds. The intensity of these weeds depends on agro-climatic condition of the region. Research results indicate that more crop-weed competition occurs during early phase of sugarcane growth. Therefore Integrated Weed Management (IWM) is holistic approach to control weeds in sugarcane and enhances the yield.

Keywords: IWM, weeds and productivity.

COMBINING ABILITY STUDIES IN AMERICAN COTTON**(GOSSYPIMUM HIRSUTUM L.)***Nalanda A. P*, Patil B. R., Deshmukh S. B. and Bainade P. B., Department of Agricultural Botany, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola 444104 (M.S.), (RESEARCH PAPER IN AGRICULTURAL BOTANY)*

The Present investigation was carried out to estimate the combining ability effects for various characters in cotton to find out superior cross combinations. Line x Tester model was selected for to study. The 4 females (lines) viz., AK-32, AK-023, AK-053, AK-8660 and 3 males (Testers) viz., AK-780, AK-976 and AK-3614-10 and their 12 crosses were evaluated in Randomized Block Design at the research field of Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* season of 2013. The mean sum of squares due to genotypes were highly significant for all the traits. This indicated the substantial genetic variability among the all genotypes. Among the female parents, parent AK-053 had recorded the highest gca effects for seed cotton yield per plant, boll weight and oil content. From the male parents, parent AK-780 recorded the highest positive gca effects for seed cotton yield per plant and parent AK-976 recorded significant gca effects for days to 50% flowering, seed index, oil content, 2.5% span length and fibre fineness. The cross AK-32 X AK-780 (5.639) recorded highest positive sca effects for seed cotton yield per plant and the cross AK-023 X AK-780 (1.747) recorded significant positive sca effects for 2.5% span length. The cross AK-053 X AK-780 revealed positive sca effect for seed cotton yield per plant and both the parents involved revealed high gca effect for seed cotton yield. Hence, this cross should be tested over locations and years to get clear cut idea regarding its performance.

Key words: Cotton, Line x Tester, General combining ability, Specific combining ability.

LAND USE PLANNING AND THEIR MANAGEMENT**¹NARENDRA KUMAR BHARATI ²SURESH KUMAR SABAL***Department of Soil Science and Agriculture Chemistry, College of Agriculture, MPKV, Dhule- 424004 (M.H.), Department of Entomology, College of Agriculture, SKRAU, Bikaner- 334006 (Raj.)*

Land use planning is a science that determines the type of land use through studying the ecological character of the land as well as its socio-economic structure. It is possible to plan for the appropriate use of the land and to enhance the present management of the land use by utilizing Geographical Information System (GIS). Land-use planning is established based on national economic and social development the demand for land as well as areas of natural, economic and social conditions. It is the leading of the entire land management in their daily planning and management because the outcome of data and file data types are more the number of large follow the conventional manual approach to management and applications can no longer meet the current economic development of the land management needs. It provided the conditions for the establishment of management information systems because of the GIS technologies. Land-use planning and management information system is based on land-use planning for the center, including a number of land-use business management and office automation integrated, space-based information systems. Digital maps were inputted along with explanatory data into an ArcGIS software application. In addition, all digital maps of layers including, elevation, slopes and aspects, soil texture, depth and structure, geology, iso-hyetal, iso-thermal, iso-evaporation, soil erosion, vegetation or canopy percentage, climate and water resources have been integrated- superimposed in the ArcGIS environment

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based on the Makhdoom analytical and systematic analysis model.

Key word:- Land use Planning, Information system, Ecological

RECENT ADVANCES IN POLLINATION MANAGEMENT IN FRUIT CROPS

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India is the second largest producer of fruits, but average national productivity is quite low as compared to other countries. In fruit crops, pollination is mandatory for adequate fruit set and yield because the part of commercial importance is fruit which develops after the process of pollination and fertilization. If there is hindrance at any stage of pollination and fertilization, it would result in poor fruit set and ultimately a total loss of the crop. Most of the fruit crops are self- incompatible and require assisted pollination for optimum production. Proper pollination is not only required for fruit set but also necessary to get fruit of large size and proper attractive shape. In some multi seeded fruits like apple, pear and custard apple *etc.* seed number have a profound influence on both the size and shape of the fruit. There are several approaches to improve the pollination *viz.*, planting of more two or more compatible varieties in same orchard, pollinizer management (10-33% pollinizer or interplanting of two compatible varieties), pollinator management (honey bee and other native bees), hand pollination, top working of pollinizer branches, bouquet pollination, pollen dispenser, avoid the pesticide application during blooming, use of bee attractant pheromones and mechanical pollination through electrostatic duster or handmade duster. Honey bees are effective pollinators in fruit crops. Bee-HereR, BeeScentTM, eugenol, geraniol, citral and lemon grass extract, mainly diluted in water, honeybee pheromones, including the worker nasanov pheromone and queen mandibular gland pheromone were effective in attracting honeybees to orchards. Many pesticides are hazardous to bees. Large numbers of bees may be killed by the application of pesticides while the bees are located in the orchard. Proper pollination management through integrated approach is today's need to fulfil our tomorrow's requirement.

Key words: Fruits, honey bee, orchard, Pollination, Production

EFFECT OF SUBSTRATES, NUTRIENT RATIO AND SUGARS ON YIELD ATTRIBUTES OF *PLEUROTUS* SPP.

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Pleurotus spp. on different grain substrates i.e., wheat, sorghum, barley, oat and bajra were grown in bottles and obtained on 15th day were significantly superior than other grains spawn. Mycelial growth on bajra and sorghum was followed by oat grain barley (76.00 mm) and (75.66 mm). In case of *P. florida*, mycelial growth on jowar was followed by barley and wheat (88.66 mm), but in case of *P. djamor* mycelial growth on bajra (90.00 mm) was followed by wheat (88.00 mm). *The different combination of calcium carbonate and calcium sulphate with different ratio increases spawn growth in both the Pleurotus spp. The maximum spawn growth (90.00 mm) was observed in 0.2:1.5 ratio (CaCO₃:CaSO₄) in P. florida and 0.3:0.9 ratio (CaCO₃:CaSO₄) P. djamor.* *Pleurotus* spp. were grown in five sugars mixed in wheat grain viz. fructose, maltose, sucrose, starch and glucose. The results revealed that among all the five sugars, maximum mycelial growth (90.00 mm) was obtained in glucose on 15th day of inoculation. Followed by maltose (88.00 mm) in *P. florida* and fructose (87.33 mm) in *P. djamor*.

Key words: *Pleurotus* spp.; pH; Temperature; Dry mycelial Weight; Radial growth; Selective medium; Enriched medium.

HETEROSIS STUDIES IN BARLEY (*HORDEUM VULGARE* L.) UNDER HEAT STRESS ENVIRONMENT

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Barley (*Hordeum vulgare* L.) is an important *rabi* cereal crop grown throughout the temperate and tropical regions of the world. The present investigation was carried out to estimate relative heterosis and heterobeltiosis in barley genotypes to identify desirable cross combinations under heat stress for days to anthesis, duration from anthesis to maturity, days to maturity, plant height, number of effective tillers per plant, flag leaf area, number of grains per spike, peduncle length, spike length, 1000-grain weight, biological yield per plant, grain yield per plant and harvest index. The F₁ crosses were made in half diallel fashion using 10 genotypes. The experiment was conducted in randomized block design with three replications during *rabi* 2016-17. The results revealed sufficient degree of heterosis and heterobeltiosis for all the characters studied. On the basis of *per se* performance, heterosis and heterobeltiosis, the crosses RD-2035XRD-2052 and RD-2592XRD-2660 emerged as good cross combinations for grain yield per plant in heat stress environment.

Therefore, it could be concluded that these cross combinations may be exploited in future breeding programme for the development of good heterotic gene pool of barley for improving grain yield and other contributing traits under heat stress environment.

Keywords:-Barley, Heterosis, Heterobeltiosis, Heat Stress.

STUDY ON THE INTEGRATED APPROACH OF FUNGICIDES, BIOAGENTS AND PHYTOEXTRACTS FOR THE MANAGEMENT OF *COLLETOTRICHUM GLOEOSPORIOIDES* CAUSING THE TURMERIC LEAF SPOT DISEASE (IN-VIVO)

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Turmeric (*Curcuma longa* L.) is an important annual herbaceous rhizome producing medicinal plants which is also called as Golden spice due to the presence of yellow colour imparting pigments named as curcuminoids and help in Indian economy by trade policies. Hence study are concerned on the integrated management of turmeric leaf spot disease caused by *Colletotrichum gloeosporioides* under field conditions during 2017-2018 by applying three consecutive foliar spray at 45 days of intervals with fungicides, bioagents and phytoextracts. The significant result was determined by measuring the average of percent of disease index after three foliar spray were recorded with fungicides, Bilitox (50WP) at 0.05% concentration (47.23%), Carbendazim (50WP) at 0.05% concentration (49.51%), and Mancozeb (75 WP) at 0.5% concentration (52.35 %), bioagents *Trichoderma viride* at 3×10^6 cfu/ml (54.23%) and *Trichoderma harzianum* 3×10^6 cfu/ml (57.45%) and with phytoextracts Neem at 20% concentration (60.43%), Garlic at 20% concentration (61.53%), Tulsi at 20% concentration (63.53%) over the control (untreated plants) 68.41%. the above result showed that the fungicides spray gave the highly effective result followed by bioagents and plant extracts as compared to untreated plants.

Key words: Turmeric, Integrated approach, fungicides, bioagents, plant extracts, *Colletotrichum gloeosporioides*.

PRESENT SCENARIO ON STORAGE QUALITY OF POME FRUITS

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Naveen Kumar, M.Sc. Department of Plant Pathology, Dr Y S Parmar UHF, Nauni Solan, **Abhivivek, M.Sc. Department of Entomology, Dr Y S Parmar UHF, Nauni Solan, *Vinay Kumar Kardam, M.Sc. Department of Plant Pathology, SKRAU, Bikaner*

Apples are rarely consumed directly at harvest but are usually stored for periods of up to 6 months to ensure a steady year round supply of high quality fruits. The major losses during this time result from infections with post-harvest pathogens as well as from post-harvest storage disorders such as scald, bitter pit, internal browning and water core. Over 90 different post-harvest phytopathogens have been described in apples, of which the most important are *Botrytis*, *Penicillium*, *Gloeosporium* and *Phytophthora* spp. Post-harvest decay in harvested fruit causes considerable economical losses. Fungicides are the primary means to control these losses. These infections may originate either from the field itself or from within the storage area, and their impact on fruit quality, depends on both pre-harvest as well as post-harvest factors. Post-harvest diseases on pome fruits are generally controlled by chemical treatments applied in packinghouses before fruit storage. Salicylic Acid as a natural and safe phenolic compound exhibits a high potential in controlling post-harvest losses of horticultural crops. Applying fertigation to fruit development phase and soil nitrogen content had a very important influence on fruit quality and storability. Appropriate nutrition supply produced more deeply coloured fruit that maintained their quality after storage for 4 months.

Keywords: Fertigation, pome fruits etc.

APPLICATION OF DOUBLE HAPLOIDS IN MAIZE BREEDING

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Maize is one of the third most important cereal crops after rice and wheat. Uses of corn increases the demand is pushing to develop new hybrids and varieties to new regions or zones, challenging us to deliver specific products as quickly as possible. Doubled haploid technology dramatically increases the speed of the inbred development process by trimming off several time intensive generations of inbreeding, while making phenotyping and genotyping more predictive. This allows us to do more testing in the same amount of time to increase the rate of genetic gain and ensure that the products we advance are the best possible choices for our customers. Doubled haploids can be produced *in vivo* or *in vitro*. *In vivo* is tissue culture method but chance of more risk. Haploid embryos are produced *in vivo* by non occurrence; mainly two types of *in vivo* haploid can be differentiated in maize, and will lead to maternal and paternal haploids, respectively. For haploid induction *in vivo*, two genotypes are required a donor and an inducer. After pollination of the donor genotype with inducer pollen, the resulting offspring will typically consist of 90% hybrids and 10% haploids. In order to identify haploids, a system of dominant anthocyanin *R1-nj* selectable marker genes is used, as described by Nanda and Chase (1966). The inducer is

homozygous for the dominant marker gene *R1-nj*. When crossed with non-pigmented donors, it leads to a purple scutellum and a “purple crown” of the aleurone of F_1 kernels. *R1-nj* causes a colored endosperm and a colored embryo. If double fertilization has occurred, both endosperm and embryo are colored and the embryo is a diploid hybrid between donor and inducer. If the pollen only fertilizes the endosperm, while the egg cell remains unfertilized, the endosperm is colored and the embryo is colourless and haploid. If only the embryo is fertilized, then there will be no endosperm covering the seed, rendering the seed unable to survive. Self pollination results in a colourless embryo and colourless endosperm, depending on the parent plant. These two characteristics are used as embryo and endosperm markers, respectively. From the haploid methods we can maximum genetic variance in line *per se* and testcross trials, high reproducibility of early-selection results, high efficiency in stacking targeted gene arrangements, simplified logistics and high cost-savings are possible due to reduced expenses for the selfing program, handling and shipping of seed batches, and for maintenance breeding.

Keywords: Hybrids, varieties, Doubled haploids and Selectable marker.

IMPORTANCE OF MAIZE LANDRACES IN CROP IMPROVEMENT FOR CLIMATE CHANGE

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Maize (*Zea mays* L.) is not only of worldwide third most important crop after wheat and rice and used as a food, feed and as a source of diverse industrially important products, but is also a model genetic organism with immense genetic diversity. Maize landraces remain deeply intertwined into the traditions and cultures of many of the world's rural communities and in India especially North Eastern Hill (NEH) regional states. However, due to recent new variety development activities resulting from the “Green Revolution”, landraces are in serious jeopardy of being totally lost within the next 50 years. The reduced use of landraces can be traced back to the beginnings of the “Green Revolution”, when there was a substantial worldwide increase in the use of new modern cereal crop varieties that provided increased productivity compared to the varieties that were currently in use that had limited genetic improvements, but recent climate changes effect the plant growth and development leads miner disease and pest become major, biotic stress decrease the yield and difficult feed increasing population. Mitigating this problem is to search source of resistance that's best and cheapest is landraces. Although it was first domesticated in Mexico, maize landraces are widely found across the continents. Several studies in Mexico and other countries highlighted the genetic variability in the maize germplasm. Recommended climate change adaptation strategies include farmers increased use of heat and drought stress-tolerant maize. Farmer adoption of improved germplasm has been disappointing because of inefficient seed input chains and farmers preference for landraces for culinary, agronomic and cultural reasons. Scientists have tended to overlook the fact that maize landraces have a critical role to play in climate change adaptation. Landraces may already exist that are appropriate for predicted climates. Furthermore, within the primary gene pool of maize and its wild relatives there exists unexploited genetic diversity for novel traits and alleles that can be used for breeding new high yielding and stress-tolerant cultivars. The breeding component of adaptation strategies should focus more on improving farmers' landraces.

Key words: Genetic diversity, Germplasm, Green Revolution and Adaptation.

INNOVATIVE TECHNOLOGIES FOR SUSTAINABLE IPM

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Integrated pest control is a pest management system that, in the context of associated environment and population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible manner as possible and maintains pest populations at levels below those causing economic injury. The modern concept of pest management is based on ecological principles and involves the integration and synthesis of different control tactics into a pest management system. Integrated pest management (IPM) in turn is a component of the agro ecosystem management technology for sustainable crop production. The zero or reduced tillage system in rice-wheat cropping sequence (RWCS) is relatively a new concept which entails adoption of wheat sowing method that involves direct drilling of wheat seeds into rice residues after the harvest of rice crop. It has influenced the species diversity, status, biology, ecology and carry-over of insects and beneficial species. To manage insect pests in an eco-friendly manner, a pest-suppressive agro-ecosystem has to be considered which is designed by identifying a suitable intercrop having insect pest deterrence, and a border crop enhancing natural enemy activity by acting as a refugium. Thus, crop diversification can be effectively integrated with bio intensive IPM packages. The development of pest control methods that can minimize the use of pesticides is required for pest management. Furthermore, use of pest-resistant crops and varieties, pest repellent plants, adoption of cultural practices that prevent buildup of pests, use of cropping system such as crop rotation, intercropping, etc., and the use of bio pesticides and semiochemicals, etc. can be used for pest control.

Keywords: IPM, Pest, Insect

AEROPONICS: AN ADVANCED APPROACH FOR SOILLESS VEGETABLE PRODUCTION**NAVJOT SINGH DHILLON*, PARVEEN SHARMA, PARDEEP KUMAR AND PALVI MEHTA***Department of Vegetable Science and Floriculture, Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176062*

The word "aeroponic" is derived from the Greek word "aero" means air and "ponos" means labor or work. The roots hang in the air and are misted with nutrient solution. The misting is usually done every few minutes. There are many advantages of growing plants aeroponically. Here nutrients are fed directly to the roots, as a result plants grow faster with smaller roots, plants may be grown closer, only 1/5th of overall space and 1/20th of total water is needed to grow plants under aeroponics in comparison to soil-based culture. There is no chance of soil-borne insect-pest, disease attack or weed infestation too. Aeroponic culture provides efficient nutrient regulation, higher density planting, and leads to increase yield having 6 to 7 times more output than conventional greenhouses production along with better quality of the produce. The industry is expected to grow exponentially in future, as conditions of soil growing is becoming difficult. Specially, in a country like India, where urban concrete conglomerate is growing each day, there is no option but adopting soil-less culture, help to improve the yield and quality of the produce so that we can ensure food security. However, government intervention and Research Institutes interest can propel the use of this technology.

Keywords: aeroponic, soilless, yield, quality, food security

PROTECTED VEGETABLE CULTIVATION: A GOOD OPTION FOR DOUBLING THE FARMER'S INCOME**NAVNEET SINGH AND RAVINDER SHARMA***Department of Social Sciences, Dr Y S Parmar University of Horticulture & Forestry, Solan- 173 230, Himachal Pradesh, India*

Vegetables play a major role in Indian economy by producing higher returns per unit area and time, besides, providing nutritional and economic security. Vegetables have higher productivity, shorter maturity cycle, better crop diversification and intensification, high value and provide greater income leading to improved livelihoods. By providing better employment opportunities to family labour, vegetables solve the problem of disguised unemployment of Indian farmers. Production of vegetables under protected conditions involves protection of production stages of vegetables mainly from adverse environment conditions such as temperature, hail, scorching sun, heavy rains, snow and frost. The primary data were collected by personal interviews of the selected farmers with the help of a specially designed schedule. Simple statistical tools like averages and percentages were used for processing the data. An attempt was made to study the comparative economics of tomato and capsicum cultivation under protected and open field conditions in Solan district of Himachal Pradesh. Comparative economics analysis revealed that the cost of cultivation of capsicum under polyhouses were higher as compared to open field conditions by Rs. 20755.63/250 m², Rs. 34769.90/500 m². The net returns from capsicum under protected conditions, were higher as compared to open field conditions Rs. 246.94/250 m², Rs. 15792.38/500 m². The net returns from polyhouse cultivation worked out Rs. 1725.64/250 m² and Rs. 12907.68/500 m² more as compared to open cultivation of tomato. The results of the study revealed that the vegetable cultivation under polyhouses have contributed to the yield significantly and increased in income of farmers.

GENETIC RESOURCES AND ADVANCES IN GENETIC IMPROVEMENT OF SEED SPICES*** NAVNEET SINGH, SHAUNAK SINGH, RAVI PRATAP SINGH***Department Of Vegetable Science, N. D. University Of Agriculture & Technology, * Kumarganj, Faizabad (U.P.),*

Spices are those plants, the products of which are made use of as food adjuncts to add aroma and flavour, while condiments are those plants, the products of which are used as food adjuncts to add taste only. India is the largest producer, exporter and consumer of spices in the world. India is often referred as "land of spices". This is because many of the spices grown in the world are native to India. Spices cover an area of 3535 M ha with production of 7077 M tonnes all over India (Anonymous, 2017) Seed spices are annual herbaceous in nature. These are used as whole or ground form, mainly for flavouring and seasoning of food. The seed is commonly used as traditional medicine for treatment of congestion of upper respiratory passages, colic, flatulence, dysentery, diarrhoea, chronic cough, and enlargement of liver and pharmaceutical preparation. Major seed spices are Fenugreek (*Trigonella foenum-graecum* L.), Coriander (*Coriandrum sativum* L.), Cumin (*Cuminum cyminum* L.), Fennel (*Foeniculum vulgare* Mill.) and Ajwain (*Trachyspermum ammi* L.). Most of seed spices are cross pollinated in nature except Fenugreek. Among seed spices Coriander grown on largest scale in India followed by cumin, fenugreek, fennel and ajwain. Rajasthan is the leading state in production of seed spices, while Madhya Pradesh has maximum area under seed spices.

STUDIES OF TRANSITION METAL COMPLEXES AND THEIR BIOLOGICAL EVALUATION**NEELAM KUMARI AND PRATIBHA***Department of chemistry, Meerut College, Meerut, U.P. India, Department of Chemistry Mewar University Gangrar Chittorgarh 31290 Rajasthan, India*

A novel series of macrocyclic ligand of Cu II were synthesized by using condensation reaction between macrocyclic ligand and corresponding transition metal salts. The Cu II complexes $[CuLx_2]$ where $L = N_4$ donor macrocyclic ligand and $X = Cl^- NO_3^-$ and $(CH_3COO)^-$ have been synthesized and characterized by elemental spectra. The molar conductance measurement of crown ether complexes of ligand LF and LG show that complexes are in 1:2 electrolytes in nature and may be formulated as $[Cu(L)]X_2$ where $L=LF$ & LG. The biological activity against different plant pathogenic fungi has been evaluated. The EPR studies suggest the tetragonal geometry for all the chloride, nitrate and acetate complexes with all the seven ligand.

KEYWORD : Tetra aza macrocyclic complexes . Spectral data, Metal Complexes, Synthesis antifungal activity.

A SURVEY ON SMALL FARMER PEST CONTROL PRACTICES FOR WATERMELON IN ALLAHABAD DISTRICT, U.P.**NEELAM YADAV AND NEERJA AGRAWAL***Department of Entomology, Chandra Shekhar Azad Univ. of Agri. & Tech., Kanpur (U.P.)*

In response to increased pest problems, small farmers use pesticides against production of watermelon crops, which could rise environmental and health concerns. An intensive survey was conducted in four villages of Allahabad viz., Mundera, Jhalwa, Peepalgao and Rajapur in year 2016. 60 farmers were interviewed about the type of sprayer and pesticides they use in fruit cultivation and the frequency of applications. Use of personal protective equipment was low. Out of total respondents of farmers from the different villages of Allahabad district, the types of pesticides used in watermelon were insecticides (50%), biopesticides (45%) and conventional practices (5%). This paper assesses the potential risk of pesticide use by smallholder farmers in the Allahabad district, Uttar Pradesh by examining pesticide usage, application methods, pesticide drift and health effects among farmers with different levels of income and market access.

Key words: Farmer, Allahabad, Pest control, Watermelon, Insecticides

ROLE OF TECHNOLOGY ADOPTION ON MARIGOLD PRODUCTION THROUGH FRONT LINE DEMONSTRATION**NEERJASHARMA¹, DEEPSHIKHA², VINOD GUPTA, SANJAY KHAJURIA, AMIT GUPTA AND SHALINI KHAJURIA³***^{1&3} K. V.K Samba, SKUAST-Jammu. ²Department of Agriculture, Jammu.*

Marigold is one of the important commercial crop among floriculture supplementing the regular income to small and marginal farmers of the Kathua district of J&K state. Jammu being a city of temples consumption of flowers is more, but as compared to consumption production is very less. However, the major constraints of marigold cultivation are low productivity due to the lack of good quality seed, non adoption of recommended package of practices and lack of awareness regarding the economics of the crop as compared to cereals. To solve this problem, front line demonstration were conducted at the farming situation of Kathua district with the participation of farmers after the baseline survey. Front line demonstration is an applied approach to demonstrate technologies among the farmer. The cultivation practices in this FLD (use of improved variety, proper nursery techniques, balance dose of fertilizers, important inter-culture operations and plant protection measures) increased the yield by 53.78 percent on an average over the farmer practice. The highest extension gap was 72.75q/ha while the technology index, which is inversely correlated to the feasibility of the improved technology in the farmers field was 24.3 percent. The adoption of improved technology under FLDs resulted in higher gross returns (Rs 728000/ha), net return (Rs 643517/ha) and benefit:cost ratio (1:7.61) as compared to farmer practice.

CURRENT PROSPECTS FOR THE USE OF BOTANICALS IN INTEGRATED PEST MANAGEMENT**NEERJASHARMA¹, DEEPSHIKHA²***¹ K. V.K. Samba, SKUAST-Jammu ²Department of Agriculture, Jammu*

Botanicals have been in use for a long time for pest control. A product of species co evolution, these compounds offer many environmental advantages. However, their uses during 20th century have been rather marginal compared with other bio-control methods of pests and pathogens. Overdependence on chemical pesticide in pest control has brought the problems like (1) pest resistance to pesticides (2) resurgence of pests (3) toxic residues on food, water, air and soil, (4) elimination of natural enemies and disruption of the ecosystem and minor pest assuming major status. On the other hand, use of botanicals offer a good alternative to manage the insects pests and diseases in an eco-friendly way. Because they are naturally occurring, high specificity to target pests, no adverse effect on beneficial insects, resistance development to them is slow or less common and no environment hazards. Due to the above reasons the role of biopesticides and bioagent is considered as a potent and reliable tool in IPM to manage insects pests. The insecticides of plant origin

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extracted from seeds, flowers, leaves stem and roots are termed as botanical insecticides. Nicotine, rotenone, sabadilla, ryania, neem based products and toosendanin are more important botanicals. In addition to that efforts are being made to make phytochemicals from annonin, citrus limnoides, karanj and Mahua. Botanical pesticides exert a range of behavioural and physiological effects on the colonization, development, growth, survival and multiplication of insects. The toxic principles in these botanicals are mostly alkaloids, heterocyclic nitrogenous compound with marked physiological activity. Botanical pesticides can be integrated with the use of parasitoids and predators, microbial pesticides and even synthetic chemical pesticides to achieve greater efficiency in pest control. However, bio-pesticides and natural enemies of pests are likely to play an important role in IPM in modern agriculture for controlling pests of vegetables and fruit crop in near future beside grain crops as well as in conserving environmental quality.

SERICULTURE FARMING: MONEY SPINNER FOR FARMERS

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Silk is the most elegant textile and known as the "Queen of Textiles" all over the world. Silk has been intermingled with life and culture of the Indians due to rich and complex history in silk production and its silk trade dates back to 15th century. India's traditional and cultural elements in the domestic market and an amazing diversity of silk garments (a look and feeling of grandeur that no other cloth can equal) that reflect geographic specificity have helped the country to achieve a leading position in the silk industry. Sericulture industry provides employment to approximately 8.51 million persons in rural and semi-urban areas in India during 2016-17. Of these, a sizeable number of workers belong to the economically weaker sections of society, including women. A successful silk industry will attract investors and private entrepreneurs subsequently making significant contributions to the national economy. Therefore, it provides livelihood opportunity for million persons owing to high employment oriented, low capital intensive and remunerative nature. Due to its significant importance and usefulness, many attempts have been done in various parts of the world for the extensive production of silk. Scope for frequent cash accrual round the year has brought mulberry sericulture to a comparable level with other agricultural cash crops grown in the similar agro-climatic condition. Now it has become a highly remunerative agro-based cottage industry, combining both agriculture and industry, the final product is silk. Besides meeting the domestic demand, silk is also exported in various forms and now this sector is important foreign exchange earner in India.

Key words: Employment, national economy, remunerative, sericulture, silk industry

PHOSPHORUS DEFICIENCY A THREAT TO SOIL

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Phosphorus is referred to as the "king-pin" in Indian agriculture and also as "energy currency" of the plants. P is second essential growth limiting macro-element next to nitrogen as an inorganic nutrient required by both plants and microorganisms. Relative abundance of P ranks 10th after O, Si, Al, Fe, Ca, Na, K, Mg, Ti in earth's crust. Phosphorus is taken up from the soil solution by plant roots mainly as primary orthophosphate ions (H_2PO_4^-) and secondary orthophosphate ions (HPO_4^{2-}). However, only a minute fraction (0.02 to 0.10%) of total phosphorus is present in soil solution with concentrations 0.1 to 1 $\mu\text{g/g}$ at any one time. 0.5-10% is in the readily available pool capable of releasing P to the soil solution and more than 80% of P is immobile in fixed portion adsorbed as Fe/Al/Ca hydroxide complexes generally known as "initial reaction products" which are slowly soluble and is not available for utilization by plants due to adsorption, precipitation or conversion to organic form. Phosphorus deficiency is widespread in the Indian as well as world soils and estimates forecast for no P-reserves by 2050. Hence, the limiting levels of available P necessitates the use of commercial fertilizers to supplement P for crop production to ensure food security in India as well as worldwide. Hence, we require the development of new techniques that enable the use of some indigenous, cheap, organic and sustainable P sources like rock phosphate being classified as low, medium and high grade with <25%, 25-30%, >30% P_2O_5 respectively. PGPRs used as biofertilizers along with RP are the best alternative to chemical fertilizers as they reduce the cost of crop production and are eco-friendly. Organic acids like citric, oxalate, malate and tatarate, gluconic, fulvic, humic accelerates the phosphate dissolution rates. Low-grade RP could be directly applied to soil as a source of P to crop plants along with acidifying materials such as elemental sulphur (S), pyrites, gypsum, etc. Enrichment of biogas sludge and soil with RP can be used as an efficient and cost effective phosphate fertilizer for different crops in acid as well as alkaline soils. Fertilizers alone cannot solve the purpose of fulfillment of plant needs as their over usage leads to high runoff losses causing degradation of water reservoirs mainly through eutrophication posing a threat to sustainable crop production. The GPS/GIS-based soil fertility mapping can enhance the judicious use of P fertilizers by preventing their over and under usage.

Keywords:- Rock phosphate, Phosphorus fixation, organic acids, PGPRs etc.

INHERITANCE OF WHITE RUST RESISTANT IN LOCAL GERMPLASM OF BRASSICA JUNCEAL.**NEHA DAHIYA*, RASHMI, RAM BHAJAN AND USHA PANT***Department of Genetics & Plant Breeding, College of Agriculture, G. B. Pant, University of Agriculture & Technology, Pantnagar, Uttarakhand-263145*

Brassicas are important source of vegetable oils in the Indian continent as well as in the world by contributing 15% to the total oilseed production. The yield of this crop suffered due to various abiotic and biotic stresses out of which White rust can capable of causing 50 to 89.8 % losses. Most of release cultivars are defenseless to this disease. The chemical control has not been found much effective. Therefore, cultivation of disease resistant varieties seems to be the most practical and affordable means to combat against this disease. Some sources of resistance have already been identified however; the hereditary control for white rust isn't completely comprehended (Thakral and Singh, 1986). Information on the nature and mode of inheritance of genes controlling resistance and their stability under various agroclimatic conditions is imperative for effective utilization of genetic resistance against diseases in the breeding programme (Chauhan and Sharma, 2001). In the present study, newly developed white rust resistant line PWR-15-8 was crossed with two susceptible varieties RGN-73 AND PM-25 to generate 2 families for comprehending inheritance of white rust resistance in the PWR-15-8. Results showed that all the plants in all the F_1 s were resistant and resembled the resistant line used as P_1 (PWR 15-8), suggesting that resistance in this line is a dominant trait. The distribution of resistant and susceptible plants in F_2 generation gave a segregation of 3 resistant: 1 susceptible plants, indicating thereby that the resistance is monogenically dominant over susceptibility. As expected the observations on back crosses of F_1 s with their respective susceptible strains (BC_2) showed segregation of 1 resistant: 1 susceptible plants, while all BC_1 plants were resistant. These results confirm the single gene control of white rust resistance in PWR 15-8.

PROSOPIS CINERARIA A LIFELINE TREE OF DESERT ECOSYSTEM**NEHA SAINI AND KAJAL MEHTA***Dept. Offorestry, CCS Haryana Agriculture University, Hisar 125004, India*

Agriculture system is fragile in the arid regions and mostly dependent on rainfall. Generally the soil in the region are poor in fertility status and low in organic matter. Traditional farming with the trees or agroforestry (combination of trees, crops and pastures) with suitable selection of tree species such as nitrogen fixing trees or multiple tree species will help in adding organic matter and improving fertility status of soil. Such a tradition of cultivating trees has been practiced in western Rajasthan since historic times. One such tree, Khejri (*Prosopis cineraria*) is an indigenous tree of tropical dry and thorn forest of North western parts of India. The tree is also called King of Great India Desert due to its multiple benefits in conserving the fragile desert ecosystem. Though the tree is present in scattered form in arid environment, it is beneficial to maintain tree density of 100- 200 trees per hectare that can increase crop yield by 15- 20 percent compared to sole crop. The tree is lopped for fodder and fuelwood. Lopping practices in winter helps for winter crops. *P. Cineraria* provides fruit of 350- 1040 kg / tree used as vegetable. In addition, *P. cineraria* provide utilizable biomass of 20 Mg per ha (tree density 208 tree/ ha). Including leaf fodder of 1 Mg/ha per year when fully grown. In the light of present day situation, it can be said that Khejri tree serves as 'island of fertility' in an ecosystem where resources are very much limited. Thus, more attention should be focused on saving the 'Lifeline tree of desert ecosystem' for evergreen agriculture productivity and livelihood security

Keywords: *Prosopis cineraria*, King of Indian desert, agroforestry tree,

GRAFTING IN VEGETABLE CROPS**NEHA VERMA^{*1} AND JYOTI VERMA^{*2}***¹ Department of Vegetable Science, PAU Ludhiana Punjab 141004, ²Department of Floriculture and Landscaping, PAU Ludhiana Punjab 141004*

Grafting is a method of propagation, done by utilizing selective rootstock and scion combinations to develop as a single plant for tolerance against biotic and abiotic stresses that directly influences the production of vegetable crops. In addition, grafted plants may have higher yields, improved tolerance to environmental stresses such as high boron, soil salinity and low soil temperatures even in off season (Oda M, 2007). It is a rapid alternative means to the moderately slow breeding methodology. Additionally, the availability of efficient grafting machines and grafting robots can increase grafting speed, increase the survival rate of grafted plants and ultimately encourage cultivation of grafted vegetable worldwide (Lee and Oda, 2003). In spite of its advantages, there are some problems associated with grafting. These include the additional cost, graft incompatibility that commonly appears to cause physiological disorders, reductions in yield, fruit quality and flower formation. Using resistant rootstocks (hybrids), cultivated species and other wild species of the same genera resistant to *Meloidogyne spp.*, *M. incognita*, *M. arenaria* and *M. javanica* have been successfully used. Resistant rootstocks of tomato 'LAO-7002', 'LAO-7003'; of pepper 'LINEM' and wild species *Solanum torvum* were identified (Gonzalez *et al.*, 2008) as resistant to *Meloidogyne spp.* Initiating or increasing the use of grafted plants should be done only after the benefits and risks of grafted seedlings have been fully understood (Edelstein, 2004).

Key words: Grafting, advantages, problems, vegetable crops.

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION

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Although, India is endowed with rich and vast diversity of natural resources, particularly soil, water, weather, multipurpose trees and agro bio-diversity. The extremes stress on these resources leading production fatigue, poor resource-use efficiency and countries rich and bountiful biological endowment is showing sigh of stress. The major issue which directly or indirectly affecting the agricultural production system sustainability are identified as follows: shrinking land resources, water scarcity, low input use efficiency, soil organic matter depletion, loss of biodiversity, salinity and alkalinity, multiple nutrient deficiency, negative nutrient balance and low fertilizers use efficiency, waterlogging, industrialization and intensification of agriculture and global climate change. Therefore, it is important to preserve these agriculturally valuable resources, so that they continue to be useful under prevalent biotic and abiotic pressures. An integration of modern tools and techniques like conservation agriculture (Bed planting, Paddy transplanter and laser land levelers), Fertigation, Organic farming, crop-diversification strategies, precision farming, site-specific nutrient management, bio-intensive farming (Raised beds, Broad bed and furrow, furrow irrigated raised bed, intensive planting, intercropping, composting, companion planting and whole energy system) and farming system research approach have shown promise to enhance resource-use efficiency on the one hand and to conserve valuable resources on the other. The ICT-based options like GIS, Remote Sensing and Nutrient Experts[®] has powerful tools for managing resources in spatial, temporal and location specific mode. The natural resource in the country needs its appropriate and scientific use.

Key words: Resources use efficiency, Soil and Water Resources, Conservation Agriculture, Precision Farming & Bio-intensive Farming.

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH

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Doubling the Farmers income by 2022, would require some specific policy and institutional reforms that take into account identification and targeting of low income farmers particularly from the regions where the required infrastructure for overall agricultural development is lacking. The low income and increasing disparity between income of a farmer and non- agricultural worker (almost double) is one of the reasons for agrarian distress. The low and highly fluctuating farm income is detrimental to growth of farming and further farm investments, and forces the cultivators to leave farming. Therefore it is very crucial to understand the income dynamics of the farm households so that various strategies can be devised to improve farmers' income. Inflation in agricultural commodities will lead to double the farmers income in the nominal terms in much shorter period but Government's intention appears to double the real income of farmers. Many new initiatives have been taken by the Government for increasing the farmers' income such as: i) "per drop, more crop", ii) availability of quality seeds, iii) soil test based nutrient management, iv) post-harvest crop losses- large investments in warehousing and cold chains, v) value addition by the farmers, vi) creation of a national agricultural market and having e-markets to link farmers to market, vii) Pradhan Mantri Fasal Bima Yojana, viii) high priority to diversification towards high value activities horticulture, dairying, food processing, poultry, sericulture, bee keeping and fisheries, etc. The strategy to double the income would demand sustainable intensification, diversification, improved resource use efficiency and resilience in farming that is economically rewarding. There is every possibility not only to double the income of farmers through enhancement in productivity, changes in cropping pattern and inspire additional income through supplementary activities but also provide stability in farmers income.

Key words: Farmers income, agricultural development, intensification, diversification, value addition

MATING DISRUPTION: MECHANISM AND CONSTRAINTS

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Male moths generally find their mates by following the females' pheromone plume to its source. Mating disruption consists of deploying dispensers of synthetic sex pheromone in crop areas to decrease the likelihood of a male finding a calling female, thereby preventing the occurrence of mating and egg fertilization. But the principal mechanism of insect mating disruption not understood so far. Mechanisms of mating disruption closely align with those established for enzyme inhibition, falling into two major categories-competitive and noncompetitive. Competitive mechanisms include competitive attraction, induced allopatry, and induced arrestment. Non-competitive behavioral mechanisms include camouflage of the female plume. Desensitization of males via either sensory adaptation or habituation, and sensory imbalance caused by interference with the male's ability to perceive the pheromone plume. Under Noncompetitive disruption, males, females, or the signal from females are already impaired when sexual activity commences. Hybrid profiles are

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possible when some males within the population begin the activity period already incapacitated, while those not pre-exposed have the capacity to respond either to traps or pheromone dispensers. Variety of pheromone-dispensing technologies in mating disruption has been developed over the years, and many of them have shown promise and success in the market. Mating disruption products have been developed for more than 20 insect species and are used on more than 750,000 hectares world, however Codling moth (*Cydia pomonella* L.) and oriental fruit moth (*Grapholita molesta* Busck) have gained the most attention.

Key words: Arrestment, competitive, inhibition, male, mating disruption

PRESENT STATUS OF IPM PROGRAMMES IN INDIA: CHALLENGES AND PROSPECTUS

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Insect pests are well recognized as one of the major limiting factors in enhancing and sustaining agricultural production in India. Recent improvements from research brought considerable change in the cropping systems and allowed farmers to grow several crops throughout the year, which were very seasonal in the past. This also brought significant shift in the insect population dynamics and change in the status of several insect pests. Recent data revealed that 93% of the farmers in India had adopted chemical control, 51% farmers get their plant protection advice from dealers, while 22% from extension officials and majority of the farmers (73%) initiate the plant protection based on the first appearance of the pest, irrespective of their population, crop stage, and their damage relationships. The cost of plant protection on various crops ranged from 7 to 40% of the total crop production cost. Though integrated pest management (IPM) has been advocated for the past two decades, only 3.2% of the farmers adopted IPM practices in various crops. IPM research in the past decade brought out changes in the farmer's attitude in pest management, which results 100% reduction in pesticide use in different crops. The recent farmer participatory approach working in a consortium mode proved very effective in the exchange of technology. Though the results are encouraging, there is a need to further strengthen the IPM adoption in Indian agriculture through increased investments in both basic as well as applied research in plant protection to overcome the prevailing three evil "Rs" (Resistance, Resurgence, and Residues). To be more effective, readdressing the policies for encouraging eco-friendly options and strengthening extension, involving farmers should be considered as high priority.

POST HARVEST TOOLS AND MACHINES FOR PEPPER AND TURMERIC

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India is origin of seed spices and condiments. It is the country which act as the outlet for the spread of spices to the whole world. A wide variety of spices are grown in India which are consumed within as well as exported to other countries. But the manhandling of the harvested produce as well as lack of proper processing leads to large amount of losses and degraded quality. The harvesting and post-harvest practices followed in seed spices are unhygienic which results in contamination of the products with foreign matters like stalks, dirt, sand, stem bits etc. The seeds are separated by beating the harvested and dried plants with bamboo sticks or rubbing the plants manually by hand or trampling under the feet of the cattle. In order to make the harvesting as well as the processes followed thereafter easy, time saving and cost effective various technological machines and tools have been invented. Traditionally pepper berries were separated from the spikes by trampling under the feet which is unhygienic and labour intensive. To overcome this the pepper threshers are used which are mechanically operated, labour saving and separates berries in a hygienic way. Fresh turmeric is cured for obtaining dry turmeric. Curing involves boiling of fresh rhizomes in water and drying in the sun. Over cooking spoils the colour of the final product while undercooking renders the dried product brittle. In conventional curing where the rhizomes are boiled in copper or galvanised iron or earthen vessels there are chances for overcooking or undercooking. Improved scientific cooking involves using boilers and perforated trough made of GI or MS sheet extended with parallel handle. This ensures optimum cooking of turmeric, which provides better colour and quality to the final produce. Dried turmeric has a poor appearance and rough dull colour outside the surface with scales and root bits. The appearance is improved by smoothening and polishing the outer surface by manual or mechanical rubbing. Manual polishing is done by rubbing the dried turmeric on a hard surface or trampling them under feet by wrapping in gunny bags. Manual polishing is an unhygienic practice, which affects quality of the product. The improved method of polishing turmeric is by using hand operated / power operated polishers. This ensures hygienic and effective polishing which gives better appearance to the product. Hence it is proposed to popularize the practice of using improved polishers for polishing turmeric.

Key words : Post harvest, pepper thresher, turmeric boiler, turmeric polisher

STATUS AND PROBLEMS OF BEEKEEPING IN BAGHPAT DISTRICT OF UTTAR PRADESH**NITIN KUMAR NAG¹, LALIT KR. VERMA² AND PUKHRAJ SINGH³***Deptt. Of Ag. Economics, J.V. College Baraut Uttar Pradesh - 250611, Deptt. Of Ag. Economics, J.V. College Baraut Uttar Pradesh - 250611*

Beekeeping as a village industry is of considerable importance but in study area it requires a lot of improvement in apicultural as well as in agricultural practices. Most of the beekeepers are facing problems due to lack of knowledge of bee management technology and related skills. This small cottage industry may be called in infancy in Baghpat district of Uttar Pradesh. Crop diversification, which can provide continuous succession of blooming bee forage, is urgently required. There must be a regional bee research and training centre to provide guidelines against threats to beekeeping like varroa mite and other serious bee diseases. Honeybees not only play a vital role in pollination of various crops but also provide honey, bees wax, royal jelly, propolis and bee venom which is useful products from medical and commercial point of view. So beekeeping is the practice of keeping and manipulating honey bees, which contribute immensely to the welfare and economy of mankind. Success of this small cottage industry depends upon planned bee management technology. Before developing an infrastructure for beekeeping in particular vicinity, it is important to recognize the problems to be faced during and after the establishment of bee keeping industry.

Keywords: Apis mellifera, Beekeeping, Bee behaviour, pollination and Queen rearing.

EFFECT OF TEMPERATURE ON MORPHOPHYSIOLOGICAL TRAITS WITH RESPECT OF GRAIN YIELD OF BASMATI RICE**NITIN MAURYA, O.P.SINGH, S.N.SINGH, AND PAWAN GAUTAM***Department of Crop Physiology, C S Azad University of Agriculture and Technology Kanpur, Uttar Pradesh, India*

The field experiment was conducted at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.), during kharif season 2016 and 2017. The design in split-plot with three replication and three dates of transplanting i.e., first date of transplanting (D1), second date of transplanting (D2) and third transplanting (D3) conditions were allocated in the main plots and four basmati rice varieties V1 (PB-1), V2 (PB-1509), V3 (PB-6), and V4 (PB-1121), in sub plot. The significantly higher to plant height in cm first date of transplanting i.e., (D1) with 31.35 and 32.87 cm at 30 DAT, 72.79 and 73.36 cm at 60 DAT, 90.80 and 91.04 cm at 90 DAT, 99.20 and 98.46 cm at harvest stage (DAT), while minimum in third transplanting date (D3) with 20.37 and 21.56 cm at 30 DAT, 64.28 and 65.82 cm at 60 DAT, 81.32 and 82.91 cm at 90 DAT, 89.46 and 91.11 cm at harvesting stage of concerning years respectively. observed significantly higher plant height with variety V4 i.e., 28.30 and 29.48 cm at 30 DAT, 74.37 and 75.61 cm at 60 DAT, 91.86 and 92.40 cm at 90 DAT, 102.25 and 103.02 cm at harvest DAT followed by variety V1 with 26.90 and 28.60; 69.12 and 70.43; 87.84 and 89.10; 96.23 and 97.39 cm meanwhile, minimum in variety V2 with 23.17 and 24.08; 63.05 and 63.89; 78.97 and 80.72; 83.89 and 85.10 experimentation, respectively.

Keywords: Condition, rice, transplanting and variety.

GROWTH AND PRODUCTIVITY OF BARELY (HURDIUM VULGARE L.) AS AFFECTED BY SOWING METHODS AND NITROGEN FERTILIZER LEVELS**OLA Z. EL-BADRY AND EL-SAYED M. GHEITH***Faculty of Agriculture, Cairo University, Egypt Department of Agronomy, *Corresponding author: Ola Z El-Badry*

Growth and productivity of barely (Hurdium vulgare L.) as affected to two sowing methods (drilling and broadcasting) and three nitrogen levels, i.e. 60, 80 and 100 kg N/fed. (one feddan = 4200m²) were studied at the Agricultural and Experimental Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt during two successive winter seasons 2015/2016 and 2016/2017. The experiments design was split-plot in randomized complete block design in four replications. Results indicated that both of sowing method and nitrogen levels significantly affected all growth characters, except leaf area index in the second season, as well as grain yield and its related favorable, except spike length and grain weight/spike, in both seasons. Increasing nitrogen levels up to 80 kg N/fed. caused an obvious increase in net assimilation rate, plant height, number of spikes/m², spike length, weight of grains/spike, grain yield, straw yield and harvest index. On the contrary, number of days to 50% heading, leaf area index and crop growth rate produced the maximum values at 100 kg N/fed. Drilling method exceeded broadcasting in all studied characters in both seasons. The interaction had significant effect on leaf area index, number of spikes/m² and grain yield which produced the highest values with using drilling method and application of 100 kg N/fed. and 80 kg N/fed., respectively in both seasons. It could be concluded that planting barley with drilling method and application of 80 kg N/fed. are the optimum for increasing barley production under the experimental site and the same conditions.

Key words: Barley, sowing method and nitrogen fertilizer.

SOIL CONSERVATION BY MODERN TILLAGE IMPLEMENTS**OLETI CHARAN CHOWDARY**

Agricultural machinery or tools which support conservation agriculture generally refers to cultivation system with minimum or zero tillage and in-situ management of crop residue. Farmers in developed countries used the different types of implements for conserving the agriculture such as zero till seed drill, root till seed drill, happy seeder, slit till drill and combine tillage machinery etc. Conventional tillage practices necessitate the use of heavy equipment that often causes soil compaction, impairs soil physical conditions and creates conditions leading to soil erosion. Many western countries, studying their conventional tillage systems through the new perspective of sustainable approaches to agriculture, are developing new tillage practices, called conservation tillage, which limit tillage to essential operations and prevent damage to soil. The majority of the small-scale farmers in developing countries use indigenous tillage systems. These are low-cost, locally adapted technologies that reflect considerable knowledge of sustainable agriculture. Conservation tillage, as compared to conventional practices has better performance in the term of increased benefits: cost ratio (2.0 - 2.5) and water operational energy (5 - 26%) .

DEVELOPING NEW GENOTYPES IN RICE WITH ENHANCED YIELD POTENTIAL, NUTRITIONAL PROPERTIES AND DISEASE RESISTANCE**¹OM PRAKASH RAIGAR*, ²DAISY BASANDRAI, ³BHALLAN SINGH SEKHON AND ⁴DINESH KUMAR**

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Food insecurity coupled with malnutrition and hidden hunger is posing a great challenge to the scientists engaged in agriculture. This indicated the immense need to focus on developing nutrition rich cultivars/hybrids with high yield potential. Keeping this in view, the present study was undertaken for the improvement of Rice with respect to above mentioned aspects. Line x Tester analysis approach was used to develop nutrition rich, disease resistant and consumer acceptable hybrids. Basmati/ aromatic Rice with preferable grain length, desirable taste and high yield potential was used as female parent while Red rice was used as male parent to incorporate the high nutrition (Iron and Zinc content), medicinal properties and resistance to the leaf and neck blast diseases. For study, basmati/aromatic rice genotypes namely Pusa 1121, Sel, Kasturi, Super Basmati, PB 1509, HPR 2800, HPR 2373, HPR 2590, RYT 3178 and red rice genotypes namely HPR 2795, HPR 2720 were used as female and male parents, respectively. The crosses were attempted during 2017-18 at experimental farm, CSK HPKV, Rice and Wheat Research Centre, Malan (Kangra) H.P. and evaluation of hybrids will be done during *Kharif* season 2018 at Malan (Kangra). The material generated could acts as a boon to farmers by increasing the turnover in terms of yield, disease resistance and quality.

Keywords: Basmati rice, crop improvement, hybrids, innovation, line x tester

CONSERVATION OF AGRICULTURAL BIODIVERSITY AND SUSTAINABLE USE OF IN AGRICULTURE**OM PRAKASH YADAV^{1*}, A. K. RAZDAN¹, SURBHI KOHLI¹ AND KANHEYA LAL YADAV²**

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Cultural diversity in remote mountain regions is closely linked to biodiversity, as there is a symbiotic relationship between habitats and cultures, and between ecosystems and cultural identity; indeed, religious rules and rituals often strengthen this relationship and are characterized by a conservation ethic. In order to allow the earth to continuously play its mother ship role and to enhance the biodiversity, man developed a body of laws and regulations known as taboos to regulate his relationship with his environment. Furthermore, he developed farming systems and fashioned farm tools, which helped him to sustain the biodiversity. Imposition of legislation to enhance the biodiversity is likely to worsen the predicament of the people. Therefore, contemporary biodiversity conservation needs to take into account alternative economic activities, which will relieve the land from the constant pressure it is being subjected today. The data collected are analyzed within the framework of traditional knowledge-based systems methodology, using the conservation purpose of rules and practices as a means of typifying the information on sacred natural sites (forests/groves, pastures, water bodies), on the phenomenon of dedicating forests to a deity, on the inherent taboos regarding resource exploitation, and on other traditional beliefs and customs, in order to understand the environmental and conservationist implications of these rules and practices. The meaning of the term conservation is itself controversial. We propose that to qualify as conservation, any action or practice must not only prevent or mitigate resource overharvesting or environmental damage, it must also be designed to do so. The conditions under which conservation will be adaptive are stringent, involving temporal discounting, economic demand, information feedback, and collective action. This knowledge and related conservation rules need to be strengthened in the face of current change.

Keywords: Nature conservation, Culture, Natural Resources and Genetic diversity.

RESPONSE OF DIFFERENT FERTILIZERS ON SOIL FERTILITY AND PRODUCTIVITY OF RICE (*ORYZASATIVA* L.) OMKAR SINGH¹ AND SHIVANGI²

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In order to study response of different fertilizer on soil fertility and productivity of Rice (*Oryza sativa* L.) a field experiment was conducted at Agronomy Research Farm of S.V.P.U.A.&T, Meerut (U.P.) during Kharif season 2018. The experiment consisted of six treatment such as T₁ (control), T₂ (RDF), T₃ (Soil test based recommendation), T₄ (Indo-Gulf Different Fertilizer), T₅ (TCL Different Fertilizer) and T₆ (Farmer's Practice). The soil of experimental field was silt loam texture, low in organic carbon (0.38%) and low in available nitrogen (151.76 kg ha⁻¹), phosphorus (14.75 kg ha⁻¹) and medium in potassium (248.0 kg ha⁻¹) and low in sulphur (9.00 kg ha⁻¹), zinc (0.50ppm) and boron (0.46ppm). All the growth parameters viz. plant height (cm), number of tillers (m⁻¹), and yield attributes like number of grains panicle⁻¹, test weight, grain and straw yield (q ha⁻¹), uptake of nitrogen, phosphorus, potassium, sulphur, zinc and boron were maximum under T₃ which was at par with T₄ and T₅ and significantly superior over T₁ (control), T₂ and T₆. The maximum grain yield of rice (46.64 q ha⁻¹) was recorded with T₃ which was significantly higher over than control (20.08 q ha⁻¹), T₆ (30.78 q ha⁻¹) and T₂ (38.10 q ha⁻¹) while at par with T₅ (43.92 q ha⁻¹) and T₄ (44.97 q ha⁻¹). The grain yield of rice was increased with the treatment T₃ 22.41% and 51.53% over T₂ and T₆ respectively. Similarly 3.71% and 6.19% over T₄ and T₅ respectively. The yield difference between both the different fertilizers was not upto the level of significance. Variation in availability of nutrients was observed under most of the treatments due to different nutrients management. The higher availability of nutrient was observed under all the treatments except control and farmer's practice. The availability of S, Zn and B were maintained under different fertilizers treatment and soil test based recommendation.

Key Words: *Oryza sativa*, soil fertility, organic carbon and growth parameters.

IMPROVEMENT IN INDIAN MUSTARD THROUGH HETEROSIS OMPAL¹, ARUN KUMAR², SHENDE R. T.² AND VIVEK RANA²

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Indian mustard (*Brassica juncea* L. Czern & Coss) is an important Rabi season natural amphidiploids (2n = 36) oilseed crop; belongs to family Cruciferae and genus Brassica. *B. juncea* is a predominantly self-fertilized crop with 5-15 cross-fertilization. Mustard seed is the world's second leading source of vegetable oil and protein meal after soybean. It is mainly grown in northern part of India, Rajasthan is the largest producing state followed by Uttar Pradesh. Heterosis breeding could be a potential alternative for substantially increasing the production of Indian mustard. Successful exploitation of heterosis would depend upon the identification of hybrids that are more productive than either of the parents and standard check cultivars and on the availability of suitable male sterility, fertility restorer systems. A number of cytoplasmic male sterility (CMS) systems have been described in *B. juncea*. Both heterosis (negative or positive) may be exploited for improvement in Indian mustard. Negative heterosis useful for days to 50 % flowering, Days to maturity, glucosinolates content and erucic acid content while positive heterosis for number of siliques per plant, number of seed per silique, grain yield, harvest index, 1000 grain weight and oil content etc. *Brassica juncea* constitutes 60-65% erucic acid of the total fatty acid. Feeding experiments with animals have demonstrated that rapeseed oil, rich in erucic acid, interferes in myocardial conductance and the peripheral vascular system, decrease survival time thus restricting their use as edible oil crop. Low erucic acid strains were initially identified for the first time in Canadian varieties of summer rape and summer turnip rape Later on, similar strains were identified in Indian mustard germplasm in Australia. Heterosis breeding scheme is better opportunity for produced genotypes with low erucic acid and glucosinolates and high grain yield.

Keywords- Mustard, Heterosis, Erucic acid and Glucosinolates.

VARIABILITY IN *SCLEROTINIA SCLEROTIORUM* OF MUSTARD IN NORTHERN REGION OF M.P. (INDIA)

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Stem rot incited by *Sclerotinia sclerotiorum* (Lib.) de Bary is one of the drastic disease of mustard and it causes quality and quantity losses in mustard. The five isolates of *S. sclerotiorum* from different geographical locations of northern region of Madhya Pradesh were collected and compared for their cultural and morphological characters under artificial culture conditions based on radial growth. The isolates were classified into three groups on the basis of growth behavior very fast, intermediate and slow growing. Three degenerated

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primers of arbitrary reverse transcription sequences produced 340 scorable amplicons through florescent labelled random amplified polymorphic DNA markers. Nucleotides range were designed for sizing DNA fragments in the 35-500 nucleotides range and provides 16 single-stranded labeled fragment. Out of these, 251 fractionated fragments were reported polymorphic. Hence, the present investigation confirmed the diversity among the different geographical isolates from five districts of northern region of Madhya Pradesh (India).

Key words: fRAPD, Stem rot, *Sclerotinia sclerotiorum*, Sclerotia, Isolate

TRENDS AND DECOMPOSITION ANALYSIS OF FOOD GRAIN PRODUCTION IN INDIA

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Food grain production in India has increased considerably from 50 million ton in 1951 to 252 MT by 2015-16. Introduction of green revolution, modernization of agriculture, encouragement to research and extension in agriculture are some of the factors contributed for this growth. The time series secondary data on area, production and yield of food grains from 1950-51 to 2015-16 were broadly partitioned into seven decades in order to demonstrate the trend of food grain production in more convincing and simple manner in the present study. The farmer could achieve these increasing mainly introduction to resistant varieties against different diseases and insects-pests, better management and matching with improved production and protection technologies. It has also been observed that the growth of area, production and yield for food grain registered positive during overall period. There is positive growth in area, production and yield during each of the decades, except negative growth rate in area during eighties and ninties. Decomposition analysis was performed and the percentage contribution of area, yield and their interaction on food grain production for each decades and the overall period was also estimated. The yield effect has a greater contribution food grains production as compared to area effect and combined area and yield interaction effect for overall period. There is area effect during fifties and sixties and after that production is changed due to mainly yield effect.

EFFECT OF MINERAL MIXTURE FEEDING ON MILK YIELD IN BUFFALO

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A field study was conducted in Ghaziabad District to observe the effect of mineral mixture feeding on milk yield in Buffalo. Animals were selected randomly from 5 villages of Ghaziabad (U.P.) (Muradnagar, Noorpur, Kanoja, Kusalia, and Badka). 20 Buffaloes were selected in their 2nd & 3rd stage of lactation and divided into two groups of 10 animals each. First group (T) was fed with 60 gm mineral mixture daily till 90 days of lactation. Other group (C) of 10 animals were not fed additional mineral mixture, which is farmers practice in that particular area. The farmers were not fed scientific method of feeding. They could not added proper quantity of mineral mixture in balance ration. To keeping in mind a trial was conducted in Ghaziabad District since 2016-17 (2017-18). Milk yield of these animals was recorded by their owners and these values were averaged for fortnightly interval. Milk production parameters like average daily milk yield, peak yield and total milk yield were compared between treatment and control groups. It was observed that average daily milk yield, peak yield and total milk yield were found significantly ($P < 0.05$) higher by 11.04, 12.37 & 11.07 in mineral mixture fed group than control group. On the basis of this, it is recommended that continuous feeding of mineral mixture bettered performance of milk yield in buffaloes.

MULTIVARIATE ANALYSIS OF GENETIC DIVERSITY IN CHRYSANTHEMUM GERMPLASM

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Sustainable production of crops relies on germplasm improvement and genetic diversity. The use of multivariate techniques is an important strategy for germplasm classification and study of genetic relationships among genotypes. The data collected for 97 genotypes of chrysanthemum germplasm from All India Coordinated Research Project on Floriculture report 2016-17 (AICRP report 2016-17) were evaluated for eight quantitative traits through cluster and principal component analysis. The first three PCs with eigen values >1 contributed 83.01% of the variability amongst genotypes. The characters contributing more positively with PC1 were no of flower per plant, no of branches and flowering duration. The cluster analysis sequestrated 97 genotypes into 4 clusters based on between-group linkage method in which euclidean distance has been used as dissimilarity measure. The cluster III and IV were more clearly separated than cluster I and II. The cluster analysis revealed that considerable variation existed in few genotypes that could be implicated in selection of chrysanthemum for the development or improvement of cultivars and germplasm.

Keywords: Genetic Diversity, chrysanthemum germplasm, cluster analysis and principal component analysis

STUDIES ON DIRECT AND RESIDUAL EFFECT OF ORGANIC + INORGANIC SOURCES OF NITROGEN IN WHEAT (*TRITICUM AESTIVUM* L.) FORAGE COWPEA (*VIGNA UNGUICULATA* L.) CROPPING SYSTEM

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A field experiment was conducted during winter and summer season of 2011-12 and 2012-13 at college Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat to study the Yield, Quality and nutrient status of soil under different integrated nitrogen management practices in wheat (*Triticum aestivum*) - forage cowpea (*Vigna unguiculata*) cropping sequence. The experiment was laid out in randomized block design with 21 treatments combination comprising of seven nitrogen management through chemical fertilizer and organic manures and three bio fertilizer inoculants. The experimental soil was sandy loam in texture and neutral in reaction with available N 199.5 kg ha⁻¹, P₂O₅ 32.17 kg ha⁻¹ and high K₂O of 389.00 kg ha⁻¹. Application of 75% RDN from chemical fertilizer + 25% RDN from FYM followed by 100% RDN from chemical fertilizer and 75% RDN from chemical fertilizer + 25% from Vermicompost produced significantly higher grain yield with Protein content in wheat. Significantly higher nutrient contents were recorded in the plots fertilized with 25% RDN from chemical fertilizer + 25% RDN from FYM + 25% RDN from Vermicompost + 25% RDN from castor cake followed by 50% RDN from chemical fertilizer + 25% vermicompost + 25% castor cake. Seed inoculation with *Azotobacter chroococcum* + *Azospirillum lipoferum* resulted in the higher grain yields and protein content in wheat. This treatment also showed higher available nitrogen, potassium and Phosphorus status of soil. Significantly higher green and dry fodder yield, and protein content in forage cowpea were recorded due to residual effect of combined seed inoculation with *Azotobacter chroococcum* + *Azospirillum lipoferum*. Application of 25% RDN chemical fertilizer + 25% from FYM + 25% from vermicompost + 25% from castor cake along with combined seed inoculation with *Azotobacter chroococcum* + *Azospirillum lipoferum* improved nutrient status of soil in wheat-forage cowpea sequence.

POPULARIZATION OF IMPROVED PRODUCTION TECHNOLOGIES IN GREENGRAM THROUGH FRONTLINE DEMONSTRATIONS

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Green gram may be seen as one of the alternative crop to rice in *kharif* season in the pursuit of diversification and sustainability of rice-wheat cropping system in Punjab. Therefore, there is perceptible need to demonstrate the farmers latest improved technologies related to green gram production. The present study was conducted by Krishi Vigyan Kendra, S.A.S. Nagar during *kharif* season in 2017 with fifty three frontline demonstrations across twenty three villages of Mohali district. Improved and latest technology viz. Yellow Vein Mosaic (YVM) resistant varieties i.e. ML 2056 and MH 421, seed treatment with bio-fertilizer and fungicide, recommended seed rate, proper dose of fertilizers, herbicide application and plant protection measures were demonstrated. The results of demonstrations showed that farmers could increase the Green gram productivity notably by switching over to improved varieties and adoption of improved production technologies. Both the varieties (ML 2056 and MH 421) recorded higher yield (12.2 q/acre and 13.4 q/acre, respectively) than the farmer adopted variety (10.1 q/acre). The increase in the demonstration yield over farmer's practices was 20.8 per cent (ML 2056) and 32.6 per cent (MH 421). Net return and B:C ratio of demonstration plots were also higher than farmers practice.

Keywords: Green gram, Cluster Frontline Demonstrations, Improved Technologies, Yield, B:C ratio

EFFECT OF PHOSPHORUS AND ZINC FERTILIZATION ON THEIR AVAILABILITY AND PERFORMANCE OF GREEN GRAM (*VIGNA RADIATA* L. WILCZEK)

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An investigation was carried out to study the "Effect of phosphorus and zinc fertilization on their availability and performance of green gram (*Vigna radiata* L. Wilczek)" at Research Farm of Division of Soil Science and Agricultural Chemistry, SKUAST-Jammu, Main campus, Chatha during summer season of 2015 with four levels of phosphorous (0, 20, 40 and 60 kg ha⁻¹) and four levels of zinc (0, 5, 10 and 15 kg ha⁻¹) with different treatment combination replicated thrice. The experiment was laid out in Factorial Randomized Block Design (F-RBD) using cv. SML-668 a high yielding variety of green gram as the test crop. The results of the investigation revealed that the effect of phosphorous and zinc on different growth and yield attributing parameters i.e. plant height at 20, 40 DAS and at maturity and plant population, number of pods per plant, 1000 seed weight, number of nodules per plant, seed yield and stover yield of green gram was found statistically significant. The grain yield (957.25 kg ha⁻¹) and stover yield (2399.40 kg ha⁻¹) of green gram were highest with the

combine application of P and Zn and found to increased with the successive application of phosphorous up to 60 kg ha⁻¹ and zinc up to 10 kg ha⁻¹ respectively and further increase in zinc levels found to decrease the growth and yield attributing trait, indicating antagonistic effect of P and Zn on each other as high P in soil reduce the uptake of Zn by roots. The interaction of P and Zn were also significant for all the growth and yield attributing parameters except plant population. The available phosphorous and zinc in soil were also significantly influenced and found to decrease with increase in time interval i.e. 20, 40 DAS and at maturity. So the application of 60 kg of P and 10 kg of Zn ha⁻¹ is best for optimum production of green gram (*cv.SML-668*) in the subtropical zone of Jammu which can be recommended for the farmers of the area for long term sustainable soil health.

CULTIVATION TECHNOLOGY OF PADDY STRAW MUSHROOM (*VOLVARIELLA VOLVACEA*) UNDER THE HILLY REGIMES OF DISTRICT EAST KAMENG ARUNACHAL PRADESH

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Paddy straw mushroom (*Volvariella volvacea*) is a world famous edible mushroom variety that has high demand due to its deliciousness and nutritive value. It is also known as Chinese mushroom, ranks sixth among the cultivated mushrooms of the world having fast growth rate, easy cultivation technology and good acceptability at consumers' level. The high temperature requirement for its cultivation also makes it a good choice for mass scale adoption among the farming community. Beside a big demand of this mushroom in East Kameng district Arunachal Pradesh, there is no proper method of cultivation technology has been standardized till 2014. In this reference an experiment was conducted in five villages of District East Kameng (*Viz.* New Sopung, Jayanti, Pampoli, Wessang and Mebua) Arunachal Pradesh during the year 2014 to 2017. The said experiment was conducted in farmer's house to standardize the cultivation technology that would maintain above said environmental requirements. Paddy straw was used as main substrate materials for the cultivation. The average yield of paddy straw mushroom was found in the range of 650 to 800 gram / bundle/cutting and overall production 2.25kg to 3.0 kg after 3rd cutting. There were significant yield differences between different farmers sites were also observed during the experiment.

Key words: Paddy straw mushroom, cultivation technology, acceptability and consumers etc.

ICTS FOR NATURAL RESOURCE MANAGEMENT

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Natural resource management is an interdisciplinary field of study that considers the handling of natural resources in physical, biological, economic and social aspects. It refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. In developing countries Information and communication technologies (ICTs) are helping to increase the efficiency, productivity, and sustainability of farms, providing up-to-date information on new farm technologies, access to credit as well as training, and the ability to interact with other farmers -often bridging the gap between scientific research and the farmer. Information Communication Technologies (ICTs) is the technology to facilitate and transfer of information across the different geographical location without taking much time and flow large volume of information. The information and communication technologies (ICTs) as tools to enhance the development of rural and remote regions remain in order to reach the unreached.. There are a growing number of tools and diagrams in the literature to capture the multiple dimensions of ICTs, and they all are providing enormous help in natural resource management. This will explore how ICTs help the farmers in natural resource management relevance to its status, opportunities, challenges and conclusions.

Keywords: ICTs, Natural resource management, sustainability.

SUSTAINABLE DEVELOPMENT

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Over the past few years, "Sustainable Development" (SD) has emerged as the latest development catchphrase. A wide range of nongovernmental as well as governmental organizations have embraced it as the new paradigm of development. A review of the literature that has sprung up around the concept of SD indicates, however, a lack of consistency in its interpretation. More important, while the all-encompassing nature of the concept gives it political strength, its current formulation by the mainstream of SD thinking contains significant weaknesses. These include an incomplete perception of the problems of poverty and environmental degradation, and confusion about the role of economic growth and about the concepts of sustainability and participation. How these weaknesses can lead to inadequacies and contradictions in policy making is demonstrated in the context of international trade, agriculture, and forestry. It

is suggested that if SD is to have a fundamental impact, politically expedient fuzziness will have to be given up in favor of intellectual clarity and rigor.

BIOLOGICAL CONTROL OF WEEDS: AN ECONOMICAL AND ENVIRONMENTALLY SENSITIVE WEED MANAGEMENT

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Weeds can be defined as plants growing out of place. Biological weed control involves using living organisms, such as insects, nematodes, bacteria, or fungi, to reduce weed populations. In nature, plants are controlled biologically by naturally occurring organisms. Biological control research and implementation is even more relevant today. Foreign and native organisms that attack weeds are being evaluated for use as biological control agents. As a weed management method, biological control offers an environmentally friendly approach that complements conventional methods. It helps meet the need for new weed management strategies since some weeds have become resistant to certain herbicides. Biological control agents target specific weeds. Moreover, this technology is safe for applicators and consumers. Biological control of weeds will not eliminate the need to use chemical herbicides. Both of these tools need to be integrated with cultural practices, such as tillage and crop rotation, in the battle against weeds. By using Integrated Weed Management, the development of weeds that are resistant to biological or chemical agents can be slowed. A combination of control methods is generally required to best manage these nuisance plants. Biological control holds much promise for long-term, economical, and environmentally sensitive weed management.

Keywords: Weeds, Biological control and environment.

GLOBAL WARMING

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Global warming, the phenomenon of increasing the average air temperature near the surface of earth. The effects of global warming are environmental and social changes caused (directly or indirectly) by human. Few effects of global warming are melting of glaciers, early snow melt and severe droughts will cause more dramatic water storages. Raising sea levels will lead to coastal flooding. While many view the effects to be more substantial and more rapidly occurring than others, the scientific consensus on climatic changes related to global warming is rising then the average temperature of earth. The main cause of the current global warming trend is human expansion of "Green house effect". Gases that contribute to the green house effect are carbon dioxide, water vapor, nitrous oxide, methane. The new report includes a review of evidence that carbon dioxide from burning coal, gas, oil is heating the planet. It notes that some amount of irreversible climate disruption is already locked in, But things can also get much and much worse, additional global warming could wreak havoc across the globe, potentially leading to food shortages, the flooding of major cities etc., key points to be considered are sharp emissions cuts, which require massive technological push and is costly for us. Others include use of renewable energy, reduce water waste, using fuel efficient vehicles etc.

PARAMUTATION FOR EPIGENETIC CROP IMPROVEMENT

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Plant breeding relies on the pre-existing genetic diversity present within a species to develop allelic combinations that may provide desired traits. Paramutation describes a process that results in heritable epigenetic changes of gene regulation and trans-homologue interactions resulting in the discovery of epialleles i.e. alleles with identical DNA sequences but differing in DNA methylation and chromatin structure. These epialleles may provide for the epigenetic diversity resulting in additional sources of variation within a species that could be captured or created for crop improvement. Paramutation phenomenon encompasses the ability of the silenced allele (paramutagenic) to silence the other allele (paramutable) present in trans. The newly silenced (paramutated) allele remains stable in the next generations even in the absence of paramutagenic allele and acquires paramutagenic ability itself. The inheritance behaviour of these epialleles permits a fast diffusion of a particular phenotype in a population. Several classic evidences of paramutation have been found in plants like maize (pericarp color, p1), tomato (sulfurea), *snapdragon* (nivea) and transgenic crops (tobacco and petunia). Potential roles of paramutation through transgenerational transfer of epigenetic information have been proposed among which generating epiRIL (a homozygous line almost identical at the genetic level but segregates at the DNA methylation level) population has

revealed role of differentially methylated regions (DMRs) between accessions in influencing quantitative traits. Paramutation phenomenon leading to epigenetic variation and the stability of newly formed epigenetic variants over generations utilizes the potential of epigenetic variation to improve crops. The development and application of methods for widespread epigenome profiling and engineering may generate new avenues for using the full potential of paramutation in crop improvement.

IMPORTANCE OF BLACK SOYABEAN, POST HARVEST TECHNOLOGIES AND ITS BY-PRODUCTS- A REVIEW **PALMEI GAIBIMEI¹, ANUPAMA SINGH¹, N.C. SHAHI¹, ANIL KUMAR² & KHAN CHAND¹**

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Soybean is one of the most important and consumed crop which provide complete protein with an affordable price. India being comprised of maximum vegetarian people sought protein in their everyday meal; soybean comes to picture by serving the purpose of replacing meat protein for people as whole. Soybean has different seed coat colours, including black, brown, red, green and yellow, the only difference between the black and the rest of the colours lies in the seed coat where the black soybean contain abundant anthocyanin pigments. Black soybean is also considered as the miracle crop due to its nutritional values and potentials to develop as healthy functional food ingredients. Black soybean provides many health beneficial effects such as anti-mutagenicity, anti-inflammatory properties, inhibition of low density lipoprotein oxidation and DNA damage reduction. Hence due to their various beneficial effects, black soybeans are increasingly seek in food and medicinal industries. There are many unit operations involved in post harvest handling and processing of black soybean to prevent losses and to maintain the quality of the crop. Some of them include harvesting, threshing, drying, cleaning, packaging, storage, transport, dehulling, cracking, etc. Black soybeans are used for producing wide variety of products such as soymilk, tofu, soy sauce, natto, tempeh, soy oil, soy flour, texturized soy protein, black soy hull extract (anthocyanin), soy protein isolate, soy protein concentrate, etc. This paper aims to renew and revive the potential of the forgotten or underutilised black soybean crop having many functional and nutritional benefits calls out the researchers for a diverse expansion of importance of the seed crop to widen its uses and application in many ways.

Keywords: Black soybean, nutritional composition, health benefits, soy products

THERMAL IMAGING AS A POTENTIAL ELEMENT OF INTEGRATED PEST MANAGEMENT IN INDIAN AGRICULTURE

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Thermal Imaging is a successful technology in the context of non-contact method of temperature measurement. Previously, this imaging system was successful in medical and military system and it has recently found successfully applicable to agriculture also. IPM is a sustainable approach to pest management, where all the methods are integrated together to check the pest population with minimum usage of pesticides. To support the successfulness of Integrated Pest Management, Thermal Imaging may be a potential element in identifying the density of pests and diseases. Using optical sensor technology is useful to identify foliar diseases like powdery mildew in barley, yellow rust in wheat, etc., but the thermal infrared radiation has the potentiality to identify not only the diseases but also its density and its associated pathogens with high spatial resolution. Pests like termites, rodents, etc can easily identified and checked. Thermal radiation is useful in weed management and it calculates the temperature of the leaves. Thermal imaging helps in identifying quality seeds by measuring its temperature. Water level of the plant as well as of the field can be measured by using thermal imaging. Though thermal imaging technology is a costly affair for now, in future with the research and development, the concept of thermal imaging can be implemented in agriculture. Though the cost of this technology seems to be more, the opportunity cost of this technology will replace the cost incurred by not using it. In near future the technology, which is going to rule agriculture, thermal Imaging will be a great example of new technology for a progressive agriculture. This paper reviews the need of thermal imaging to be an element of Integrated Pest Management in coming years for Indian agriculture.

Keywords: Thermal Imaging, Technology, Thermography, IPM, Agriculture

ASSESSMENT OF GENOTYPIC VARIABILITY IN OATS (*AVENA SATIVA* L.) FOR FODDER QUALITY

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Oat (*Avena sativa* L.) is an important cool season cereal crop grown all over the world. It belongs to the family *Poaceae* and ranks sixth in the world cereal production following wheat, rice, barley maize, and sorghum. Oats are used widely as feed for livestock (cattle, sheep,

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poultry and horses). Most of the farmers use oats as livestock feed with or without mixing with concentrate. Present experiment was conducted at Forage research area of Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar during *rabi* 2017-18. Different germplasm accessions of oats were used in this study. Significant genetic variability was found in these genotypes for various morphological and quality traits. Among the test genotypes, some lines have high value of crude protein in grain and fodder. Various morphological parameters like plant height, leaf length, and leaf width were found positively correlated with fodder yield. These traits can be utilized as indirect selection criteria for fodder and seed yield. Based on the study, it was concluded that these germplasm lines can be utilized in breeding programmes for improvement in seed and fodder yield.

Key word: Oats, Genotypic variability, Fodder quality, Seed yield.

“STUDIES ON NEWER INSECTICIDES AND THEIR COMBINATIONS AGAINST GRAM POD BORER, *HELICOVERPA ARMIGERA* (HUBNER) IN CHICKPEA (*CICER ARIETINUM* L.)”

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The present investigation was carried out during *Rabi* Season, 2017-18 at Student's Instructional farm, N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) to study the newer insecticides and their combinations against gram pod borer, *Helicoverpa armigera* (Hubner) in chickpea (*Cicer arietinum* L.). The insecticides and their combinations tested were: Rynaxypyr 20 SC (18 g a. i./ha), 2% urea + Rynaxypyr 20 SC (18 g a. i./ha), Emamectin benzoate 5 SG (11 g a. i./ha), 2% urea + Emamectin benzoate 5 SG (11 g a. i./ha), Flubendiamide 480 SC (60 g a. i./ha), 2% urea + Flubendiamide 480 SC (60 g a. i./ha), 2% urea and compared with control (water spray). Rynaxypyr 20 SC (18 g a. i./ha) was found most effective insecticide with 100% reduction in larval population, followed by flubendiamide 480 SC @ 60 g a.i./ha with 92.30 % and Emamectin benzoate 5 SG@11 g a.i./ha with 84.61 % reduction in larval population. Least effective treatment was 2% Urea in which only 76.92 % reduction in larval population was found. All treatments were found effective over control that gave significantly higher yield of chickpea. This study recommends the use of Rynaxypyr 20 SC for the control of gram pod borer.

Key words: Rynaxypyr, flubendiamide, Emamectin benzoate, gram pod borer, *Helicoverpa armigera*

EFFECT OF ORGANIC FARMING ON SOIL PHYSICAL PROPERTIES

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Organic farming could be an option to ensure food, air, water, and soil quality leaving the environment safe for the present and future generation. The effects of organic farming practices on the development of soil physical properties, and in particular, soil structure in comparison with conventional agricultural management. Organic farming is a production system, which avoids the use of synthetic fertilizers, pesticides, growth regulators, and additives and relies on natural principles that contribute to the growth, development, and health of plants. Its aim is safe production of quality produce and maintenance and improvement of the sanitary condition and quality of soil and the environment. Soil structure is most important among the physical soil properties due to its large impact on the water, air and thermal status, chemical and biological properties of the soil, soil tilth and the growth of plant roots are affected by farming system. It is an indicator of soil fertility and productivity. The objective of this study was to determine the contribution of organic agriculture to soil structure improvement by comparing soil structure indicators from organic farms.

Key Words: Soil structure, soil quality, organic management and biological properties etc.

BIO FERTILIZERS, A POTENTIAL TOOL FOR SUSTAINABLE SOIL HEALTH AND NUTRIENT

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Dependence on chemicals for future agricultural needs would result in further loss in soil health, possibilities of water contamination and calculated burden on the fiscal system. Indiscriminate synthetic fertilizer usage has polluted the soil, water basins, destroyed micro-organisms and eco-friendly insects, made the crop more susceptible to diseases and depleted soil fertility at the primary levels as of today, which is the main concern of the write up. In this critical context, Microorganisms have been emerged as the potential alternative for the productivity, reliability and sustainability of the global food chain. Carrier based bio fertilizers have already proved to be the best over the agro chemicals and have been showing the tremendous effect on the global agriculture productivity since the past two decades.

Rectifying the disadvantages of the carrier based bio fertilizers, liquid bio fertilizers have been developed which would be the only alternative for the cost effective sustainable agriculture. The increasing productivity by applying excessive fertilizers and pesticides has led to various environmental problems such as contamination of water resources, loss of soil fertility, and hazard to human health disorders etc. There is a need for more sustainable way of producing crops relies organic farming and minimized use of harmful chemicals. One best alternative is to supplement synthetic chemicals with useful microorganisms such as Plant Growth Promoting Rhizobacteria (PGPR), Mycorrhiza, Blue green algae, etc. Bio fertilizers and bio pesticides affect plant's growth and development, change nutrient dynamics and alter a plant's susceptibility to disease and abiotic stress.

FARMERS' PERCEPTIONS TOWARDS APPLICATIONS OF MODERN FARMING TOOLS USED IN VEGETABLE PRODUCTION AT SOLAN DISTRICT, HIMACHAL PRADESH-INDIA

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Increase in vegetable productivity has been achieved in several parts of the country mainly by modernizing agriculture. In this context application of modern farming tools play significant role. The concerned study has analyzed the awareness levels of farmers' towards application of modern farming tools used in vegetable production and study the effect of modern farming tools on farmers' income. The scientific orientation inclined by farming community that new methods of farming give better results to a farmer than old tools. The key economic motivation that enforced the farming community were that farmer should work towards higher yield and economic profits. The key constraints and problems emerged during the study mainly circumvented around the lack of sufficient incentives provided by the government and the imparting of adequate training for the use of farm tools.

Keywords: Perception, Modern farming tools, Vegetable Production.

WATER MANAGEMENT OF HORTICULTURAL CROPS IN DRY REGIONS

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There is a fundamental role of water in agriculture and anybody planning to set out as a farmer must consider the availability of water resource near the place where he intends to put up the farm. Water is very important both for livestock and for plants. It forms a large part of tissues and cells. Due to increase in population there is also an increase in demand of fresh water. And the water resources are degraded to large extent. Ground water level is also dropping at the rates faster than ever. Water is one of the most important plant growth regulator and how we manage it will influence our future well being. Agriculture sector is the largest user of water i.e. >70%. In agriculture water is used for irrigating the fields, for diluting the insecticides and herbicides. Increase in water demand and water scarcities will have a major economic and political impacts. As the horticultural crops have high value and intense cultural practices they are better suited for adaptation to improve water saving technologies than many agronomic crops. Not only the arid regions but other regions with saline water are suffering from the water scarcity. The productivity of dry regions is less due to unavailability of irrigation water. But water can be used with maximum efficiency by using drip irrigation system. Recently drip irrigation system is used for many vegetable in southern and eastern United States. Micro irrigation have also been used successfully in fruit trees. Horticultural crops have higher market value than traditional agricultural crops. Hence, improved water saving technologies have been focused on certain horticultural crops.

Key words : Water management, horticultural crops, dry region etc.

RECENT ADVANCES IN MUTATION BREEDING OF FRUIT CROPS

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A wide range of genetic variability has been induced by physical and chemical mutagens. In the past several decades, induced mutations have contributed immensely to the development of improved varieties in several crop plants. Till date, 3,218 mutant varieties have been released worldwide. More than 60 % of officially released mutant varieties are from Asia with China, India and Japan topping the list. Optimum utilization of mutant lines worldwide can be made by free exchange of a mutant material and its deployment in regions where a farmers' need is paramount. With the aid of well-defined objectives in national research programmes, availability of efficient mutagenesis protocols and high-throughput, efficient phenotype screening methods, mutagenesis can be made more useful in the improvement of crop plants. Mutant identification selection at the genotypic level, using new, high-throughput technologies, has changed the way mutations are now used in genetics and breeding. The possibility of directed mutation by using mutagens and certain chemical

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pretreatments should help in achieving the goal. Induced mutations are poised to play a more significant role in the times to come.

Keywords: Fruit Crops, Mutagenesis, Mutation Breeding

HORTICULTURE - THE GROWTH DRIVER OF AGRICULTURE: CHALLENGES AND OPPORTUNITIES

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Although agriculture occupies shrinking share of India's national economy, but achieving rapid growth in agriculture remains policy concern nationwide. The contribution of agriculture to India's GDP fell from 40 per cent in 1980-81 to 21 per cent in 2004-05 and 17.01 per cent in 2015-16. However 72 per cent of population lives in rural areas and 3/4th still depends on agriculture for livelihood. Since the 1980s, the international trade in fruits and vegetables has expanded rapidly. There is an overall increase in the demand for fruits and vegetables for consumption both in the fresh and the processed form. The study conducted on area, production and productivity of horticultural crop was found that compound annual growth rate using data from 2001 to 2016 and it was found that there was 2.77 per cent increase in area under horticulture crop, 5.53 per cent increase in production and 2.69 per cent increase in productivity. Data collected from Horticulture Statistic division Department of agriculture cooperation and farmers welfare of different horticulture crop viz. fruit, vegetables, flower, spices, medicinal and aromatic plantation show there was compound growth rate of 2.47 per cent of area and 5.35 per cent in production. Data collected from on change cropping pattern among the farmers of Himachal Pradesh and it shows that they are shifting to horticulture at the rate of 2.47 per cent. Data collected from Government of India shows that there was significant increase in horticulture export i.e., 13.33 per cent and import is 19.30 per cent. when comparing the export of field crop, horticulture and livestock the results are obtained which shows that the compound annual growth rate were 19.83 per cent, 13.33 per cent and 17.16 per cent respectively and import of field crop, horticulture and livestock the results are obtained which shows that the compound annual growth rate were 26.41 per cent, 19.30 per cent and 17.87 per cent respectively. Though there is significant increase in area production and productivity of horticultural crop over years but data on export and import shows that farmers are facing challenges that are making balance of trade negative thus we need to combat those problems.

Key words: Agriculture, growth rate, export and import, demand.

EFFECT OF FLAXSEED POWDER SUPPLEMENTATION ON THE HAEMATOLOGICAL AND SERUM BIOCHEMICAL PROFILES OF GIRIRAJA BIRDS

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The experiment was conducted at Department of Animal Husbandry and Dairy Science, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra to determine flaxseed powder supplementation on the haemato-biochemical parameters of Giriraja birds. A total of 140 one-day-old Giriraja chicks were individually weighed and randomly assigned to five treatment groups, each with 4 replicate pens of 28 chicks. The dietary treatments included were T₀: Control (basal ration), T₁: basal ration + 2 per cent flaxseed powder, T₂: basal ration + 3 per cent flaxseed powder, T₃: basal ration + 4 per cent flaxseed powder and T₄: basal ration + 5 per cent flaxseed powder. The results of the experiment revealed that incorporation of 5 per cent flaxseed powder in Giriraja bird as feed additive significantly improved haematological parameters viz. Hb (8.60 mg/dl), RBC (2.501 10⁶/mm³), WBC (22165.5cell/mm³) and PCV (32.35 %) and biochemical traits i.e. Cholesterol (93.92 mg/dl), HDL (53.50 mg/dl), LDL (42.57 mg/dl), VLDL (19.11 mg/dl) and Triglycerides (95.50 mg/dl) as compared with control group. The study concluded that 5.0 per cent of flaxseed powder more beneficial for maintaining blood haematological and serum Biochemical profile. Therefore, it may be recommended that incorporation of flaxseed powder in the basal diet of Giriraja birds improved their physiological status.

Keywords: Flaxseed Powder, Haematological and biochemical profile, Giriraja

STUDY OF PPD-D1 GENE IMPACT ON DIFFERENT PHENOTYPIC TRAITS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Wheat is world's most widely cultivated food crop which belongs to the family Graminae (Poaceae) and the genus *Triticum*. It is the most important food grain in the world that ranks second in total production as a cereal crop, after maize and ahead of rice. The winter wheat

and spring wheat varieties can be photoperiod sensitive or insensitive. The photoperiod insensitive wheat varieties are early to flowering in short days condition as compared to their counterpart photoperiod sensitive varieties. Photoperiod sensitivity is controlled by Ppd-A1, Ppd-B1 and Ppd-D1 genes of group 2 chromosomes. Ppd-D1 gene has been identified as the major source of earliness in wheat varieties worldwide that Ppd-D1 allele is expressed to synthesize PRR protein and thereby cause induction of the Vrn-3 florigen, under SD and LD conditions. All the 242 lines of wheat were genotyped with Ppd-D1 marker and observed 1:1 segregation among the population for the presence and absence of this gene. It was observed that presence of this gene reduced 11 traits as compared with those lines which had no Ppd-D1 gene but few traits were expressed positively by the presence of this gene. Reduction in days to heading and plant height is the common effect observed by many researchers and days to heading also affect the spot blotch severity as reflected by area under disease in this experiment. Diversity in climate is attribute of India and variability created by Ppd-D1 gene for flowering time may be exploited in breeding programme for development of varieties for divergent regions.

Key words: wheat, Ppd-D1 gene, photoperiod sensitivity

MICROBIAL DECOMPOSITION OF CROP RESIDUES

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Whatever remains after something else has been taken, separated, removed, called residues. Crop residues are Organic residues remaining after the harvesting and processing of a crop like stalks, stems, leaves, roots, etc. Nowadays management of Crop residue is important as it is highly considered as major factor in organic and conservation agriculture. There are different practices for crop residue management, among them burning is not considered as eco-friendly because it causes pollution and nutrient losses. While other practices like mulching, in-situ incorporation and composting are eco-friendly, but it takes time if proper environment for recycling is not available. Composting and In-situ incorporation method require better physical chemical and microbial condition for the decomposition of crop residues. Soil physical and chemical properties decide the rate of microbial activity in case of In-situ incorporation while in composting its affected by the environment created by us for microbial decomposition. Therefore, favourable environment for microbial activity is necessary which is very important for microbial decomposition of crop residues. There are two types of crop residues available first one is residues remained on field and another one is processed crop residues. Burning, mulching, in-situ incorporation and composting are four different practices for their management. Rice stalk, wheat straw, sugarcane trash, sorghum and maize stubbles are major crop residues available. Their chemical structure consist of cellulose, hemicellulose, polysaccharides, starch, protein, pectin and chitin. Their microbial degradation through in-situ incorporation and composting can be done properly and in eco-friendly manner.

Key words: crop residues, pollution, in-situ incorporation, composting, microbial activity, microbial decomposition, chemical structure.

EFFECT OF WATER STRESS ON PHYSIOLOGICAL CHARACTERS OF CERTAIN VARIETIES OF RICE (*ORYZA SATIVA* L.).

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Water stress is the major problem for the rice production in several regions of the world. It directly affects growth of rice, especially in low rainfall season. For the better understanding of water stress effect in certain resistant and susceptible rice varieties during *Kharif* season of 2014-2015 and 2015-2016 experiment was conducted under rainout shelter. A total four basmati rice varieties namely; PusaBasmati1, Pusa1121, Type3 and Vallabh Basmati 21 and two non-basmati Nagina 22 and Susk Samrat were studied for physiological parameters under water stress. Water stress affected the rate of photosynthesis, relative water content and also membrane stability index. The Photosynthesis ranged from 6.58 $\mu\text{mol.m}^{-2}\text{s}^{-1}$ (VB21) to 9.85 $\mu\text{mol.m}^{-2}\text{s}^{-1}$ (Nagina 22) with an average mean of 7.8 $\mu\text{mol.m}^{-2}\text{s}^{-1}$ under control condition, while under water stress condition Photosynthesis ranged from 3.09 $\mu\text{mol.m}^{-2}\text{s}^{-1}$ (Vallabh Basmati 21) to 7.21 $\mu\text{mol.m}^{-2}\text{s}^{-1}$ (Nagina 22) with an average mean of 4.69 $\mu\text{mol.m}^{-2}\text{s}^{-1}$. The Membrane stability index ranged from 40.81% (Type3) to 48.23% (PB1121) with an average mean of 43.92 % in control condition, while under water stress condition membrane stability index ranged from 33.44 % (Type3) to 44.41% (Nagina 22) with an average mean of 33.74%. The Relative water content ranged from 61.38% (PB1121) to 77.79% (PusaBasmati1) with an average mean of 69.59% in control condition, while under water stress condition relative water content ranged from 34.57 % (PusaBasmati1) to 58.98% (Nagina 22) with an average mean of 46.44%. Water stress affected the growth and reduced the fresh shoot and root weights, root and shoot lengths and the photosynthetic pigments which ultimately reduced the photosynthetic rate and physiology processes. The water stress has more adverse effect in the basmati rice varieties in comparison to non-basmati rice varieties Nagina 22 and susk samrat also known as water stress rice varieties.

Keywords: Rice, Water stress, Photosynthesis, Relative water content, Membrane stability index.

NATURAL RESOURCE MANAGEMENT AND ITS CONSERVATIONS**PAWAN K NAGAR¹, J PRATHORE² AND ANKITA MANTRI³***¹Department of Horticulture, BACA, Anand Agricultural University, Anand, Gujarat, ²Division of Fruit Science, FOH, SKUAST-Kashmir, Shalimar Campus, Srinagar (J & K), ³Department of Fruit Science, ASPEE CHF, Navsari Agricultural University, Navsari Gujarat*

Natural resource management refers to the management of **natural resources** such as **land, water, soil, plants** and **animals**, with a particular focus on how management affects the **quality of life** for both present and future generations. Natural resource management deals with managing the way in which people and natural **landscapes** interact. It brings together land use planning, water management, **biodiversity conservation**, and the future sustainability of industries like **agriculture, mining, tourism, fisheries** and **forestry**. It recognises that people and their livelihoods rely on the health and productivity of our landscapes, and their actions as stewards of the land play a critical role in maintaining this health and productivity. Natural resource management specifically focuses on a scientific and technical understanding of resources and **ecology** and the life-supporting capacity of those resources. **Environmental management** is also similar to natural resource management. In academic contexts, the **sociology of natural resources** is closely related to, but distinct from, natural resource management. The success of natural resource management is ultimately determined by the level of community involvement and the adoption of ecologically sustainable practices across the community. It integrates the management of social, economic and environmental values by involving the community and industry in planning and decision making. Conservation of natural resources includes developing location specific, cost effective, eco-friendly conservation and management technologies for higher input use efficiency, agricultural productivity & profitability without deteriorating natural resource base.

DOUBLING THE FARMER INCOME THROUGH HI-TECH HORTICULTURE**PAWAN K. NAGAR, J PRATHORE¹ AND AMIT KUMAR¹***Department of Horticulture, BACA, Anand Agricultural University, Anand-388 110, ¹Division of Fruit Science, FOH, SKUAST-Kashmir, Shalimar Campus, Srinagar (J & K)*

Precision farming in Horticulture sector provides an excellent opportunity in raising the income of the farmers throughout the year. A significant shift towards horticulture is envisaged in the country with an increase in area and production after the launch of the RKVY scheme. Despite the scope and importance for cultivation of various horticulture crops, the sector is yet to make break-through in the productivity fronts and market chain for many reasons. This is because of the fact that the farmer in mass are not adopting the latest production technologies comprising of precision horticulture practices related to soil, water and selection of planting material. The adoption of precision horticulture technologies in protected cultivation there by help in doubling the farm income. This precisely envisages less challenges and more profit by using per drop of water. There were more common challenges in crop production mainly decrease in water level in bore wells reaching up to 1000 feet depth, less or poor availability of supply of electricity to operate the pumping of water, non-judicious use of inputs and low market prices resulted in lesser productivity with low income. The private company partners were also involved particularly in Colour and Green Capsicum, Carnation and English Cucumber to give technical information to the farmers on management of crop under polyhouses and marketing avenues. The impact of interventions helped in doubling the income of the farmers through hi-tech horticulture from zero knowledge level in polyhouse cultivation. The benefit was also extended to the farmers by assisting with subsidies from the department through RKVY, NHM and KrishiBhagya schemes for construction and cultivation of crops in polyhouses. Local employment was generated through this activity as the polyhouse operations require labor daily at an average of 5 person days per polyhouse. Thus, the increase in the income by these farmers helped in gaining confidence in precision farming technologies.

KNOWLEDGE LEVEL OF CITRUS GROWERS IN HARYANA**PAWAN KUMAR*, P. S. SHEHRAWAT AND J. S. MALIK***Department of Extension Education, CCS Haryana Agricultural University, Hisar*

The study was conducted to study the knowledge levels of different citrus growing farmers in Haryana. Being one of the most widely grown commercial fruit crop in Haryana the crop is getting popularized day by day and hence an increase in area under cultivation and production is witnessed in recent past. The study revealed that majority of the mausambi growers (83.33 per cent) had significantly higher knowledge level whereas, 16.67 per cent had medium level of knowledge regarding time of planting. Similarly, 83.33 per cent of the respondents possessed high level of knowledge about irrigation techniques whereas; only 4.17 per cent of the respondents had low level of knowledge. Further, it was revealed that maximum number of mausambi growers (75.00 per cent) possessed high level knowledge regarding recommended cultivars while only 25.00 per cent growers possessed medium level of knowledge. In regard to manure and fertilizers, it was recorded that only 14.17 per cent of respondents had medium knowledge whereas 75.00 per cent growers had high level of knowledge. It was also recorded that majority of the respondents (75.00 per cent) had high knowledge level regarding

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intercultural operations. Hence, it can be delineated that majority of the citrus growers in Haryana have good level of knowledge regarding different cultivation practice such as time of irrigation, proper manuring and fertilizer application, weed and pest control etc.

Keywords: mausambi, cultivation practices, knowledge level and Haryana

TO STUDY THE EFFECT OF SEED RATE AND ROW SPACING ON PLANT HEIGHT AT MATURITY OF FENUGREEK (*TRIGONELLA FOENUM-GRAECUM* L.)

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The experiment was carried out to find the effect of seed rate and row spacing on quality seed production of fenugreek (*Trigonella foenum-graecum* L.) was conducted at Research Farm of Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during winter season of 2016-17. The seed material used for the experiment was a released variety *Hisar Sonali*. The investigation comprising of five different seed rate (16, 18, 20, 22 and 24 kg/ha) and three row spacing (20, 30 and 40 cm) was laid out in a factorial randomized block design with three replications with a plot size of 2.4 x 4.0 m. The result revealed that highest value for plant height (99.63 cm) was registered with a treatment combination S₅R₁ i.e. seed rate 24 kg/ha and row spacing 20cm.

Key words: Fenugreek, seed rate, row spacing, seed yield

STUDY OF BLACK POINT DISEASE OF WHEAT (*TRITICUM AESTIVUM* L.)

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Black point caused by various fungal pathogen each considered as minor disease, affected the grain as well as seed quality but its importance in global context can be imagined with the fact the U.S. grain standard to be damaged and only 2 percent are permitted in wheat grade as U.S. No.2. The disease is responsible for reduce market price and dockage by the elevator. Keeping in view, the above facts the present investigation on studies on black point disease of wheat was conducted with the objective of evaluation of wheat genotypes against foliar blight and its correlation with the black point infection. The monitoring of the disease in seed samples collected from different sources and locations. The maximum (1.15%) seed infection of the black point was recorded in PBW 154 which was collected from Bhudna village of the district Sitapur. Besides, the infected seeds were separated and classified on the basis of symptoms on grains. The fungal flora associated with various types of infected grains was isolated through standard blotter technique/PDA. The healthy and infected seed lot of respective varieties were analysed for germination which was affected by (9.56%), root length (1.26%), shoot length (0.96%), seedling dry weight by 0.5%, vigour index 69.1%, over the varieties.

The total fungal count on average basis over the variety was 8.11 and fungal flora isolated from infected seed included *Fusarium moniliforme*, *Bipolaris sorokiniana*, *Curvularia lunata*, *Alternaria alternate* and *Aspergillus species*.

ROLE OF HOST PLANT RESISTANT IN IPM

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There are two type of resistant one is ecological resistant and other one is genetic resistant in ecological resistant. Apparent resistance resulting from transitory characters in potentially susceptible host plants due to environmental conditions and in genetic resistant when resistant is govern by a gene or modified in gene. Painter (1951) grouped mechanisms of resistance into 3 main categories viz. Non-preference, Antibiosis and Tolerance. Kogan and Ortman (1978) proposed term "Antixenosis" to describe the host plant properties responsible for non-preference. The 3 important mechanisms of resistance are Antixenosis, Antibiosis and Tolerance. Principles of Host Plant Selection - It is a process by which an insect detects a resource-furnishing plant, within an environment of a multitude of diversified plant species. (Panda and Khush, 1995) Generally, 5 phases are defined in this process (Kogan, 1994; Panda and Khush, 1995; Metcalf, 1999). Host-habitat finding, Host finding, Host recognition, Host acceptance and Host suitability. Concept of Biotypes- The term biotype is generally used to describe a population capable of damaging and surviving on plants previously known to be resistant to other populations of the same species. (Kogan, 1994). Host Plant Resistance in IPM Selection and growing of a resistant variety minimize cost on all other pest management activities. Advantages of HPR as a component in IPM-Specificity, Cumulative effect, Eco-friendly, easily adoptable. Effectiveness, Compatibility, Decreased pesticide application, Persistence, Unique situations.

DETECTION OF PLANT PATHOGENIC BACTERIA

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Gram staining test can differentiate bacteria into two broad groups that are Gram positive and Gram negative. Gram positive strain gives

Blue violet colour and gram negative strain give pink red to red colour. Dome test is modified test to that of indicator plant test where the healthy plant parts are vacuum infiltrated with infiltrated water extracts to test sample. This infiltrated plant parts are grown under high relative humidity. Immunoassay test involved the detection of antigen by antibody and the intensity of color resulting from enzymatic activity substrate determined through spectrophotometer or calorimeter. Immune florescent technique is important serological test when antibodies conjugated to a florescent dye, binds to bacteria may be visualized under immune fluorescence microscope. ELISA is one of the commonly used serological tests for the detection of seed borne bacteria. ELISA test is substrate beings to turn color due to presence of enzymes and even very low bacteria titers are detectable. RFLP is one of the advanced techniques adapted to plant science. The technique monitories variations in the strains and genera by monitoring changes in the length of defined DNA fragment produced by the digestion of DNA sample with restriction enzyme and therefore termed as restriction fragment length polymorphism. PCR provides a simple, denous method to exponentially amplified specific DNA sequence in vitro DNA synthesis. Overall for the detection of bacteria pathogens the process is initiated starting from simple and traditional method to the most recent to molecular one providing reproducible result. Also the method should be quick, cheap, and easy for comparable result without any ambiguity.

STUDIES ON REPRODUCTIVE TRAITS OF RED SINDHI CATTLE MAINTAINED AT A.C. DHULE

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The data on reproductive traits of Red Sindhi cattle maintained at Division of Animal Husbandry and Dairy Science, College of Agriculture, Dhule, Maharashtra were collected and analyzed by least squares technique (Harvey, 1990) to estimate the effect of period of calving/birth, season of calving/birth, lactation order and age at first calving. Wherever the effects were significant, mean values were compared by Duncan's Multiple Range Test (DMRT) as modified by Kramer (1957). The correlations among the reproductive traits under study were also studied. The overall least squares mean for AFC, SP, LL, and CI was 1315.02 ± 14.30 days, 85.60 ± 13.36 days, 303.207 ± 11.85 days and 375.67 ± 14.35 days, respectively in Red Sindhi. The effect season of birth on AFC was significant ($P < 0.01$) and effect of season of calving on SP, LL and CI was non-significant. The influence of period of birth on AFC was significant ($P < 0.01$) and effect of period of calving on SP, LL and CI was non-significant. The variations due to lactation order and age at first calving group on SP, LL and CI was non-significant. Phenotypic correlation of LL and AFC was negative and non-significant (-0.089) and it was positive and significant ($P < 0.01$) LL with SP (0.60), LL with CI (0.76) and SP with CI (0.79) While, it was positive and non-significant of SP with AFC (0.06) and CI with AFC (0.04).

DOUBLING FARMER'S INCOME THROUGH INNOVATIVE APPROACH

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Doubling agricultural income in India is a gigantic task and the need of the hour in present day. The past strategies for development of agriculture sector in India have focused primarily on raising agricultural output and improving food security. The net result has made India not only food self-sufficient, but also a net food exporting country. But, the strategy did not clearly address the need to raise farmer's income, which is evident from the incidence of poverty among farm households. In this backdrop, the goal set to double farmer's income is central to promote farmers welfare, reduce agrarian distress and bring parity between income of farmers and those working in non-agricultural professions. There are three primary ways in which income of farmers may be enhanced viz., increasing the gross income, reducing the costs, and stabilizing the income. Some of the innovative approaches for doubling farmer's income are enhancing production through improved seeds, planting material and organic farming; adopting biotechnological approaches; genome editing an alternative to transgenic technology; leveraging water resources and initiating integrated water use policy; strengthening warehousing and cold chain facilities to curb post harvest losses; value addition through food processing; overcoming deficiencies in agricultural marketing through e-NAM; special focus on dryland areas; adopting smart nutrient management practices; regular income through integrated farming systems approach; income enhancement through diversification and professionalization; promoting agri-tourism and rural non-farm employment; structural reforms in agriculture pertaining to land leasing and market restrictions need to be addressed; agriculture to be brought to the concurrent list of the constitution for better central planning; establishing Special Agriculture Zones (SAZ) by selecting export oriented and industrial use crops; promoting scientific agriculture micro-irrigation along with the nutrient application on a very large scale; precision agriculture; harnessing solar energy; agricultural diversification including secondary and specialty agriculture and leveraging the flagship programmes of the government. By adopting the above said approaches in an integrated manner, the objective of doubling farmer's income can be achieved.

CAN IDENTIFICATION OF NITROGEN EFFICIENT CULTIVARS HELP IN ADDRESSING THE PRESSING CHALLENGE OF SUSTAINABLE AGRICULTURE?**PEERSAFFEULLAH¹, TINU ANAND KAIN¹, SHAHID UMAR¹, TARIQ OMAR SIDDIQI¹**¹ Department of Botany, Jamia Hamdard, New Delhi, India-110062

A marked increase in food production has occurred over the past half-century to feed the growing population, which is mainly attributed to application of chemical fertilizers. However, excess inputs of fertilizers also results in severe environmental pollution, climate change and biodiversity loss, which is an enormous environmental challenge of the 21st century. It is estimated that more than 120 million tons of N fertilizers is used annually and less than half of the N applied in developing countries was taken up by crops. Thus reducing fertilizer usage but maintaining crop yield is a pressing challenge. One of the ideal ways to tackle this crisis is to improve NUE of crops. One approach is the identification of new cultivars that utilize N more efficiently. Therefore, our study emphasizes on screening of genotypes on the basis of their Nitrogen efficiencies. An experiment was conducted in the herbal garden of Jamia Hamdard, New Delhi, to study the variations in Nitrogen efficiency (NE) of sixteen accessions of Cauliflower (*Brassica oleracea* L. var *botrytis*) developed by the IARI and IVRI. Cultivars were grown with (60, or 120 kg N ha⁻¹) or without application of N fertilizer. Curd and Shoot yield and N-content were measured and NE was calculated. Nitrate reductase activity was also assayed and plants were screened as low, medium or High N efficient cultivars. The study suggests that the use and identification of high N efficiency accessions might help in addressing the problems of environmental pollution and lead to sustainable agriculture.

Keywords: Sustainable agriculture, Nitrogen efficiency, cauliflower, N fertilizer, screening,

QUALITY SEED PRODUCTION THROUGH SEED CERTIFICATION: A KEY COMPONENT FOR DOUBLING THE FARMERS' INCOME**PEEYUSH KUMAR JAYSAWAL¹, S.K VERMA, PRACHI PANDEY²**¹ Department of Agronomy, ² Department of Genetics and Plant Breeding I. BHU Varanasi-221005, India

A farmer's entire crop depends on the quality of the seed he sows. Therefore it is necessary to produce quality seed for which seed certification is an important step. Seed certification is a legally sanctioned system to maintain quality of seeds during seed production, post harvest operation and distribution of seeds. It is a quality assurance process which includes field inspection, seed quality test, pre and post quality check. It is carried out by Seed certification agency (SSCA) of the concerned state or by National seed corporation (NSC) where such an agency does not exist. The process of seed certification is initiated by an application by the seed grower to the concerned SSCA for certifying the seed produced by him. The application should provide details about the location of farm area of seed plot, crop variety, and the class of seed proposed to be produced, isolation etc. The application is made well in advance of sowing. The SSCA scrutinizes such and on being satisfied, carries out field inspections and seed tests to ascertain the suitability of seed crop for certification. If seed lot satisfies the prescribed purity and quality requirements, SSCA issues suitable tags of certification for affixing them to the seed bag under certification. The validity period of the certificate is nine months from the date of test at the time of initial certification. The validity period could be further extended for six months provided on retesting seed conforms to the prescribed standards in respect of physical purity, germination and insect damage for all seeds except vegetative propagating material for which lots shall be re-examined for seed standards specified for respective crop. The main objective of seed certification is to ensure the acceptable standards of seed viability, vigour, purity and seed health.

Key words: Seed certification, Isolation, Field inspections, validity period

AWARENESS OF DRUDGERY REDUCTION FARM TOOLS AMONG RURAL WOMEN IN AGRICULTURE**PETLA PRIYANKA¹ AND DR. DEEPAK KUMAR MOHANTY²**

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Rural women play a major role in country's economy through their active participation in agricultural activities. They involve in agricultural and allied fields like the crop production, irrigation, manuring, post harvest operations, agro/social forestry, livestock activities, fisheries, etc. The extent of women's involvement and type of activities performed by them in agriculture and allied fields varies greatly from state to state even within a state. These works which lead to "drudgery" is conceived as physical and mental strain, agony, monotony and hardship experienced by human beings while all of the women in the is regard is alarming as they continue to be constrained by illiteracy, malnutrition, and unemployment. So the need of the day is to empower the farm women through technology to have high efficiency in their work output and reduce drudgery through women friendly farm tools and implements. Rural women are not always aware of the improvements they could make by using scientific and technological knowledge. Thus, the attention of rural women was directed towards the women friendly improved farm tool. Rural women from the unorganized sector are vulnerable as new and improved technologies are inaccessible for them. It is imperative that they are exposed to these technologies and encouraged and

motivated to adopt the new technologies which would help them to improve their quality of life.

Keywords: Farm women, drudgery and quality.

HORTICULTURAL INNOVATIONS, FOOD PROCESSING AND VALUE ADDITION

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Abstract: The horticulture sector is considered as the most dynamic and sustainable segment of agriculture in all over the world. It covers pre- and postharvest management of a wide spectrum of crops, including fruits and nuts, vegetables (including potatoes), flowering and aromatic plants, tuber crops, mushrooms, spices, plantation crops, edible bamboos etc. Shifting food pattern in wake of increasing income and health awareness of the populace has transformed horticulture into a vibrant commercial venture for the farming community all over the world. In order to optimize the use of resources, hi-tech interventions like precision farming, which comprises temporal and spatial management of resources in horticulture, is essentially required. Infusion of technology for an efficient utilization of resources is intended for deriving higher crop productivity per unit of inputs. This would be possible only through deployment of modern hi-tech applications and precision farming methods. For improvement in crop production and returns to farmers, these technologies have to be widely spread and adopted. Considering the above-mentioned challenges of horticulturist and their expected role in ensuring food and nutritional security to mankind, a compilation of hi-tech cultivation techniques and postharvest management of horticultural crops is needed. When conditions are not suitable for storage or immediate marketing of fresh produce, many horticultural crops can be processed using simple technologies. There are some processing methods that can be used by small-scale handlers, including drying, fermenting, canning, freezing, preserving and juicing. Fruits, vegetables and flowers can all be dried and stored for use or sale in the future. Fermentation is popular throughout the world as a food preservation method, and over 3,500 individual fermented foods have been described by Campbell-Platt (1987). Fruits and vegetables can be canned or frozen, and fruits are often preserved in sugar or juiced. Value-added to horticultural waste streams and over supply using extraction, separation, concentration and stabilization of specialized ingredients such as fiber and bio actives to improve fresh shelf-life by modified atmosphere packaging, post-harvest coating, dips technologies and sanitation practices. Develop products such as fruit snacks and chilled soups and beverages such as fruit juices that retain fresh-like characteristics by using novel technologies (high pressure processing, pulsed electric field, ultraviolet, short-time heat processing).

Key Words: horticulture, innovations, processing, Value-add, food *etc.*

VERMICOMPOSTING AND ITS IMPORTANCE IN IMPROVEMENT OF SOIL NUTRIENTS AND AGRICULTURAL CROPS

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The tremendous increase in population, urbanization, industrialization and agricultural production results in accumulation quantities of solid wastes. Vermicomposting involves the utilization of earth worms to manage organic wastes and transform them into a stabilized product without including at hermophilic phase (Riggle and Holmes 1994). The vermicompost quality is the most essential criterion in recycling organic waste. It improves soil aeration and texture thereby reducing soil compaction. It improves water retention capacity of soil because of its high organic matter content. It also promotes better root growth and nutrient absorption and improves nutrient status of soil, both macro-nutrients and micro-nutrients (Punjab State Council for Science and Technology, 2010). Vermicompost involves aerobic decomposition of organic waste by using microorganisms. Maximizing the waste-processing rate depends on maintaining high earthworm density throughout the vermicomposting process. *Eisenia foetida* is the most universally known, other earthworms have also been studied, such as *E. andrei* (Castillo *et al.* 2005), *Eudrilus eugeniae* (Padmavathiamma *et al.* 2008). In an ideal condition earthworms can consume practically all kinds of organic matter and they can eat their own body weight per day for example one kilogram of worms can consume one kilogram of residues every day. And yet their casts contain eight times as many microorganisms as their feed. And the casts don't contain any disease pathogens-pathogenic bacteria are reliably killed in the worm's gut. Worm casts also rich in nutrients such as Nitrogen, Phosphorous and Potassium.

IDENTIFICATION AND ISOLATION OF SEEDBORNE FUNGI ASSOCIATED WITH WHEAT FROM JOBNER VICINITY (JAIPUR)**PIYUSH GOSAIN¹, R. RAHIR, PRAVEEN MANGAL²**¹Department of Plant Pathology, S.K.N. College of Agriculture, SKNAU, Jobner-303329, ²Department of Plant Pathology, S.K.N. College of Agriculture, SKNAU, Jobner-303329

A total of eight seed samples were collected from farmers field situated 10-30 kms away from college campus, Jobner (Jaipur). Seed samples were categorized in six groups i.e., Shrivelled, Discoloured, Mechanically and insect damaged, Impurities (plant debris, stone, sand) and apparently healthy seeds. The range of seed moisture varies (13.30 - 15.20%) & germination (83.30% - 85.80%) & maximum healthy seedling (75.70%) were observed. The total spore load/seed in various samples ranged from (6.33×10^3) to (16.05×10^3) by seed washing test. The samples were tested for fungal seedborne pathogens by using the standard blotter method and agar plate method. Present study revealed seven different seedborne fungi viz., *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus niger*, *Curvularia lunata*, *Fusarium oxysporum*, *Rhizopus stolonifer* and *Penicillium spp.* *Aspergillus flavus* was predominance with an infection range of (4.90-11.00) by blotter method and (5.15-11.00) by agar plate method.

IMPORTANCE OF GENETIC ENGINEERING AND ITS ROLE IN DEVELOPMENT OF SALT TOLERANCE**POOJA KHORANIYA¹, SURESH KUMAWAT², SUNIL KUMAR GORA³**

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We believe that the most significant changes in crops will come out by applying genetic engineering tools. Crops may be bioengineered to produce modified kinds of starch, oils and high-value proteins for better nutrition, medical diagnostics and industrial uses. For example, walnuts and peanuts containing healthier oils, along, could become available to consumers. Seedless vegetables and other fruits should appear in the marketplace within 10 years. Oil-producing seed crops may be modified to create specialty oils for a variety of nonfood products such as detergents, lubricants, inks and dyes. Feed seeds engineered to produce higher concentrations of sulfur-containing amino acids could improve wool growth in sheep. Plants could be modified to deliver oral vaccines that prevent diseases such as hepatitis and influenza. Although the tolerance of saline conditions by plants is variable, crop species are generally intolerant of one-third of the concentration of salts found in seawater. Attempts to improve the salt tolerance of crops through conventional breeding programmes have met with very limited success, due to the complexity of the trait: salt tolerance is complex genetically and physiologically. Tolerance often shows the characteristics of a multigenic trait, with quantitative trait loci (QTLs) associated with tolerance identified in barley, citrus, rice, and tomato and with ion transport under saline conditions in barley, citrus and rice. Physiologically salt tolerance is also complex, with halophytes and less tolerant plants showing a wide range of adaptations. We have possible ways, which were appropriate at that time, to develop salt-tolerant crops: (1) develop halophytes as alternative crops; (2) use interspecific hybridization to raise the tolerance of current crops; (3) use the variation already present in existing crops; (4) generate variation within existing crops by using recurrent selection, mutagenesis or tissue culture, and (5) breed for yield rather than tolerance.

Keywords- Genetic Engineering, Salt Tolerance and Crop Resistance to insect pests**RECENT ADVANCES OF SALT TOLERANCE IN TROPICAL AND SUBTROPICAL FRUITS CROPS****POOJA KUMARI, ABHA KUMARI, ARYAMA DEEPTI, SONI KUMARI, NEHA KUMARI**

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Salt stress is one of the major abiotic threats to plant life and plant agriculture worldwide and significantly reduces crop yield in affected areas. Excessive salt above the tolerable limit hamper the plant growth and productivity and extreme condition may lead to plant death. About 20% of all irrigated land is affected by soil salinity, decreasing crop yield. Plants are affected by salt stress in two ways: osmotic stress and ionic toxicity. These stresses affect all the major plant physiological processes including photosynthesis, cellular metabolisms, and plant nutrition. Plants can be divided into two categories in regards to salt stress: glycophytes and halophytes. Glycophytes are extremely sensitive to salt in soils; halophytes are salt tolerant and often grow in salty environments. There are some newly developed salt tolerant rootstocks namely Attani-1 and Attanti-2 in Citrus, Khistwai and Barban in Date palm. Under stress condition proline acts as osmoprotectant and a storage source of nitrogen and may be engineered into citrus for higher salt tolerance. Paclobutrazol (PBZ) play an important role in promoting the avoidance of salt stress in mango by increasing the levels of photosynthetic pigments, water content, K⁺ uptake and its accumulation, reducing defoliation, membrane injury index and uptake and accumulation of harmful Na⁺ and Cl⁻ ions and minimises the effects of salt stress. *In vitro* studies related to abiotic stress provide more understanding of the effect of salinity and draught on date palm cell callus cultures tolerance. Pandey *et al.*, in 2014 suggested that lower levels of Cl⁻ and Na⁺ accumulation could be used as indicators for screening mango rootstocks for resistance to NaCl stress and based on overall performance, salinity tolerance

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increased in the following order Chandrakaran < Moovandan < Bappakai < Nekkare < Kurukkan < Terpentine < Olour. The use of plant growth-promoting bacterial (PGPB) endophytes that contain 1-aminocyclopropane-1-carboxylate (ACC) deaminase has the potential to facilitate plant growth on land that is not normally suitable for the majority of fruit crops due to their high salt contents.

Keywords: - Salinity stress, fruit crops, Management, Recent advances

REMOVAL OF HEAVY METAL FROM WATER AND SOIL

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At many sites around the nation, heavy metals have been mined, smelted, or used in other industrial processes. The waste (tailings, smelter slag, etc.) has sometimes been left behind to pollute surface and ground water. The heavy metals most frequently encountered in this waste include arsenic, cadmium, chromium, copper, lead, nickel, and zinc, all of which pose risks for human health and the environment. They typically are spread out over former industrial sites and may cover acres of land. Mine spoils (locally called chat) cover much of the open space inside the city, and contain high levels of lead, zinc, and cadmium. Heavy metal contamination can be carried with soil particles swept away from the initial areas of pollution by wind and rain. Once these soil particles have settled, the heavy metals may spread into the surroundings, polluting new areas. Cleanup (or remediation) technologies available for reducing the harmful effects at heavy metal-contaminated sites include **Excavation** (physical removal of the contaminated material). Advantages of excavation include the complete removal of the contaminants and the relatively rapid cleanup of a contaminated site. **Stabilization** of the metals in the soil on site, and the use of growing plants to stop the spread of contamination or to extract the metals from the soil (**phytoremediation**). Growing plants can help contain or reduce heavy metal pollution.

MOLECULAR ANALYSIS OF YR GENES IN WHEAT (*TRITICUM AESTIVUM* L. EM. THELL)

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The present investigation entitled was conducted to evaluate 210 recombinant inbred lines of bread wheat to estimate variability, promising RILs, the associations among the various traits and to identify *Yr* genes using SSR markers. High and medium values of GCV, PCV, heritability and genetic advance as percent of mean for grain yield per plant and biological yield in both years indicating a high scope of selection for these traits followed by 100-grain weight, number of spikelets per ear, harvest index, days to heading and days to maturity. Grain yield was significantly and positively correlated with biological yield, harvest index, number of tillers per plant, ear length, number of spikelets per ear, plant height and number of grains per ear, whereas negative and significantly correlated with days to heading in both years. Biological yield and harvest index had high direct and indirect effects on grain yield per plant over the years, indicating the true relationships with grain yield, in this set of material. The RIL No. 52 had better performance for the traits loaded on PC-2, namely grain yield per plant, biological yield and number of tillers per plant and showed 4 *Yr* genes (***Yr7*, *Yr36*, *Yr47*, *Yr53***). This line also showed better performance than mean values in terms of grain yield and its components. The lines viz, RIL No. 13, 24, 31, 120, 121, 134 showed a desirable combination of the traits loaded on PC-1 and PC-2, namely grain yield per plant, biological yield and number of tillers per plant and complemented with disease resistance. The RIL No. 117, 25, 12, 15 had better performance for the traits loaded on PC-1, namely grain yield, biological yield and ear length and showed 2 *Yr* genes (***Yr7*, *Yr47*, *Yr18*, *Yr36*, *Yr26*, *Yr29*, *Yr26*, *Yr29***) respectively. The RIL Nos. 12, 15, 25 were also showed better performance than mean values in terms of grain yield and its components. Fifteen, out of 70 SSR markers were found polymorphic in parental genotypes and in RILs. The gene *Yr7*, *Yr18*, *Yr26*, *Yr29*, *Yr36*, *Yr47* and *Yr53* were linked to yellow rust resistance in the present investigation.

Keywords: Bread wheat, diversity, yellow rust, SSR markers, *Yr* genes

INTEGRATED PLANT DISEASE MANAGEMENT OF BACTERIAL DISEASE

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Major economic losses in agriculture production due to diseases are need to be reduced in order to meet increasing global food demands associated with growth in human population. Particularly on disease control for many bacterial incited disease facing challenges because

of pathogen diversity, high rate of multiplication of bacteria in relatively short period of time, inability to identify durable resistance in host plant to the target pathogen and lack of effective chemical control measures. For most of plant diseases, including bacterial incited diseases, an integrated management strategy is essential. Since current control measures involving the use of traditional chemicals or antibiotics are losing their efficacy due to natural development of bacterial resistance. There is a well recognized need to develop new ecofriendly control measures to combat bacterial crop diseases. Bacteriophages, the viruses of bacteria, have received increased research interest in recent years as a realistic environment friendly means of controlling bacterial diseases. Unlike chemical biocides, phages occur naturally in the environment and humans are thus exposed to them on daily basis without any harm. After application their number increases if their target bacterial host species are accessible to them. Their use presents a viable control measures for a number of destructive bacterial crop diseases, with some phage based products already becoming available on the market. Phages can be used effectively as part of integrated disease management strategies especially with other biocontrol agents. The relative ease of preparing phage treatments and low cost of production of these agents make them good candidates for widespread use in developing countries as well.

THE IMPACT OF A BIO-FERTILIZER ON THE SOIL ORGANIC MATTER STATUS AND CARBON SEQUESTRATION RESULTS FROM A FIELD-SCALE STUDY

POONAM KUMARI YADAV AND SANTOSH YADAV

Long-term soil and crop management such as the excessive use of inorganic fertilizers and pesticides along with the use of heavy machinery, and in-adequate practices of soil management exert a considerable influence on soil quality by worsening the physicochemical and biological properties of the soil. The application of bio-fertilizers is one of the management practices that can help to maintain or increase the content of organic matter (OM) and improve soil fertility in arable soils. The application of UGmax on arable soil resulted in significant changes in the quantity and quality of soil organic matter. Organic matter in the soil treated with UGmax had a higher TOC content, a higher content and contribution of CHAs and C humin in TOC, higher CHAs/CFAs ratio and a lower content of DOC as compared to the control. The use of a bio-fertilizer that increases the formation of permanent humus compounds provides evidence of an increase in the soil organic matter stability. Consequently, the contribution of the organic matter fractions that are more resistant to decomposition is crucial for increasing soil carbon sequestration. Therefore, beneficial soil microbes should be further studied and exploited for the development of sustainable agriculture as an ecological alternative for soil fertility management.

COMPOSITION OF VERICOMPOST AND USE IN AGRICULTURE

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Vermicomposting is the process of producing organic fertilizer or the vermicompost from bio-degradable materials with earthworms. Vermicomposts have higher level of available nutrients like carbon nitrogen, phosphorous and potassium, calcium and magnesium derived from the wastes. In vermicomposting three varieties of earthworms used such as *Eisenia fetida*, *Eudrilus eugeniae* and *Perionyx excavates* in the vermicomposting of plant debris, cattle dung and waste paper mixture of waste paper, plant debris and cattle dung in the ratio of 1:1:1 was found to be the best ratio than 3(paper waste): 2(cattle dung) and 5(plant debris). In 60 days time excellent quality and quantity of compost was produced by three earthworms. The ranges of EC, pH, C/N and germination index were 7.5-4.9 mS/cm, 5.6-7.53, 30.13-14.32% and 12.8-58.4%, respectively. The C/N value showed that the vermicompost was stable. Vermicompost is accepted as humus biofertilizer, soil fertility booster, soil activator and soil conditioner with required plant nutrients of storage polysaccharides and structural polysaccharides, vitamins, enzymes, growth regulators and beneficial microorganisms like nitrogen fixing, phosphate solubilising, denitrifying, decomposing bacteria and methanogenic bacteria. "The Green Revolution" that was promoted in early part of 20th century, was a boost to food production without foreseeing its ill effects. The present trend about waste management is to focus on recycling and the recovery of waste as new materials or as energy. Advantages of vermicompost include enriching soil, increasing harvest yields and suppressing plant disease. Vermicomposting enriching soil, increasing plant growth and yields and suppressing disease. Damping off, seedborne such as *Pythium*, *Phytophthora*, *Rhizoctonia* species successfully suppress these disease.

Key words: Vermicompost; Plant debris; Paper waste; Cattle dung; *Eisenia fetida*; *Eudrilus eugeniae* and *Perionyx excavates*

VERTICAL FARMING: FUTURE FARMING

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Traditional farming is taking a huge toll on the environmental problem that's set to worsen due to our ever-growing global population. Yet there are some high-tech solutions. Here's what you need to know about the burgeoning practice of controlled-environment agriculture and how it's set to change everything from the foods we eat to the communities we live in. As a solution, an increasing number of

horticulturalists and entrepreneurs are turning to controlled-environment agriculture (CEA), and the related practice of vertical farming. While not a total panacea, these high-tech farms are doing much to address many of the problems associated with conventional farming practices. Vertical farming is the practice of producing food and medicine in vertically stacked layers, vertically inclined surfaces and/or integrated in other structures (such as in a skyscraper, used warehouse, or shipping container). The modern ideas of vertical farming use indoor farming techniques and **controlled-environment agriculture** (CEA) technology, where all environmental factors can be controlled. These facilities utilize artificial control of light, environmental control (humidity, temperature, gases) and **fertiligation**. Some vertical farms use techniques similar to **greenhouses**, where natural **sunlight** can be augmented with artificial **lighting** and **metal reflectors**. Vertical farms can help meet our growing population's needs by offering an additional way to produce food that does not share the same volatility and risk as conventional agriculture. While vertical farms require less water and arable land than conventional farms, they are not carbon neutral. Their climate footprint depends heavily on the source from which they draw their electricity to power lighting and control the indoor environment. As renewable energy sources become adopted more widely, the carbon cost of vertical farming will continue decreasing. From a market perspective, it may not bring down prices, but on a societal level, the hope is that vertical farming can help address gaps in overall food demand where conventional agriculture fails.

Keywords: Vertical Farming, Conventional Farming, CEA (**controlled-environment agriculture**), Fertiligation

HYDROPONIC GREENHOUSE: INCREASING FARMER INCOME

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Hydroponics is a modern technology supporting the application of integrated crop management in greenhouse. It is a modern technology involving plant growth on inert media in place of the natural soil, in order to uncouple the performance of the crop from problems associated with the ground, such as soil-borne diseases, non-arable soil, poor physical properties, etc. In combination with greenhouses, hydroponics is becoming increasingly popular. It is high technology and capital intensive. It is highly productive, conservative of water and land and protective of the environment. A balanced distribution of small and larger pores is required in a substrate to ensure adequate availability of water to the plants without to affect the supply of oxygen to the roots. Various non-toxic porous materials are used as plant growth substrates, including rockwool, perlite, pumice, expanded clay, various volcanic materials, polyurethane foam, coir dust, etc. Hydroponics has no adverse effect on the quality of fruits, vegetables and flowers produced in such systems. For production of leafy vegetables and herbs, deep flow hydroponics is common. Organic fertilizers can also be used to supplement or entirely replace the inorganic compounds used in conventional hydroponic solutions. Computers today operate hundreds of devices within a greenhouse by utilizing dozens of input parameters to maintain the most desired growing environment. The technology of greenhouse food production is changing rapidly with systems today producing yields never before realized. The future development of hydroponic/soilless cultured systems appears more positive today than any time over the last 50 years.

Keywords: Hydroponics, soil, crop, greenhouse, environment.

IMPACT OF VARIABLE PRUNING INTENSITIES OF *DALBERGIA SISSOO* ON GROWTH AND YIELD ATTRIBUTES OF MUSTARD VARIETIES UNDER AGROFORESTRY SYSTEM IN CENTRAL INDIA

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The present investigation was taken up with 19 years old agrisilviculture system (*Dalbergia sissoo*+ mustard) during *rabi* season of 2017-18 under AICRP on Agroforestry, Department of Forestry, JNKVV, Jabalpur, M.P. The planting geometry of *Dalbergia sissoo* was 5 × 5 m. The treatment combinations involved four pruning treatments (viz., no pruning, 25% pruning, 50% pruning and 75% pruning) and one open (without tree) in main plot and three mustard varieties (viz., JM-3, Urvashi and NRCR-2) in sub plot. The experiment was laid out in strip plot design with four replications. The soil of the experimental area was medium black. Clay sandy loam with pH 6.0 (acidic), high in organic matter (0.81), medium in available nitrogen (288.1 kg ha⁻¹), high in available phosphorus (20.38 kg ha⁻¹) and low in available potash (170 kg ha⁻¹). In intercropping with *Dalbergia sissoo* three mustard varieties were sown in 45 cm row spacing. The result revealed that crop under open condition recorded significantly higher plant height (142.92 cm), number of branches/plant (6.68), number of siliqua/plant (133.64), length of siliqua (6.08 cm), number of seeds/siliqua (12.05) and 1000 grain weight (4.68 gm). Open condition (without tree) recorded significantly higher grain yield (670 kg ha⁻¹) which was significantly superior to other pruning treatments. Among different pruning treatments 75% pruning recorded significantly higher grain yield (461 kg ha⁻¹) at par with 50% and 25% pruning but significantly superior to no pruning which recorded the lowest grain yield (352 kg ha⁻¹). The percent reduction in grain yield under no pruning, 25%, 50% and 75% pruning as compared to open condition was 47.4%, 36.8%, 34.7% and 31.1%, respectively. Mustard variety i.e. urvashi recorded higher grain yield (509 kg ha⁻¹) at par with NRCR-2 variety (487 kg ha⁻¹) and superior to variety JM-3 which recorded significantly lowest grain yield of 410 kg ha⁻¹. The percent increase in yield under urvashi over NRCR-2 and JM-3

was 4.3 and 19.4 % respectively. Managed agroforestry system gave higher monetary return (Rs. 61628 ha⁻¹) as compared to unmanaged agroforestry system i.e. no pruning (Rs.66349 ha⁻¹). Under managed agroforestry system mustard+ *D.sissoo* in 25% pruning recorded higher monetary return (Rs.80225 ha⁻¹) as compared to crop alone (Rs.19793 ha⁻¹) and tree alone (Rs.48847 ha⁻¹).

Key Words: Agroforestry system, Mustard, *D. sissoo*, Monetary Return

ROLE OF PLANT GROWTH PROMOTING RHIZOBACTERIA IN AGRICULTURE

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Plant growth promoting rhizobacteria (PGPR) shows an important role in the sustainable agriculture industry. The increasing demand for crop production with a significant reduction of synthetic chemical fertilizers and pesticides use is a big challenge nowadays. The use of PGPR has been proven to be an environmentally sound way of increasing crop yields by facilitating plant growth through either a direct or indirect mechanism. The mechanisms of PGPR include regulating hormonal and nutritional balance, inducing resistance against plant pathogens, and solubilizing nutrients for easy uptake by plants. In addition, PGPR show synergistic and antagonistic interactions with microorganisms within the rhizosphere and beyond in bulk soil, which indirectly boosts plant growth rate. Agriculture is one of the human activities that contribute most to the increasing amount of chemical pollutants via excessive use of synthetic chemical fertilizers and pesticides, which cause further environmental damage with potential risks to human health. Nitrous oxide (N₂O) is an example of chemical pollutant produced by excessive use of nitrogen fertilizer and is a major source of greenhouse gases causing global warming. PGPR plays an important role in enhancing plant growth through a wide variety of mechanisms. The mode of action of PGPR that promotes plant growth includes (i) abiotic stress tolerance in plants; (ii) nutrient fixation for easy uptake by plant; (iii) plant growth regulators; (iv) the production of siderophores; (v) the production of volatile organic compounds; and (vi) the production of protection enzyme such as chitinase and glucanase. Nitrogen fixation is one of the most beneficial processes performed by rhizobacteria. Nitrogen is a vital nutrient to plants and gaseous nitrogen (N₂) is not available to them due to the high energy required to break the triple bonds between the two atoms. Rhizobacteria, through nitrogen fixation, are able to convert gaseous nitrogen (N₂) to ammonia (NH₃) making it an available nutrient to the host plant which can support and enhance plant growth. The host plant provides the bacteria with amino acids so they do not need to assimilate ammonia. The amino acids are then shuttled back to the plant with newly fixed nitrogen. Nitrogenase is an enzyme involved in nitrogen fixation and requires anaerobic conditions. Membranes within root nodules are able to provide these conditions. The rhizobacteria require oxygen to metabolize, so oxygen is provided by a hemoglobin protein called leghemoglobin which is produced within the nodules. Legumes are well-known nitrogen-fixing crops and have been used for centuries in crop rotation to maintain the health of the soil. Rhizobacteria are also able to control plant diseases that are caused by other bacteria and fungi. Disease is suppressed through induced systematic resistance and through the production of antifungal metabolites. *Pseudomonas* bio control strains have been genetically modified to improve plant growth and improve the disease resistance of agricultural crops. In agriculture inoculants bacteria are often applied to the seed coat of seeds prior to being sown. Inoculated seeds are more likely to establish large enough rhizobacterial populations within the rhizosphere to produce notable beneficial effects on the crop.

STUDIES ON EFFICACY OF BIO-AGENT AND MANAGEMENT OF ALTERNARIA LEAF SPOT OF BROAD BEAN IS CAUSED BY *ALTERNARIA ALTERNATA* (FRIES).

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Faba bean (*Vicia faba* L.) is belonging to family Fabaceae, which is native to North and Southwest of Africa and popularly known as bakala in India, broad bean, field bean tick bean, hors bean, (small type) etc. It is one of the earliest domesticated food legumes in the world and provides protein requirement of human diet and also a chief source of calcium, iron and vitamins and ranks high among the vegetable. Sprouted seed is a rich source of vitamin A and C. Nutritive value of faba bean is high with about 30 % protein, carbohydrate 56%, fat 0.8 %, crude fiber 6.61-8.54%, ash 3.45% and lipid 1.63% (Crepon *et al.* 2010). Faba bean ranks fourth in the world as an important food legume after garden pea, chickpea and lentil (Torres *et al.* 2006). The leading faba bean producing countries are China, Ethiopia and Egypt (Tekalign, 2014; FAOSTAT, 2017). Faba bean plants infected with many fungal pathogens which caused a considerable yield losses (Mahmoud and Nagwa, 1996). Also it attacked by many foliar diseases such as; chocolate spot (*Botrytis fabae* and *B. cinerea*), Alternaria leaf spot (*Alternaria alternata*), rust (*Uromyces fabae*), downy mildew (*Peronospora viciae*). As well as, root-rots and viral diseases, which are responsible to cause considerable losses in the yield and its component. In general; chocolate spot disease was the major problem of faba bean plants. However, Alternaria leaf spot disease comes predominant on faba bean in many countries (Reis *et al.*, 2007 and Juroszek 2011). Leaf spot of *Vicia faba* (Faba bean) caused by *Alternaria alternata* (Fries) Keissler is one

of the most serious diseases in many areas of Bihar and Jharkhand. Under severe conditions of infection yield loss up to 40 per cent has been reported (Upadhyay and Kumar, 2005). **The evaluated the efficacy** five *Trichoderma harzianum* isolates (T_1 , T_2 , T_3 , T_4 , and T_5). In dual culture plate test revealed that the percentage growth inhibition of *A. alternata* by *T. harzianum* was in the range of 53.85 to 82.81 %. The evaluated nine fungicides against *A. alternata* under *in vitro* condition. Among the tested fungicides Prochloraz (95.3%) found most effective in inhibiting mycelial growth followed by Propineb (65.8%), Saaf (60.5%) and Mancozeb (57.8%). The evaluated the efficacy of different systemic and contact fungicides against early blight of tomato. Among systemic fungicides, Difenconazole inhibited maximum growth of *A. solani* and in contact fungicides, Mancozeb gave highest per cent inhibition.

COMPARATIVE FIELD EVALUATION OF PNEUMATIC PLANTERS FOR VEGETABLE CROPS

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India is the second largest producer of vegetables in the world and accounted for about 15% of the world's production of vegetables with the production level of over 178 million tonnes (mt) from around 10 million hectares (mha) in 2016. The crops of *Brassicaceae* family viz. cauliflower, cabbage and knol-khol etc. were grown on 0.388 mha in 2016 over the country. The total production of the same was 0.88 mt with yield of 22.6 tonnes ha^{-1} in 2016. The conventional method of planting of vegetable crops is manual transplanting. Among different sowing methods, precision sowing is preferred method at present however lack of suitable machines limits the mechanical planting of vegetable crops. Pneumatic planter has the potential of metering irregular shaped seeds, which places the single seed in furrows as per the desired plant to plant spacing by using a rotating seed plate under vacuum pressure. Hence the objective of study was to test and evaluate the field performance of the tractor operated three-row pneumatic planters developed by Centre of Excellence for Farm Machinery (CoEFM), Ludhiana, Punjab and Agricola Italiana SNC (model: SN-1130) for cauliflower, cabbage and knol-khol crops. It was observed that testing field had sandy loam soil with 6.2 % (db) soil moisture content. Lower moisture content helped to avoid furrow opener blocking of pneumatic planter. The suction pressure of the pneumatic chamber was kept as 300, 400 and 500 mmH₂O for the cauliflower, cabbage and knol-khol crops in order. The planters were operated at an average speed of 2.8 km h^{-1} . The row to row distance was maintained as 42 and 44 cm in CoEFM make and Agricola Italiana SNC pneumatic planters with actual field capacities of 0.24 and 0.29 $ha\ h^{-1}$ respectively and their corresponding field efficiencies were 71.92 and 82.25 %.

Key words: field testing, pneumatic planter, cauliflower, cabbage, knol-khol.

"ADVANCES IN MUNG BEAN BY DEVELOPING GENOMIC RESOURCES & FUTURE BREEDING PROGRAMMES"

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Mungbean [*Vigna radiata* (L.) Wilczek] is an important legume crop of Asian continent. It is known for easily digestible protein rich seed, sprouts and dal. It also provides a good source of Folate and Iron. Small genome size (579mb) short life cycle, self-pollination are the desirable features makes it model plant. In recent decades many efforts have been taken to develop molecular markers and mapping populations for QTL analysis of polygenic traits for betterment of yield & other attributes. The sequencing of its wild relative *Vigna radiata* var. *sublobata* has provided framework for genetic research in it. The genetic resources of mungbean are maintained at different centres at Global Level as Asian Vegetable Research & Development Centres, Taiwan; Research & Development Authority, Korea; Plant Genetic Resource Conservation Unit, University of Georgia. Earlier the markers used in mungbean before sequencing of genome was RFLP and RAPD but now a days transcriptome marker as well as sequence based genetic marker as Simple Sequence Repeat & Single Nucleotide Polymorphism are developed, These are codominant, single locus, diallelic markers and easily detectable also. Now the era is changed from traditional marker assisted breeding to next generation sequencing for mungbean and its relatives. The objective of regulatory mechanism manipulation is to develop crop that can withstand changing weather pattern, stress and environmental responses and its stability at multilocation.

USE OF MOLECULAR TECHNIQUES FOR IMPROVING GRAIN QUALITY IN RICE

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Rice which is the world's most important food crop, is a rich source of carbohydrate. It is a staple food and most economic crop of most part of the world. The increasing population of world demands high yielding and nutritional quality of grains. Quality expected in rice grains varies according to geographical region and on consumer demand. Molecular marker techniques are currently the most advanced method available for the transfer of desired gene in desired rice variety with required combination. The known genes or quantitative trait loci can successfully be applied in breeding programs for marker assisted selection (MAS) to improve the breeding and selection efficiencies. Many QTLs and genes have already been mapped or characterized, which help to understand the genetics of grain quality of

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rice. Different validated markers will facilitate marker assisted breeding for grain quality. Various genes can also be pyramided together using gene pyramiding method to obtain desired grain quality according to consumer preferences across the world. Therefore, modern breeding techniques MAS and QTL mapping play an important role in ensuring high yield with excellent quality traits in rice grains and their application is a novel prospect for enhancement of rice yields.

EFFECT OF IRON IN GROWTH, YIELD AND NODULATION OF GREEN GRAM (*VIGNA RADIATE L.*) PRADEEP KUMAR AND RABISH DATT SHUKLA

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The present study entitled Impact of Effect of Iron in growth, yield and Nodulation of Green gram. these carried out at School of Agricultural Sciences and Engineering, IFTM University, Moradabad in 2017-2018. Iron (Fe) is one of the essential micronutrients for higher plant growth and reproduction. Iron plays an important role in nitrate and sulfate reduction and energy production within the plant. These treatments T₁ Control, T₂ RDF + 30kg P₂O₅ + Seed treatment (Fe⁺⁺), T₃ RDF + 30kg P₂O₅ + Seed treatment + One Spray (15 DAS), T₄ RDF + 30kg P₂O₅ + Seed treatment + Two Spray (15 & 30 DAS), T₅ RDF + 45kg P₂O₅ + Seed treatment, T₆ RDF + 45kg P₂O₅ + Seed treatment + One Spray (15 DAS), T₇ RDF + 45kg P₂O₅ + Seed treatment + Two Spray (15 & 30 DAS), T₈ RDF + 60kg P₂O₅ + Seed treatment, T₉ RDF + 60kg P₂O₅ + Seed + One Spray (15 DAS), T₁₀ RDF + 60kg P₂O₅ + Seed + Two Spray (15 & 30 DAS) and three replication.

EMPLOYMENT GENERATION WITH SUSTAINABLE DEVELOPMENT THROUGH SERICULTURE PRADEEP SINGH

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Sericulture, also known as silk farming is an eco-friendly agriculture based labour intensive cottage industries involving mulberry cultivation, silkworm rearing and egg production, reeling and weaving of the loom and other post cocoon processes like twisting, dyeing, painting, finishing etc. along with the utilization of by products, offering a most promising alternative agricultural activity. There are mainly five varieties of silk produced in India such as Mulberry, Tropical Tasar, Oak Tasar, Eri and Munga. Silk is known as the Queen of Textiles the world over. There was 30265 MT silk production in India in the year 2016-2017. Sericulture conserves the environment by non cutting and felling of trees. Sericulture industry provided employment to approximately 8.25 million persons in rural and semi-urban areas in India during 2015-2016. India traditional and culture bound domestic market and an amazing diversity of silk garments that reflect geographic specificity has helped the country to achieve leading position in silk industry.

Key words: Employment, sustainable, sericulture etc.

INTEGRATED RICE-FISH FARMING: A SUSTAINABLE AGRICULTURAL APPROACH PRADOSH KUMAR PARIDA¹, DEBASHIS NAYAK² AND BISWARANJAN SAMANTRAY³

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The integrated rice-fish system is an ancient practice employed by numerous farmers in Asia. China, in particular, has mastered this farming technique where rice and fish grow simultaneously in a symbiotic relationship. It involves a dynamic system of fish poly-culture (a systematic way of rearing fish), production of poultry, livestock and crops, and the "integrated" use of manure, grass and other crops as feeds and fertilizers. Integrated fish farming refers to the coordinated growing of crops as well as rearing of fish in the same plot. This could also involve the rearing of fish. Fish eat weeds and pests, promoting weed control and reducing insect damage. This improves the cultivation of rice, while also reducing fish feed requirements and the use of pesticides. Fish manure serves as fertilizer, and the movement of fish helps turn over and loosen the soil, promoting fertilizer decomposition and root development. With the increasing demand of Rice, both as a major cash and staple crop in India, there is indeed the need for an efficient way of Rice production in reasonably large quantities to meet up with increasing food demand. Fish on the other hand is very essential due to its high nutritional, medicinal and industrial value. This also calls for an improved way of growing fish to meet such high demand.

Keywords: Rice, Fish and integrated.

BIOTECHNOLOGICAL INTERVENTIONS FOR IMPROVEMENT OF FLORICULTURAL CROPS PRAGNYA PARAMITA MISHRA^{1*} AND DURGA PRASAD MOHARANA²

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Floriculture, undoubtedly, has revolutionized the horticultural industry. Floriculture industry requires new plant varieties with elite traits

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such as improved anatomical attributes, wide range of flower colour, long postharvest life, biotic and abiotic stress resistance, floral architecture, fragrance, productivity, timing, synchronicity of flowering, and other desirable attributes. Apart from being a tool for beautification and style, flowers also give a sense of aesthetic gratification. Since the past century, different biotechnological techniques like tissue culture, micropropagation, specific-pathogen-free plantlet production, hybrid embryo rescue, haploidy/doubled haploids, somatic embryogenesis, transgenic, or GM (genetically modified) based technologies, etc. are contributing significantly to the floricultural sector. Biotechnology plays an important role in developing novel and interesting flowering plants with unique and desirable attributes.

Keywords: Floriculture, biotechnology, transgenic, aesthetic gratification

SURVEY AND CHEMICAL MANAGEMENT OF RICE FALSE SMUT DISEASE

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Rice (*Oryza sativa*) is the most staple food crop in world. False smut of rice (*Ustilagoidea virens*) is one of the major emerging and destructive disease especially in high yielding rice varieties. Survey has been made for disease incidence of rice in infected rice varieties. The incidence of flowering of infected tillers was found ranging from 5 % to more than 50 % in different varieties like Sarjoo 52, NDR 359, HUR- 12. The experimental result revealed that the fungicides Amistar Top (azoxystrobin 18.2 % + difenoconazole 11.4 % w/w SC) Folicur was found most effective where percentage of infective spikelet's per m² reduced to 10.75%. In the term of percentage of infected spikelets/panicle, the treatment with Amistar Top (azoxystrobin 18.2 % + difenoconazole 11.4 % w/w SC) recorded the lowest percentage i.e. 6.35 % which was at par with the treatment Folicur (tebuconazole 250 EC). The grain yield obtained from each plot it was found that the treatment with Amistar Top (azoxystrobin 18.2 % + difenoconazole 11.4 % w/w SC) gave the highest grain yield/plot (49.64 q/ha) which was at par with the Folicur (tebuconazole 250 EC) i.e. 48.92 q/ha.

Key words: Survey, Incidence, Tillers, fungicides etc.

ESTIMATION OF HETEROSIS AND COMBINING ABILITY IN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Heterosis and combining ability analysis were studied in a 6 × 6 diallel set of bread wheat during Rabi 2015-2016 at Crop Research Farm, Nawabganj of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, (Uttar Pradesh). Observations were recorded on 9 quantitative traits. Analysis of variance for general combining ability (gca) among the parents revealed that all the traits were found highly significant but specific combining ability (sca) for the crosses were observed highly significant for all the traits except number of productive tillers per plant, spike length and grain yield per plant. Combining ability analysis revealed the involvement of both additive and non-additive gene action in the inheritance of most of the traits. Among the parents, K9107, PBW343 and K1006 proved to be good general combiners based on their gca effects as well as per se performance for grain yield. In regards to sca effects, the F₁ hybrids K1006×K9107 and K9107×K607 were exhibited good specific combinations for grain yield. Heterosis at better parent reflected the idea of gene action i.e. dominance, over dominance or recessive. The positive and significant values always indicated over dominance effect of the parents. For grain yield per plant, three cross combinations K1006×K424, K9107×K424, and K607×K424 identified with positive significant over better parent heterosis.

Keywords: Wheat, diallel, GCA, SCA, heterosis.

STUDY ON EFFECT OF TECHNIQUES OF CROP ESTABLISHMENT AND NITROGEN LEVELS ON THE PERFORMANCE OF RICE (*ORYZA SATIVA* L.)

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Present investigation entitled "Study on effect of methods of establishment and nitrogen levels on the performance of rice (*Oryza sativa* L.)" was conducted during Kharif 2016 at experimental site of (Agronomy Research Farm), Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.). The experiment was carried out in field with three methods of establishment (M₁- transplanting, M₂-SRI and M₃- direct seeding) were kept in main plots and five nitrogen levels (N₀- 0 kg N ha⁻¹, N₁- 40 kg N ha⁻¹, N₂- 80 kg N ha⁻¹, N₃-120 kg N ha⁻¹ and N₄- 160 kg N ha⁻¹) in sub plots. The experiment was laid out in split plot design with three replications on silt loam soils having low organic carbon (0.43 %) and nitrogen (160 kg ha⁻¹), medium in phosphorus (16.50 kg ha⁻¹) and potassium (260.0 kg

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ha⁻¹). Results of the experiment revealed that growth contributing characters viz., plant height (cm), number of tillers m⁻², dry matter accumulation (g m⁻²), leaf area index, and yield attributes like number of panicles m⁻², length of panicle (cm), number of grains panicle⁻¹, test weight (g), grain and straw yield (q ha⁻¹) of rice were significantly higher under SRI method (M2) as compared to other methods of establishment. The growth characters like plant height (cm), number of tillers m⁻², dry matter accumulation (g), LAI and yield attributes like number of panicle m⁻², length of panicle, test weight (g), grain and straw yield (q ha⁻¹) of rice were significantly higher under 160 kg N ha⁻¹ being at par with 120 kg N ha⁻¹ and found to be significantly superior over other nitrogen levels. Test weight (1000- grain weight) was not influenced significantly due to methods of establishment and nitrogen levels.

Key words: SRI method, LAI,

EFFECT OF DIETARY SUPPLEMENTATION OF NEEM LEAF MEAL ON GROWTH PERFORMANCE OF VANARAJA CHICKS

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Ten weeks feeding trial was conducted to evaluate the effect of neem (*Azadirachta indica*) dried leaf meal supplemented diet on growth performance of Vanaraja chicks. One hundred fifty growing chicks of Vanaraja birds were randomly divided into 15 separate floor pens each comprising of 10 chicks in three replication groups following completely randomised design. Five rations were formulated to contain dried neem leaf meal at 0, 1.25, 2.50, 5.00 and 10.00 percent of ration. Feed intake was measured daily and chicks were weighed weekly. Feed and water were given *ad-libitum*. Performance records and mortality percentage were measured. The significance differences in feed consumption and final body weight ($p < 0.05$) were observed among five treatment groups. There was no significant difference were in BW and FCR when chicks fed diet 0, 1.25 and 2.50 % of leaf meal. On 71st day two birds from each pen were slaughtered to analyse haematological profile (PCV, RBC, Hb, Serum and tissue cholesterol). Bird fed 5% neem leaf meal supplemented diet shows better haematological parameters in PCV, RBC and Hb. Also, supplementation of dried neem leaf meal at 5% and 10% of diet shows significant effect ($p < 0.05$) on decreasing mortality over control group. Serum and tissue cholesterol level significantly decreases ($p < 0.05$) with increasing level of neem leaf meal. The result of this investigation shows that supplementation of neem leaf meal up to 5% of dietary level can be used as growth promoter in Vanaraja chicks and could be sale early for meat purpose.

Key word: *Neem, Leaf meal, Haematological profile, Vanaraja Chicks*

CHANGES IN PHYSICAL PROPERTIES DURING NORMAL AND MODIFIED VERMICOMPOSTING OF DIFFERENT ORGANIC RESIDUES

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The experiment was laid out in factorial randomized block design with Four treatments (sugarcane trash, soybean straw, vegetable market waste and sugarcane trash + soybean straw) and three replications for both of the method (Normal vermicomposting M₁ and Modified vermicomposting M₂). During vermicomposting period, the samples were collected at an interval of 15 days. i.e. 15th, 30th, 45th, and 60th day's interval. In normal vermicomposting black colour indicated in vegetable market waste, very dark brown in soybean straw, dark grey in sugarcane trash and very dark brown in sugarcane trash + soybean straw. While in case of the modified vermicomposting black colour of vermicompost indicated in vegetable market waste, very dark grey in soybean straw, very dark grey in sugarcane trash and very dark grey in sugarcane trash + soybean straw. The result indicated that the physical properties like temperature and porosity was recorded significantly higher in normal vermicomposting (M₁) than modified vermicomposting (M₂) at 15 to 60 days. In treatment the maximum reduction of temperature was recorded with vegetable market waste (T₃) 24.83°C over to soybean straw (T₂) 27.17°C, sugarcane trash + soybean straw (T₄) 27.67°C and sugarcane trash (T₁) 28.67°C at all days. The lower value of porosity was recorded 67.54 to 63.39 % with vegetable market waste (T₃) at 30 to 60 days of vermicomposting than the other treatments. The high value of bulk density (Mg m⁻³) was recorded in modified vermicomposting (M₂) over to normal vermicomposting (M₁) at 30 to 60 days. In vermicomposting with vegetable market waste (T₃) was highest bulk density recorded (0.97 Mg m⁻³) at 60 days.

ROOTSTOCK TRANSFORMATION: STRATEGY TO MITIGATE THE VARIOUS STRESSES IN FRUIT CROPS

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Fruits are the source of vitamins, micronutrients and play an important role in the nutritional security. The extending area under fruit

cultivation with an efficient utilization of degraded and affected land in order to enhance per capita availability of fruits. The several biotic and abiotic stresses such as salinity, drought, frost, insect-pest and diseases etc. hinders an establishment of a fruit orchard in the stress-prone area thereby greater reduction in the total fruit yield and productivity. The strategies of conventional rootstock breeding often more time consuming, labor intensive and expensive. Genetic engineering as an alternate approach to make breeding faster, more specific and economical. The development of resistant rootstocks through *Agrobacterium*-mediated and particle bombardment transformation with the intention of silencing stress causing genes. The non-transformed desirable fruit variety used as scion for grafting on genetically modified rootstock. There is no any modification in the genetic of scion after grafting on transformed rootstock. The normal transportation of water, sugar and other metabolites including small molecules of RNA except DNA from the GM-rootstock into the non-GM scion variety. Even though there is no alteration in the DNA of the scion by the transformed rootstock. Those transported molecules from the rootstock can influence the expression of specific genes in the scion which are responsible for stresses in a specific manner. The transformed rootstocks for grafting has been adopted in some regions of the world in some fruit crops like apple, peach, grape and walnut etc. The studies on the feasibility of rootstock transformation against specific stress in other commercial fruit crops are needed.

TRADITIONAL KNOWLEDGE AND ETHNOBIOLOGY

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This paper involves the portrayal of how traditional knowledge is important in agriculture and how its adaptation with recent trends can prove beneficial in maintaining the social and economic sustainability of the environment. It asserts that an understanding of indigenous practices of cultivation along with the scientific study about the behaviour of the farmers can offer huge potential for revolutionizing the manner in which the agricultural sector in our country operates. Since the majority of Indian farmers are not very accepting of change to modern practices, the utility of Ethnobiology to overcome the barrier can be made. Ethnobiology is the study of biological knowledge of particular ethnic groups cultural knowledge about plants and animals and their interrelationships. Traditional knowledge is emerging as important, even necessary, for managing key resources and ecosystem. Most of the knowledge is learned long ago and passed on to generations but Ethnobiological knowledge is subject to change since our environment is dynamic. The combination of religious practices, myths and spiritual beliefs all render the traditional practices not as a science, yet, this aspect has significance which is why the topic is of utter interest among recent scholars. There is a desperate need to record knowledge that is being forgotten due to adoption of modern practices that are not completely beneficial to agriculture. Thus, Ethnobiology is a major part of the ongoing effort to save these natural and human worlds and reduce the dominance of technology.

Keywords :- Ethnobiology, sustainability, indigenous knowledge, environment.

GENETIC VARIABILITY STUDIES IN CLUSTER BEAN [*CYAMOPSIS TETRAGONOLOBA* (L.) TAUB]

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An present investigation was carried out at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences Allahabad during during Kharif 2016-17. Fifteen genotypes of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] were evaluated to estimate variability, broad sense heritability and genetic advance over mean for vegetable pod yield and related attributes. Maximum range of variability was observed for plant height 90 days (cm), number of branches 90 days, fruit clusters per plant, pod/plant, pod yield per plant (g) and pod yield/ha (q). High heritability coupled with high genetic gain in percentage was observed for all studied traits excepted days to 1st flowering, days to 50% flowering, days to 1st pod picking, pod width, pods/cluster. Showed high genotypic coefficient of variation as well as high phenotypic coefficient of variation was recorded for number of branches/plant 45 days while recorded minimum for days to 1st pod picking. The results of present investigation suggested that selection based on plant height 90 days (cm), number of branches 90 days, fruit clusters per plant, pod/plant, pod yield per plant (g) and pod yield/ha (q) might bring simultaneous improvement in vegetable pod yield of cluster bean.

Keywords: Cluster bean, genotypic coefficient, phenotypic coefficient of variance, heritability and genetic advance

EFFECT OF LEVELS OF POTASSIUM AND IRRIGATION ON YIELD, TUBER QUALITY AND WATER USE EFFICIENCY

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Potato is grown usually on the moisture stored in soil during preceding rains and as such the crop suffers from frequent moisture stress

condition. Under such condition it becomes imperative to utilize water efficiently and to improve the water use efficiency of the crop with improved yields. Thus, optimum use of water and potassium is needed for improved yield and quality of potato. Experiments were conducted at water management field of Rajendra Prasad Central Agricultural University, Pusa (Samastipur), Bihar on calcareous sandy loam soil, alkaline in nature having pH 8.5, low nitrogen, phosphorus and potassium in split plot design, replicated thrice to evaluate the performance of potato on four levels of irrigation on the basis of IW/CPE ratio (I_1 , I_2 , I_3 and I_4 i.e., 0.6, 0.8, 1.0 and 1.2, respectively) in main plots and five levels of potassium (K_0 , K_1 , K_2 , K_3 and K_4 i.e., K_2O @ 0, 50, 100, 150 and 200 kg ha⁻¹) in sub plots. Yield, tuber quality and water use efficiency were studied. I_4 level of irrigation improved the potato tuber yield by 16.43 and 17.65 per cent over I_1 similarly K_3 level of potassium improved the tuber yield by 22.88 and 29.20 per cent over control (K_0) 1st year and 2nd year, respectively. I_4 level of irrigation was found the best for all quality parameters like reducing sugar, starch content, T.S.S., specific gravity and crude protein. For crude protein and reducing sugar K_3 level was found the best while K_4 level for starch, T.S.S. and specific gravity. The highest value of water use efficiency was recorded with I_2 level of irrigation. Increasing levels of potassium significantly improved the water use efficiency up to K_3 level of potash application during both years.

Key Words : Potassium , Irrigation, Tuber quality ,water use efficiency

EFFECT OF NPK ON PLANT YIELD AND QUALITY OF CAPSICUM (*CAPSICUM ANNUM* L.) C.V. YOLO WONDER UNDER SHADE NET CONDITION.

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A field experiment was conducted to study of "Effect of NPK on Plant Growth, Yield and Quality of Capsicum (*Capsicum annum* L.) c.v. Yolo Wonder Under Shade Net Condition" during *Rabi* season (October to March) in the year 2017-18 of the Department of Horticulture, at Faculty of Agriculture, Bhagwant University Ajmer under semi arid eastern plains. The experiment consists of 9 treatment viz, There were 9 treatment viz T_1 , T_2 , T_3 , T_4 , T_5 , T_6 , T_7 , T_8 , T_9 laid out in Randomized Block Design with three replications. The treatment combination of N.P.K. T_7 (160:60:50 kg/ha) found superior overall other treatments in relation to growth parameters but low in production and quality, N.P.K. T_5 (160:70:50 Kg./ha) found superior in terms of yield and N.P.K. T_6 (150:60:50 kg/ha) was superior in relation to quality (fruit length, fruit diameter, shelf life, TSS) of capsicum. Maximum T_5 Number of Fruit/Plant, fruit yield per plant (kg), fruit yield (kg)/green house (8.70), (1.99kg), (321.84kg) and T_6 fruit length (9.61cm), fruit diameter (8.01cm), TSS (5.82°B), Shelf life (7.60 days) fruit weight (gm.) (230.99gm). T_5 was found to be most viable economically in terms of net returns, and Cost of benefit ratio (7069554Rs/ha & 1:3.18). Thus, application of optimum doses of NPK was found highly beneficial for plant growth, yield and quality of capsicum.

Keyword: Capsicum, NPK, Growth parameter, yield, TSS, Shelf Life.

EFFECT OF ORGANIC MANURE AND INORGANIC FERTILIZERS ON MAIZE PRODUCTION

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It is one of the most important cereal crop, that allow the food self-sufficiency program of the country, playing a key role in the human diet and animal feed, providing adequate amounts of energy and protein. Being the exhaustive crop, maize requires large amount of nutrients particularly N for producing more yield. Depletion of soil organic matter (SOM) and plant nutrients lead to reduction in soil fertility and productivity. This problematic situation is aggravated by continuous cultivation on crop with the mismanagement of nutrient sources, especially mineral fertilizers resulting in imbalanced soil nutrient status. The quality protein maize is low due to inherent low soil fertility and poor nutrient management practices like low use of inorganic fertilizers, no use of organic manures, poor recycling of crop residue and no use of secondary and micronutrient. In maize cultivation, the farmers are giving much attention only to N fertilization and very often P and K applications are carried out at minimal level, mostly missing K fertilization. The SSNM approaches not only aim to reduce or increase fertilizer use, it is also effective tools for supplying crop nutrients and to achieve higher yield, besides this it also aims to increase nutrient use efficiency, leading to more net returns per unit of fertilizer invested.

MECHATRONICS DRIVEN SEED METERING MECHANISM IN PRECISION PLANTING

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Mechatronics basically refers to mechanical electronic systems and normally described as a synergistic combination of mechanics, electrical, electronics, computer and control. When these are embedded makes possible the generation of simple and reliable systems

such as precision sowing technologies. Precision planting is a prerequisite for mechanized cultivation and its importance in efficient land use. Conventional planters have problems of ground wheel skidding and vibration in the mechanical transmission system which affect desired seed spacing. This opens new innovative ways of cultivating that allows farmers to quality of planting without losing seed, accuracy and time. The mechatronic driving system performed better than the mechanical driving system both on tilled and non-tilled fields. The control system could make the seed-metering device synchronized with the working speed of the planter so as to reduce seeding non-uniformity caused by ground wheel's slipping. It was observed that as the working speed increased, quality of feed index (QFI) of the seed-metering device dropped gradually with increased miss index (MI) and precision index (PI) as well as deviation from the average seeds spacing became greater. The studies were indicated that pneumatic planter equipped with mechatronics system observed good seeding uniformity among all seeding technologies. Thus, mechatronics metering mechanism may be one of the options to achieve accurate seed spacing with higher efficiency in order to reduce the effect of forward speed.

Keywords: Precision, Synergistic, Sensor, Mechatronics, mechanized.

EFFECT OF WEED MANAGEMENT ON SOIL MICRO FLORA IN SPRING SEASON SWEET CORN (*ZEA MAYS* L. SACCHARATA) IN TARAI REGION OF UTTARAKHAND

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A field experiment was conducted in the spring season of 2017 in sweet corn crop to evaluate different weed control methods and to find out the best weed management practice with the lowest impact upon soil health. Effectiveness of weed control measures were evaluated on the basis of weed control efficiency on the basis of total accumulation of weed dry matter. The highest weed control efficiency was recorded in hand weeding twice at 20 and 40 DAS which was closely followed by pre-emergence application of atrazine 1000 g/ha followed by sequential application of tembotrione 120 g/ha. The lowest set of values of soil dehydrogenase activity was recorded from pre-emergence application of atrazine at 1000 g/ha alone and in combination with other weed control measures suggesting an overall negative impact of atrazine upon the soil microbial activity. Pre-emergence application of atrazine 1000 g/ha was found to have detrimental effects upon soil micro flora as indicated from the decline in soil dehydrogenase activity. However application of tembotrione alone as post emergence 120 g/ha was having very low impact upon soil micro flora on the basis of soil dehydrogenase activity with an appreciable weed control efficiency. The study also indicated about the time that a healthy soil needs to recover from the damage caused to the soil micro flora by application of different chemicals. Continuous use of atrazine 1000g/ha as soil application without proper allowance time for the soil micro flora to come back to its original state after the damage has been caused, should be strictly avoided from soil and environmental health point of view. Manual weeding and use of less toxic foliar applied herbicides like tembotrione 120 g/ha and halosulfuron-methyl 90g/ha as post emergence application may be used as options for effective weed control in spring sweet corn crop profitably without deteriorating soil biological health especially.

EFFECT OF CHEMICAL FERTILIZERS AND BIOFERTILIZERS ON NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI) IN BARLEY CROP

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Barley (*Hordeum vulgare*) is fourth most important cereal crop in the world after wheat, rice and maize having share of seven percent of the global cereals production. It can be successfully grown in adverse climatic conditions of drought, salinity and alkalinity. An experiment was conducted during *rabi* 2015-16 and 2016-17 at Agronomy Research Area of CCS Haryana Agricultural University, Hisar, Haryana (India) situated at 29°10' N latitude and 75° 46' E longitude at an elevation of 215.2 m above mean sea level to study the response of barley to fertilizer levels and different combinations of biofertilizers. The experiment was laid out in a split plot design with three fertilizer levels (50, 75 and 100 % RDF) in main plots and seven different combination of biofertilizers (Uninoculated, Seed inoculation with *Azotobacter*, Seed inoculation with *Azospirillum*, Seed inoculation with PSB, Seed inoculation with biomix, Seed inoculation with *Azotobacter*+PSB and Seed inoculation with *Azospirillum* +PSB) in sub plots replicated thrice. Based on the research investigation it was found that NDVI value of barley at all the stages of crop growth increased significantly with increase in fertilizer levels during both the years of experimentation. But, the NDVI value of barley with the application of 75% RDF was at par with application of 100% RDF at all the stages of crop growth. However, in the year 2016-17 the difference in NDVI value of barley at anthesis stage was significantly higher with the application of 100 % RDF as compared to 75 % RDF. Various combinations of biofertilizers inoculation failed to influence NDVI value of barley at all the stages of crop growth.

Keywords: biomix, NDVI, *Azospirillum*, *Azotobacter*, PSB

EFFECTIVE USE OF NITROGEN FIXING WATER FERN AZOLLA AND ANABENA IN RICE CROP**PRITISHREE BHOI¹ AND DEBASHIS NAYAK²***1: Gandhi Institute of Biological sciences, Berhampur University, Gunupur, Rayagada, Odisha, 2: Dept. of Agronomy, Krishi Vigyan Kendra Mayurbhanj-I, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha*

Agriculture is one of the most important factors contributing to the economic growth of India. Out of the 329 million hectares of India's geographical area, about 114 million hectares are under cultivation. In order to reap a better harvest, farmers inoculate the soil with fertilizers. Fertilizers come in two types they are either chemical or biofertilizers. Increasingly high inputs of chemical fertilizers during last 150 years have not only left soils degraded, polluted and less productive but have also posed severe health and environmental hazards. Organic farming methods (such as the use of biofertilizers) would solve these issues and make the ecosystem healthier. Ability of Azolla-Anabaena system to fix atmospheric nitrogen at faster rates makes it an outstanding agronomic choice for the cultivation of rice under tropical conditions. Nitrogen fixation potential of the Azolla-Anabaena system has been estimated to be 1.1 kg N ha⁻¹ day⁻¹ and one crop of Azolla provided 20-40 kg N ha⁻¹ to the rice crop in about 20-25 days. Azolla has been known to influence the dynamics of the total soil and microbial population of nitrogen fixing bacteria. The soil fertility index will improve due to the accumulation soil enzymes. Therefore we need to have efficient strains of Azolla to maintain the soil fertility.

Keywords: Azolla, Nitrogen fixing bacteria and soil fertility.

IMPORTANCE OF VALUE ADDITION IN HORTICULTURE CROPS**PRIYANEGI¹ AND RAJ BALACHOUDHARY²***Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner, Jaipur (Raj.) 303329*

Fruits and vegetables are highly perishable but most important commodity for human diet due to their high nutritional value. Fruit and vegetable are available in surplus only in certain seasons and availability in different regions. In peak season due to improper handling practices, marketing, storage problems around 20-25% fruit and vegetable are spoilt in various stages. They are the cheapest and other source of protective food supplied in fresh or processed or preserved form throughout the year for human consumption. Hence, proper postharvest management handling and processing is required in horticulture crops. To make foods available throughout the year, humans have developed methods to prolong the storage life of products, that is, value addition by preserve them. The technology has become a necessity to improve the food safety and strengthen nation's food security. The technology helps to boost export of horticultural commodities in the form of preserved and value added products. Preservation helps the farmers to obtain a better return by checking wastage during a market glut. It keeps the products in proper condition, which is not possible under ordinary or cold storage conditions. hence, preservation is suitable substitute for storage. It allows fruits and vegetables to be available during off seasons and in locations where these are not grown. One of the main difficulties in the path of the growth of the fruit and vegetable industry has been the inadequacy of knowledge of the modern methods and techniques of preservation. So, to overcome these difficulties various aspect of the importance of various preservation methods and limitations to be considered during preservation of fruits and vegetables.

Keywords: value addition, preservation, post harvest, horticulture crops.

SECONDARY METABOLITES OF MICROBIALS AS POTENTIAL SOURCE OF AGROCHEMICALS**PRIYASINGH***Department of Plant Pathology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand*

Indiscriminate use of pesticides over last four to five decades have led to development of resistance in plants and accumulation of toxic residues in the environment, leading to serious health hazards. Use of microbial secondary metabolites is an alternative strategy for pest management. Microbial pesticides comprise of microorganisms such as fungi, bacteria, viruses and actinomycetes. They produce mixture of structurally related compounds called as secondary metabolites which have no role in their growth and development. The natural products of microbial origin are categorised as Bactericides, fungicides, insecticides, herbicides and nematocides. The major insecticide includes Spinosads from actinomycetes, Avermectins and milbemectins. *Bacillus thuringiensis* and *Photobacterium luminescence* are potential insecticides. The toxin produced by *Bacillus thuringiensis* is effective against wide range of insects including Lepidoptera, Diptera and Coleoptera. Bialaphos and Vulgamycin isolated from actinomycetes are major commercially available bioherbicide. They can effectively control both monocot and dicot weeds. Fungicides and bactericides of microbial origin comprise of Strobilurins, Blastocidin, Kasugamycin, Vallidamycin which are effective against *Venturia inaequalis*, *Cercospora arachidicola* and *Phytophthora infestans*. According to Business Communication Company (BCC) the total global market for microbes and microbial products was estimated at nearly \$143.5 billion in 2014 and is expected to reach nearly \$306 billion at a compound annual growth rate (CAGR) of approximately 14.6% over the period from 2015 to 2020 (Microbial products 2015). Pesticide based on micro-organisms are proven to be highly effective. Being ecofriendly, less hazardous to non target pest, these microbial pesticides emerges as potential option for pest management and there is ample scope for further development in agriculture.

INFLUENCE OF FOLIAR APPLICATION OF NUTRIENTS ON FLOWERING, FRUITING CHARACTERISTICS AND YIELD OF GUAVA (*PSIDIUM GUAJAVA*) CV. L-49**PRIYA YADAV, J.R. SHARMA, RUPAKSHI AND SATPAL BALODA***Department of Horticulture, CCS Haryana Agricultural University, Hisar*

In depth study focusing to ascertain the effect of foliar sprays of ZnSO₄ (0.50, 0.75 and 1.00%), FeSO₄ (0.2, 0.4 and 0.6%), K₂SO₄ (0.5, 1.0 and 1.5%) and Urea (1.0, 1.5 and 2.0%) along with control (water spray) before flowering and after fruit set, during rainy and winter seasons, in improving the flowering, fruiting characteristics and yield of guava (*Psidium guajava* L.) cv. L-49 was carried out in the Experimental Orchard of Department of Horticulture, CCS Haryana Agricultural University, Hisar during 2016-17. The findings of the experiment revealed that the foliar application of various nutrients significantly increased the flowering and fruiting characters of the plants over control. Maximum number of flowers per branch (19.66 and 14.74), fruit set (61.17 and 70.24%) and yield per plant (32.76 and 29.31 kg/tree) were recorded with minimum fruit drop (19.52 and 14.27%) under the treatment ZnSO₄ @1.00 per cent, during rainy and winter seasons, respectively. Application of ZnSO₄ @0.75 per cent was also found to be equally good, during both the seasons of investigation.

Key words: Nutrients, foliar spray, guava, growth, yield.

EFFECT OF BIOFERTILIZERS ON GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L.)**PRIYANKA GURJAR¹, R.S. GURJAR² AND J.S. GURJAR³***1. College of Agriculture, RVSKVV GWALIOR, 2. BRAUSS, Mhow, M.P., 3. M.G.C.G.V., Chitrakoot, Satna M.P.*

Okra (*Abelmoschus esculentus* L.) is one of the most important vegetable crops belongs to malvaceae family being grown all over the country. Okra is an economically important vegetable crop grown in tropical and subtropical parts of the world. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flower, pods, stems and seeds. Okra immature fruits which are consumed as vegetables, can be used in salads, soups and stews, fresh or dried, fried or boiled. Raw okra is 90% water, 2% protein, 7% carbohydrates and negligible in fat. In India okra is grown in 501.02 lakh hectare areas and its production is 5972.23 MT (2017-2018). This experiment was conducted college of Agriculture gwalior during the rabi season of 2017 - 2018 to study the "Effect of Biofertilizers on growth and yield of okra c.v Pusa Sawani. The experiment comprised of biofertilizer viz. Azospirillum and AMF with 4 levels of recommended dose of fertilizer 25, 50, 75, 100% were tested in comparison with control (no fertilizer and chemical fertilizer). The experiment was laid out in RBD (Randomized block design) with 9 treatments replicated thrice. Based on the results, it could be concluded that the application of biofertilizers Azospirillum + AMF + 75% RDF could increase the growth, yield and yield components of okra.

FOOD PROCESSING AND VALUE ADDITION IN HORTICULTURAL CROPS**PRIYANSHU SINGH, PH.D. RESEARCH SCHOLAR (DEPT. OF HORTICULTURE)***Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh- 221005*

The purpose of traditional food processing is preservation to maintain a supply of wholesome, nutritious food during the year and preservation for the time of scarcity. While food processing still has the main objective of providing a safe nutritious diet in order to maintain health, other aspects, particularly the generation of wealth for the producer and seller, have become increasingly important. The increasing number of women who now work away from home adds additional pressure for such changes. Even people with a heavily traditional diet are demanding external products either as occasional treats such as gassy drinks, or basic commodities such as white sugar and flour. One of the major problems in horticultural sector is value addition of raw products by processing as horticultural crops are perishables. On average less than one percent of vegetables produced are processed as most of the processing takes place by the traditional method and for the traditional use as results vegetables are processed at the very small scale. The goal of the project is to improve livelihood opportunities through vegetable processing. The objectives of the project was value addition in fresh leafy vegetables by processing through solar drying method; upgrade the technical knowledge and skills of improved vegetables processing techniques, and increasing food security in the community. The findings include the fact that leafy vegetables losses is very high as majority of community members lack knowledge and technical skills in food processing, lack of market for processed vegetables and inadequate capital for investment. However, the income generating activity identified to improve livelihoods was leafy vegetables processing by solar dryer method. Vegetable processors group implemented the project which was designed based on the specified objectives. Participatory monitoring and evaluation realized project output at 86.4% for the enhancing knowledge of vegetables processing techniques.

Keywords: solar dryer method, food processing, participatory monitoring and evaluation

THEME: ENVIRONMENTAL AND LIVELIHOOD SECURITY FOR SUSTAINABLE DEVELOPMENT

STUDY OF DISSIPATION BEHAVIOR OF MALATHION IN CABBAGE

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A field experiment was conducted at research farm of Department of Entomology, CCS HAU, Hisar during the 'rabi' season of 2017-2018 to study the dissipation behavior of malathion 50 EC @ 1L/ha in cabbage samples. Malathion was applied as foliar spray at the recommended dose @ 1L/ha and double of the recommended dose @ 2L/ha at the head formation stage to control the different insect-pests of cabbage. For the analysis of residues of malathion in cabbage the samples were picked at 0 (1hr), 3, 5, 7, 10 and 15 days of application of insecticide. Samples were carried out in residue analysis laboratory, Department of Entomology, CCS HAU, Hisar. Samples were **extracted and cleaned up by using liquid-liquid partitioning method**. Residues of malathion in cabbage was analyzed by using the Gas Chromatography System. Half life period of malathion was 1.18 days at the recommended dose and 1.0 day at double of the recommended dose in cabbage. Residues of malathion was dissipated up to 86.76% on 7th day after spray and reached below detectable limit (BDL) of 0.05 mg kg⁻¹ on 10th day at the recommended dose @ 1L/ha. Furthermore, at the double of recommended dose of @ 2L/ha residues of malathion was dissipated up to 93.38% on 7th day and 96.61% on 10th days after spray.

Keywords: Dissipation, Malathion, Cabbage, GC, Half-life

SOIL AMENDMENTS FOR IMPROVING CROP YIELD IN SALT AFFECTED SOILS

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Soil amendment are improving the crop yield in salt affected soils. Sodic and alkali soils are characterized by the occurrence of excess sodium (Na⁺) and salts of sulphate, chlorides, carbonates and bicarbonates etc., are adversely affect soil structure and disturb the availability of nutrients for plant growth. Increasing the productivity of water and making safe use of poor quality waters in agriculture will play a vital role in easing competition for scarce water resources, prevention of environmental degradation and provision of food security. Driven by the pressure to produce more, even the saline and alkali waters are being increasingly diverted to irrigated agriculture. Development of salinity, sodicity and toxicity problems in soils not only reduces crop productivity and quality but also limit the choice of crops. Major production constraints of Saline soils exit in arid and semi-arid region, such soils are poor physical properties- high ESP, dispersion of fine clay- (high Na), low permeability impeded aeration, soil water movement, poor aggregate stability, low organic matter content, reduced availability of N, K, Zn, Fe etc. this is cause reduction in crop yield mainly due high concentration of soluble salts in soil, salt toxicity, and their management strategies include leaching and drainage methods. Such a way sodic soil are contributing the same problems in crop production like hard pan formation and reduces the infiltration capacity, hydraulic conductivity etc., Management strategies of alkali/sodic soil include leaching, crop establishment, crop choice, organic and inorganic amendment. Application of gypsum based on the gypsum requirements (GR) varied from 8.5 to 15.5 t ha⁻¹ is considered as one of the most useful strategies to reclaim alkali/sodic soils. Cultivation of salt tolerant crops (barley, sugarbeet, cotton), grasses (karnal grass, para grass, bermuda grass) and tress (date palm, eucalyptus, acacia) increase the productivity but also improve the soil physico-chemical properties. These approaches help for enhancing the crop yield.

EVALUATION OF DIFFERENT GENOTYPES OF CROSSANDRA (CROSSANDRA SPP.) IN RESPECT OF GROWTH AND FLOWERING ATTRIBUTES

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The present investigation was conducted at AICRP on Floriculture, National Agricultural Research Project Ganeshkhind, Pune7, MPKV; Rahuri, during 2015-2016. The experiment was laid out in randomized block design with three replications and seven genotypes. At 60 days after planting, the genotype Arka Ambara recorded significantly maximum plant height. At 120 and 180 days after planting, the genotype Local-2 recorded significantly maximum plant height. The number of branches at 180 days after planting, the genotype Local-1 recorded significantly maximum number of branches (32.15) which was at par with Local-2 (28.60) and Arka Kanaka (26.01). The spread of plant (N-S) at 60, 120 and 180 days after planting was significantly maximum Local -1. The plant spread (E-W) direction at 60, 120 and 180 DAP was significantly maximum in genotype Local-1 (44.76 cm) which was at par with Arka Shrvya. Arka Shrvya was significantly superior over all genotypes, which recorded least days for flower initiation, rachis length and spike length which was at par with Arka Kanaka. Variety Arka Ambara was significantly superior over all genotypes, which was significantly superior over all genotypes, which recorded floret length and width which was at par with Arka Kanaka.

Key words: Crossandra genotypes, growth and flowering attributes.

CHITOSAN COATING AFFECT THE SHELF LIFE AND QUALITY OF PLUMS DURING LOW TEMPERATURE STORAGE

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Plums are one of the important temperate fruit crops in India but the fruits are highly perishable and have a very short shelf life. The combined effects of chitosan and low temperature storage on the shelf life and quality maintenance of fresh plums (*Prunus salicina* Lindley, cv. 'Santa Rosa') were investigated. The plum fruits were coated with 2.0 % chitosan coating and then stored at 1 ± 1 °C and 90/95 % Relative Humidity. The chitosan coating significantly reduced the fruit firmness and weight loss, delayed changes in pectin methylesterase activity and malondialdehyde contents and inhibited the loss of soluble solids content, titratable acidity, ascorbic acid, total phenol and antioxidant activity during 35 d of storage. The coating was also shown to be very effective in inhibiting the ethylene evaluation, respiration rate compared to the control samples at 1 ± 1 °C. In addition, the 2.0 % chitosan coated plum was firmer and showed less peel colour change than the uncoated samples at the end of storage. During storage, anthocyanin synthesis was significantly inhibited with the combination of chitosan and low temperature. The results of our study revealed that the 2.0 % chitosan coating showed good potential to enhance the storage life of plums during cold storage.

PHENOLOGICAL AND MORPHOLOGICAL BEHAVIOUR OF PARENTS AND IT'S HYBRID SEEDLINGS IN PEACH [*PRUNUS PERSICA* (L.) BATSCH]

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The F1 hybrid seedlings developed from different cross combination of two peach 'Sharbati' and 'Flordaguard' and one plum 'Kala Amritsari' during 2017 and 2018. The earliest flowering was noted in Sharbati then Flordaguard and Kala Amritsari. Flowering of Sharbati and Flordaguard coincide very well for hybridization. In control pollination highest fruit set percent was recorded in Sharbati × Flordaguard (36.40%) and minimum in Kala Amritsari × Flordaguard (17.28%). Highest fruit retention was recorded in Flordaguard × Sharbati (40.38%) and minimum in Sharbati × Kala Amritsari (4.58%). The maximum days from full bloom to maturity were taken in Flordaguard × Sharbati (128 Days) and minimum in Kala Amritsari × Flordaguard (111 Days). Fruits of Kala Amritsari × Flordaguard were mature earliest (8th-12th May) and latest in Flordaguard × Sharbati (20th-28th June). The highest pollen viability in case of stored as well as fresh pollen respectively, was recorded in Flordaguard (96.26 and 97.58%) while, minimum in Sharbati (90.89% and 96.60%). Seedlings of Sharbati, Sharbati × Flordaguard and Flordaguard × Sharbati showed better growth performance on Flordaguard seedlings. The colour of newly developed leaves of Sharbati and Kala Amritsari were dark green on the upper surface and light green in lower surface. The leaves of Flordaguard and both the hybrids (Sharbati × Flordaguard and Flordaguard × Sharbati) showed dark reddish to purplish green colour on upper surface and light reddish green in lower surface of leaves. The hybrid seedlings from both the crosses showed the dominant red leaf colour of Flordaguard.

Keywords: Kala Amritsari, Hybridization, Pollen viability, Flowering behaviour, Leaf colour

SUSTAINABLE HORTICULTURE PRODUCTION

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The stage is set for rapid expansion of vegetable production in India, which is currently insufficient to meet per capita requirements. Increased income, population growth, and fast urbanization have created additional demand for vegetables. There is need to diversify production, and forces are reinforced by consumer demand for a diversified diet. Both production- and trade-oriented strategies should be used to overcome shortage and seasonality in vegetable supplies. Production-oriented strategies should focus on developing high yielding and stress tolerant varieties and management technologies, so that more farmers can produce more vegetables at lower per-unit cost while vegetables, taking advantage of higher production and lower costs in favorable growing areas. Successful production of sufficient, good quality vegetables leads to good health, more jobs, diversified and higher incomes for producers, and long-term sustainability of the agricultural resource base. To achieve all these, however, some minimum level of farmers' education, field-market linking infrastructure, and favorable government policies to encourage and stabilize vegetable production are required. Under this scenario, technological innovation can act as a catalyst to expand vegetable production. The enhanced management capability of

vegetable-growing farmers would then enable them to actively participate in the economic development process of the whole economy.

GOOD AGRICULTURAL PRACTICES (GAP) IN PROTECTED CULTIVATION

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Good Agricultural Practices (GAP) are “practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products”. During 1997, to set standards for the certification of agricultural products around the globe, Euro-Retailer Produce Working Group (EUREPGAP) were initiated, which later evolved into GLOBALGAP. The four pillars of GAP are economic viability, environmental sustainability, social acceptability and food quality and safety. Greenhouse production systems require adherence to GAP protocols because exhaustive cultivation in greenhouses often involves excessive use of chemicals since the stakes are high due to intensive inputs and high expectations on quality front. Major principles of good agriculture practices that should be followed in protected cultivation include Traceability, record keeping and self-inspection, varieties and root stocks, site history and site management, Soil and substrate management, fertigation, crop protection, harvesting, produce handling, waste and pollution management, recycling and re-use, workers health, safety and welfare, environment Issues, complaint form, practicing timely operations, trenching around polyhouse, Maintaining uniform bed height, Changing of cladding material, use of pathogen, weed free manures like well decomposed farmyard manure or goat / sheep dung, planting early or lately according to market study, selection of proper varieties, avoid overaged & underaged seedlings, regular monitoring, timely fertigation, Provision of double gate on opposite sites, fan at entrance, restriction of movement of workers and visitors will help in prevention of carrying pathogens, Sanitary practices like restriction of smoking, eating in polyhouse, should be practiced and Practicing JPM is a systematic approach to manage pests which combines a variety of strategies to either reduce pest population or reduce their economic impact while keeping in view the international consumption and commercial standards.

ENHANCING THE YIELD AND YIELD ATTRIBUTES OF CHICKPEA BY USING NITROGENOUS FERTILIZER AND RHIZOBIUM CULTURE

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A field experiment was conducted on chickpea to study the effect of seed treatment with rhizobium and the different level of nitrogenous doses 25%, 50%, 75% and 100% of Recommended Dose of Fertilizer (RBD) for estimating the yield and the yield attributes. The experiment was laid out in Randomized Block Design (RBD) with three replications during *Rabi* season of 2017-2018 in the experimental field of Lovely Professional University, Phagwara, Punjab, India. The aim of experiment was to focus on the variations in yield due to rhizobium treatment and different level of nitrogenous doses. The collaboration of rhizobium culture showed variations in different treatments of chickpea. The best treatment was T₅: 100% RDF in chickpea brought out fundamentally a proper growth, development and yield of the crop during this experiment.

Key words: Crop, Inorganic fertilizer, Rhizobium

HETEROSIS STUDIES IN OKRA (*ABELMOSCHUS ESCULENTS* (L.) MOENCH) FOR YIELD AND YIELD CONTRIBUTING TRAITS

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Analysis of variance revealed highly significant differences among genotype and parent and hybrids for all the characters studied indicating substantial amount of genetic variability present in the material. The magnitude of heterosis varied from cross to cross for all characters. Mean squares due to parents vs hybrids were significant for all the traits except fruit breadth and number of fruit/plant indicating that considerable heterosis for those characters. The highest significant Mid Parent heterosis was observed yield/plant Arka anamika × BO-13 (40.44%). The other characters showed considerable amount heterosis were number of fruit/plant for the cross Hissar Naveen × SB-8 (80.77%). The cross Parbhani kranti × BO-2 showed highest heterosis 101.88 and 16.02 for the trait yield q/ha and 1000 seed weight, respectively. The character no. of seed/fruit showed highest heterosis for the cross parbhani kranti × 136 thin (36.41) and length of fruit parbhani kranti × kashi pragati (18.27). The significant mid parent heterosis was observed for internodes (-49.60%) for the cross Hissar Naveen × Kashi pragati. The present investigation revealed that Arka anamika × BO-13, Hissar Naveen × Kashi pragati, Hissar Naveen × SB-8, Parbhani kranti × BO-2, Parbhani kranti × 136 thin and Parbhani kranti × Kashi pragati were found to be the best

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cross combination for fruit yield and yield contributing traits which could be further exploited in future breeding programme.

Key words: Heterosis, Heterobeltiosis, Line x Tester and Okra.

EFFECT OF DIFFERENT GROWTH CONTROLLING STRATEGIES ON TREE GROWTH AND FLOWERING IN CHINESE SAND PEAR

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Pear is one of the most important temperate fruits next only in importance after apple. In the state of J & K, both types of pear viz., *Pyrus communis* and *Pyrus pyrifolia* exist. Nakh Kashmiri is the most important cultivar of *Pyrus pyrifolia* group considering its yield potential as well as its consumer acceptability. But due to excessive vigour there is problem of reduced flower bud development, light penetration and increased incidence of insect pests and diseases. In order to stimulate flower bud formation in pear, it is imperative to control vigour of plants. Root pruning, trunk incision and pruning are considered the major growth controlling strategies which were tested in the present study. In addition, application of growth regulators (paclobutrazol and ethephon) were tested for their efficiency in controlling tree vigour and flower induction. The study was conducted on twenty-year-old Chinese Sandy pear trees in experimental orchard/ laboratory of Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar (J&K) during the year 2011 and 2012. Trees of similar vigour and size were selected, marked and maintained under uniform cultural operations. The experimented trees were treated with root pruning (during dormancy upto 35 cm depth and 30 cm away from trunk), trunk incision (during dormancy upto 20% of trunk diameter on both sides at 30 cm distance), summer pruning (mid June- thinning out of most of the extension shoots from middle of canopy and 50% from upper and lower canopy), application of paclobutrazol (at full bloom-800 ppm and 15 days after full bloom-500ppm) and Ethephon (at full bloom-200 ppm and 15 days after full bloom-100 ppm). Plants treated with root pruning + paclobutrazol showed better results with minimum trunk growth, TCSA, internodal length maximum chlorophyll content, carbohydrate and C: N ratio (shoots and leaves), flower intensity, per cent bloom. The overall results showed that root pruning + paclobutrazol can be considered as best strategy for optimizing tree growth and flowering in pear orchard.

INTERCROPPING OF SESAME (SESAMUM INDICUM L.) WITH MUNGBEAN [VIGNA RADIATA (L.) WILCZEK] UNDER DIFFERENT LEVELS OF SULPHUR

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The field experiment comprising twenty treatment combinations replicated three times, was conducted in Randomized Block Design (RBD) with five levels of intercropping systems [sole mungbean, sole sesame, mungbean + sesame (2:1), mungbean + sesame (3:1) and mungbean + sesame (4:1)] and four levels of sulphur (0, 15, 30 and 45 kg S/ha) during kharif season, 2017 at Agronomy farm school of Agriculture, O.P.J.S. University Churu, (Rajasthan). Result showed that significantly maximum plant height of mungbean was recorded in mungbean + sesame (2:1) intercropping system, whereas sole mungbean recorded significantly more dry matter accumulation of mungbean at 40 DAS and at harvest. Mungbean + sesame (2:1) recorded significantly higher dry matter accumulation of sesame at 60 DAS and at harvest. Further, results indicated that sole mungbean, remaining at par with 4:1 and 3:1 row ratios, recorded significantly higher number of pods per plant and number of seeds per pod. Whereas sesame grown in 2:1, being at par with 3:1 and 4:1 row ratios, recorded significantly higher values of yield attributes viz., number of capsules per plant and number of seeds per capsule as compared to sole sesame. Both the sole crops (mungbean and sesame) gave significantly higher seed yield (1207 and 724 kg/ha, respectively) as compared to all other intercropping systems. The sole mungbean, being at par to 4:1 row ratio, recorded significantly higher MEY (1207 kg/ha), while mungbean + sesame (4:1) gave significantly highest LER (1.07) as compared to all other intercropping systems.

Keywords Sulphur, Intercropping, Sesame-Mungbean

EFFECT OF POTASSIUM FIXATION WITH CHLORIDE AND SULPHATE ANIONS IN SOIL ON WETTING AND DRYING CONDITIONS IN HARYANA

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To study the effect of Potassium fixation with Chloride and Sulphate anions were wetting and drying cycles in soils of Haryana. Twelve soils were selected from different part of the Haryana for the investigation, soil samples derived from different parent material differing in their physico-chemical properties and collected at a fix depth of 0-25, 26-50, 51-75, 76-100 cms from all the soil samples. Results revealed that the most of the soils were light in texture and alkaline in reaction. The amount of Potassium fixed increased with the

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increasing days of wetting and drying cycles at different levels of Potassium from 20 to 1000 µg/ml in soil up to a depth of 25 cm. The highest amount of fixed Potassium was observed after 7 days then followed by 14 days and 28 days of drying cycles as compared to the wetting conditions. Its indicated that a period of 7 to 28 days of wetting and drying cycles sufficient for transfer of Potassium ions from the non-exchangeable Potassium pool to the available Potassium pool. Among all locations the maximum amount of Potassium fixed was observed in the Palwal soils and minimum in Chautala soils with different levels of Potassium.

Key words: Potassium fixation, wetting and drying cycles, chloride, sulphate, anions.

OPTIMIZATION OF *IN-PLANTA* METHOD OF GENETIC TRANSFORMATION IN PIGEON PEA (*CAJANUS CAJAN* L. MILLSP.)

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Pigeon pea (*Cajanus cajan* L. Millsp.) is one of the major grain legume crops of the tropics and subtropics grown in about 50 countries of Asia, Eastern and Southern Africa and the Caribbean for various uses such as food, fodder & firewood. Present study was conducted to develop and optimize tissue culture independent in planta transformation system in pigeonpea. This system can help in widening genetic base as well as solutions over various biotic and abiotic factors through engineering novel genes across the species. The various transformation parameters viz., Optical density of Agrobacterium suspension, virulence inducer and infection time were optimized through 18 different treatment combinations. The plumular and intercotyledonary meristem axes of 2-3 days old seedlings of pigeon pea cv. BSMR 853 was exploited for Agroinfection by sewing needles. Out of 270 inoculated seedlings 11.34 mean number of plantlets were recovered. The putative transformants were confirmed by GUS histochemical and PCR assay. Transformation efficiency was calculated on mean number of recovered plantlets and mean number of transformed plantlets. Among 18 different treatment combinations, the treatment pertaining Agrobacterium suspension of O.D 1.0, virulence inducer (acetosyringone) at 250 µM/ml and infection time of 1.0 min was found optimum. Among all transformation parameters, bacterial growth of O.D. 1.0 and acetosyringone concentration, 250 µM/ml has shown significant impact on transformation efficiency. The treatment comprising bacterial O.D. 1.0 with 250 µM/ml acetosyringone and 1.0 infection time 1.0 min revealed 90.02% transformation efficiency. However, lowest transformation frequency i.e. 68.76% was reported in treatment of bacterial O.D. 1.5 with 150 µM/ml acetosyringone and 0.5 min. infection time. Our investigation revealed the optimization of *in planta* transformation parameters in pigeon pea and suitability of genotype BSMR853 for genetic transformation and further genetic improvement.

Keywords - Agrobacterium, GUS gene, in planta, Pigeon pea

EFFECT OF FEEDING CROP RESIDUES BASED COMPLETE FEED RATION ON NUTRIENT UTILIZATION AND GROWTH PERFORMANCE OF KONKAN KANYAL GOATS

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An experiment was conducted at Dr. B. S. Konkan Krishi Vidyapeeth Dapoli, Maharashtra to assess the effect of feeding crop residue based complete ration on nutrient utilization and growth performance of Konkan Kanyal goats. In this experiment sixteen healthy Konkan Kanyal bucks of same age and average body weight were selected randomly divided into four *iso-nitrogenous* complete rations viz., T₀ (conventional feed + concentrate mixture), T₁ (60% Maize stover + 40% conc. Mix), T₂ (60% Nagali straw + 40% conc. mix.) and T₃ (60% Proso-millet straw + 40% conc. Mix) with randomized block design in each treatment there were four goats. The chemical analysis of experimental feeds T₀, T₁, T₂ and T₃ revealed that, it contains DM- 49.25, 88.63, 87.17 and 87.40, CP-13.32, 13.72, 13.61 and 13.67, EE- 3.34, 3.24, 3.49 and 3.55, Ash-11.61, 7.32, 9.70 and 12.46, NFE- 50.47, 47.71, 48.48 and 45.30, NDF- 50.31, 57.99, 45.64 and 48.22, ADF- 28.95, 37.22, 35.29 and 29.53, Ca - 1.28, 1.84, 1.42 and 1.30 and P-0.70, 0.84, 0.58 and 0.45 per cent, respectively on DM basis. The average body weight gain significantly higher in T₁ (62.5 g/day) than T₃ (55.36 g/day), T₂ (53.57 g/day) and T₀ (50 g/day). From the results of the present investigation it may be concluded that the T₁ group (60% Maize stover + 40% conc. Mix) complete feed based on maize stover crop residue found suitable for feeding and body weight gain than other crop residues for goats.

Keywords: Body weight gain, complete ration, goats and on nutrient utilization.

SUITABILITY OF *ALOE BARBADENSIS* GENOTYPES FOR SOUTH EAST REGION OF RAJASTHAN

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A field experiment was conducted during kharif season of 2016-2017 on the suitability of *Aloe barbadensis* Genotypes for South East Region of Rajasthan. The experiment was conducted at the Herbal garden, Department of Forest Products and Utilization, College of

Horticulture and Forestry, Jhalrapatan city, Jhalawar. The sobriquet of *Aloe* is "Gwarpatta". The *Aloe* name is derived from the Arabic word *Aloe* mean "shining bitter substances". *Aloe* is a stem less, perennial, drought resisting, succulent plant, bearing rosettes of leaves at the end of juicy green branches and has reportedly been used since ancient times for medicinal purposes. (Rathod *et al.*, 2014). The experiment consisted of 15 genotypes, the laid out in randomized block design. The analysis variance showed highly significant variations among the genotypes for all the traits under study, which revealed the existence of good deal of variability in the germplasm the maximum plant height was recorded in [T₈, IC-112533 (57.71 cm)] and while significantly maximum number of Leaves per plant was recorded in [T₁, IC-111267 (13.44)]. Significantly maximum leaf length was recorded in [T₈, IC-112533 (54.55 cm)]. and maximum leaf width was recorded in [T₈, IC-112533 (8.14cm)]. The maximum leaf Thickness recorded was in [T₉, IC-112534 (12.74 mm)] and maximum leaf yield (Fresh) per hectare was recorded in the genotypes [T₉, IC-112534 (48.85 t.)]

Key words: - *Aloe barbadensis*, genotypes, experiment, growth, yield, quality

EFFECT OF PRE HARVEST APPLICATION OF BIOFORMULATIONS ON LATENT INFECTION OF MANGO ANTHRACNOSE

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The Effect of pre harvest application of bioformulations individual and combination spray on latent infection of mango anthracnose was studied. Both individual and combination application of bioformulations (*P. fluorescens* (BIB₂) + *B. subtilis* (BIL₈) + chitin) significantly reduced the disease incidence when compared to control. Pre harvest application of *P. fluorescens* (BIB₂) + *B. subtilis* (BIL₈) + chitin on 20 days before flowering, flowering stage, 20 and 60 days after flowering plus Carbendazim (0.1%) at 40 days after flowering recorded the minimum disease incidence (8.33 per cent) at 14 days after storage and was on par with T₈ - Carbendazim (0.1%) on 20 days before flowering, flowering stage, 20, 40 and 60 days after flowering recorded 7.67 per cent at 14 days after storage. It was followed by application of *P. fluorescens* (BIB₂) + *B. subtilis* (BIL₈) + chitin @ 5g/litre of water on 20 days before flowering, flowering stage, 20, 40 and 60 days after flowering.

EXPLOITATION OF ESSENTIAL OILS AS AN ALTERNATIVE STRATEGY TO CONTROL STEM END ROT DISEASE OF MANGO

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Mango, being a perishable fruit, is subjected to various post-harvest diseases caused by different pathogens. Among post-harvest diseases of mango fruit, Stem end rot disease caused by *Lasiodiplodia theobromae* is the major issue. The aim of the present study was to investigate the efficacy of five essential oils extracted from lemon grass, citronella, citriodora, geranium and turmeric leaf oil on the mycelial growth of *L. theobromae* under *in vitro* condition. The *in vitro* antifungal activity was tested by the poisoned food technique. The results showed that citriodora oil showed 100 per cent mycelial inhibition of *L. theobromae* over control @ 0.02%. This was followed by citronella oil 41.94, 58.61 and 100 per cent inhibition over control at 0.02, 0.04 and 0.06% conc. respectively. Similarly lemon grass oil and geranium oil showed 100 per cent mycelial inhibition at 0.10 and 0.12% conc. Respectively.

PRECISION AGRICULTURE, SOIL AND WATER CONSERVATION FOR SUSTAINABLE RADHAKISHAN YADAV AND GAVASKAR

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The concept of precision agriculture (PA) and sustainability are inextricably linked. From the first time a global positioning system was used on agricultural equipment the potential for environment benefits has been discussed. Intuitively, applying fertilizers and pesticides only where and when they are needed, should reduce environment loading. Precision agriculture is one of many modern farming practices that make production more efficient. With precision agriculture, farmers and soils work better, not harder. Conservation of soil and water resources is important for sustainability of agriculture and environment. Soil and water resources are under immense pressure due to ever increasing population thereby ensuing growing demand for food, fiber and shelter. Soil and water resources are being deteriorated due to different anthropogenic and natural factors. Soil erosion is one of the several major deteriorative processes which results in deterioration of the soil. Soil erosion is removal of soil due to movement of water and/or air. Soil erosion may lead to the significant loss of soil productivity and thus may lead to the desertification under severe conditions. Water and wind are the major agencies which are responsible of soil erosion. Deforestation, over-grazing, mismanagement of cultivated soils, intensive cultivation and intensive urbanization are major factors triggering the soil erosion. For sustainable agriculture and environment, it is pertinent for

the protection of soil resources against erosion. Different control measures should be adopted to protect the soil resources against erosion. The concept of soil conservation cannot be materialized without conserving and efficient use of water resources. It is therefore pre-requisite that soil conservation practices should be adopted. Soil conservation practice include soil management, crop management, engineering, range management and operation.

Keywords: Soil, Water, Erosion, Conservation, Sustainable etc.

VARIATION IN PHYSICAL AND PHYSICO-CHEMICAL PROPERTIES OF DIFFERENT CULTIVARS OF JACKFRUIT SEEDS HARVESTED FROM NORTHERN REGION OF INDIA

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The jackfruit is the largest tree-borne fruit belongs to family *Moraceae*, composed of pulp, seed and rind. Seed contains 10 to 20% weight of the total fruit. In the present study the physical and nutritional properties of jackfruit seeds were analyzed. Five different cultivars were used in study viz. Hadiyava, Bhadaiyan, Khaja, Safeda, and Katahri. The average moisture content of seeds was 48.62 to 67.84% (wet basis). The average for the three characteristic dimensions, length, width and thickness was 2.30 to 2.77 cm, 1.45 to 1.93 cm and 1.22 to 1.64 cm among the seeds from different cultivars, respectively. The geometric mean diameter was 1.72 to 2.04 cm for all the cultivars. The bulk density of seeds ranges from 0.44 to 0.53 g cm⁻³. Jackfruit seed contains 13.30 to 16.60% of protein content. Safeda cultivar has the highest protein content (16.60%) than other cultivars. The seeds have a sufficient amount of carbohydrates. Seeds of jackfruit can be used as the production of flour and starch.

Keywords: Jackfruit, dimensions, geometric mean, Bulk density, Seed.

STUDIES ON EXOTIC APPLE VARIETIES UNDER HIGH DENSITY ORCHARDING IN NORTH HIMALAYAN REGION OF INDIA

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The present study entitled studies on Exotic Apple Varieties under High Density Orchardling in North Himalayan region of India was undertaken at experimental fields of Division of Fruit Science, SKUAST-Kashmir, during the year 2014. In order to solve the problems of low productivity, poor quality, less color and irregular bearing habits in current apple plantations in India, and compete with the productivity of advanced countries, four apple varieties namely Super Chief Sandidge, Gala Red Lum, Fuji Zhen Aztec and Golden Clone B were imported from Italy on M9T337 rootstock and planted at a distance of 1.5 × 3m on four wire trellis system (2222 trees/ha). Tree morphology, growth characteristics, phenological stages, flowering behavior, floral/fruit characteristics, physical, chemical and organoleptic measurements were performed on all the four varieties. The variety Super Chief Sandidge performed best in terms of quality parameters, variety Golden Clone B recorded highest yield (10 Mt/ha) and yield efficiency. The overall results indicate that the introduced apple varieties are characterized with different biological and quality polymorphism. All of the studied varieties show positive characteristics and can be recommended for further evaluation in Kashmir valley.

CONSERVATION TILLAGE FOR SUSTAINABLE AGRICULTURE PRODUCTION AND ECO-SAFETY

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Traditional agriculture, based on tillage and being highly mechanized, has been accused of being responsible for soil erosion problems, surface and underground water pollution, and more water consumption, while conservation agriculture is a management system that maintains a soil cover through surface retention of crop residues with no till/zero and reduced tillage. CA is described by FAO as a concept for resource saving agricultural crop production which is based on enhancing the natural and biological processes above and below the ground. The main components of conservation tillage are zero tillage, minimum or reduced tillage, strip tillage, no-tillage, raised bed system, crop diversification and crop residue managements. The main advantage of CT are the reduced erosion and increase organic matter and ultimately increase the yield and maintain soil health. Till planting is the method of zero tillage. Crop residue can be used as mulch to cover the soil to reduce erosion, maintain soil moisture, improve soil tilth and quality, reduce nutrient runoff, and provide wildlife cover instead of burning them on field. Laser land leveling and directed seeding of rice are the resources conserving techniques.

Key word: Traditional agriculture, water pollution, crop diversification, wildlife, Laser land leveling.

A POSITIVE APPROACH TO HELP AGRICULTURAL SYSTEM THROUGH SUSTAINABLE INTENSIFICATION AND CLIMATE-SMART AGRICULTURE**RAGINI KUMARI AND SUNIL KUMAR***Asstt. Professor-cum-Jr.Scientist, Department of Soil Science & Agricultural Chemistry, Bihar Agricultural University, Sabour (Bhagalpur)-813210*

Climate is the primary important factor for agricultural production. Concerning the potential effects of climatic change on agriculture has motivated important change of research during the last decade. Agriculture is a foundation of the climate change equation. While it is seriously affected by global warming, agriculture is also a major source of greenhouse gases which contribute to the problem in the first place. However ending hunger, food insecurity and malnutrition for all will require continued and focused efforts to increase capacity for agricultural productivity. Climate-smart agriculture (CSA) and sustainable intensification (SI) are a positive approach to help agricultural systems worldwide, concurrently addressing three challenge areas: increased adaptation to climate change, mitigation of climate change, and ensuring global food security-through innovative policies, practices, and financing. The 'sustainable intensification' (SI) approach and 'climate-smart agriculture' (CSA) are highly complementary. SI is an essential means of adapting to climate change, also resulting in lower emissions per unit of output. With its emphasis on improving risk management, information flows and local institutions to support adaptive capacity, CSA provides the foundations for incentivizing and enabling intensification. SI and CSA are crucial for global food and nutritional security, they are only part of a multi-pronged approach that includes reducing consumption and waste, building social safety nets, facilitating trade, and enhancing diets.

CHARACTERIZATION OF UPLAND AHU RICE ACCESSIONS USING SSR MARKERS ASSOCIATED WITH DROUGHT TOLERANCE**RAHUL C KALDATE¹, MAYURI D MAHALLE¹, RAHUL K VERMA¹, SANJAY K CHETIA², PRADIP C DEY², A. ROY³, MAHENDRA K MODI¹***¹Department of agricultural biotechnology, AAU, Jorhat-785013, ²Reginal Rice Research Institute, AAU, Titabar-785632, ³Regional Agricultural Research Station, AAU, Diphu-782462*

We have studied 5 rice accessions using 24 drought linked SSR markers to identify drought responsive QTLs along with a respective resistant check. The screening result obtained for *qDTY1.1*, *qDTY2.3*, *qDTY3.1*, *qDTY4.1*, *qDTY6.2*, *qDTY10.1*, *qDTY12.1* from their related markers shows promising result for the accessions under study. Genetic diversity analysis was carried out using 21 polymorphic markers. The number of alleles per locus ranged from 2 to 5 with an average of 2.95. The polymorphic SSRs revealed high diversity measures such as mean values of expected heterozygosity (H_e ; 0.61), observed heterozygosity (H_o ; 0.20), the polymorphic information content value (0.91) was obtained for RM12091 and RM12141 followed by RM13600 (0.75) with an average of 0.54. The PIC values revealed that RM12091 and RM12141 were considered as the best markers for the identification of rice genotypes under study. Cluster analysis based on 21 simple sequence repeat markers revealed 3 branches and indicated the presence of variability within the selected rice germplasm. The screening of drought related QTLs along with genetic diversity estimates can be important for devising future breeding programmes in rice.

Key words: Upland rice accessions; genetic diversity; drought tolerant QTLs; simple sequence repeat marker, principal component analysis.

EFFECT OF DIFFERENT PRUNING INTENSITIES IN *DALBERGIA SISSOO* ON GROWTH AND YIELD OF PADDY AND MUSTARD+ GRAM+ WHEAT VARIETIES UNDER AGRISILVICULTURE SYSTEM.**RAHUL DONGRE, M. L. SAHU, POORNIMA MALVIYA, B. D. GHODE AND S. D. UPADHYAYA***Department of Forestry, College of Agriculture, JNKVV, Jabalpur, MP, India*

Experiment was conducted during 2016 to evaluate the "Effect of different pruning intensities in *Dalbergia sissoo* (5x5m) on growth and yield of Paddy and Mustard+ Gram+ Wheat varieties under Agrisilviculture system." at JNKVV, Jabalpur, M.P, India Under 18 years old agrisilviculture system (D.sissoo + Paddy-Mustard/Gram/Wheat rotation) where 4 pruning treatments (viz; no pruning, 25%, 50% and 75% pruning) and one open were carried out in main plot and three crop rotation i.e. [T1- Early paddy (Danteshwari) + Mustard], [T2- Medium paddy (MTU-1010) + Gram], [T3- Late paddy (Kranti) + Wheat] in sub plot; replicated five times. Different pruning treatments showed significant influence on grain yield of paddy varieties. Significant maximum grain yield of paddy was recorded under open condition (1600 kg ha⁻¹) at par with 75 % pruning (1464 kg ha⁻¹) and 50 % pruning (1333 kg ha⁻¹). No pruning recorded significantly lowest grain yield (862 kg ha⁻¹) at par with 25 % pruning (875 kg ha⁻¹). The percent reduction in grain yield under no pruning, 25%, 50% and 75% pruning as compared to open condition was 46%, 45%, 16.7% and 8.5%, respectively. During Rabi season crops viz., mustard, gram and wheat were sown after paddy. Significantly higher wheat equivalent yield (8832 kg ha⁻¹) was recorded under open condition and was significantly superior to all the pruning treatments. No pruning recorded significantly lowest yield (5063 kg ha⁻¹). Significantly

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higher wheat equivalent yield (15766 kg ha^{-1}) was recorded under late paddy + wheat followed by early paddy + mustard (2787 kg ha^{-1}) and medium paddy + Gram (1176 kg ha^{-1}) which were at par. Significantly maximum net monetary return was recorded under *D. sissoo* + medium paddy (MTU-1010) + Gram (Rs. 63688 ha^{-1}) crop rotation closely followed by *D. sissoo* + early paddy (Danteshwari) + Mustard (Rs. 63138 ha^{-1}).

Keyword- Pruning, D.Sissoo, economic return, Agrisiviculture system.

EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS ON YIELD, QUALITY AND NUTRIENT UPTAKE BY MUSTARD (*BRASSICA JUNCIEA* L.)

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In India, it is the third most important edible oilseed crop after soybean and groundnut sharing 27.8% in the India's oilseed economy. The global production of mustard and its oil is around 38-42 mt & 12-14 mt respectively. India contributes 28.3% and 19.8% in world acreage and production. India produces around 6.9 mt of rapeseed-mustard next to China (11-12 mt) and EU (10-13 mt) with significant contribution in the world mustard industry. Plant height Total Dry matter accumulation, leaf area index and seed and stover significantly higher when RDF 120:17.6:16.6:40 N:P:K:S kg/ha was applied along with FYM 10 t/ha. Higher values of growth parameter viz. number of branches, plant height, yield attributes, seed and stover yields were recorded in plots receiving 75% RDF + 5 t/ha FYM + Zn 10 kg/ha + S 25 kg/ha respectively. Plant height, dry matter accumulation, primary and secondary branches per plant, chlorophyll content in fresh leaves, seed/siliqua, 1000-seed weight and seed and stover yields were significantly higher under incorporation of FYM 20 t/ha over 10 t/ha. It is revealed that use of organic and inorganic sources of nutrients out beneficial all ways besides improving the growth, yield and quality of mustard.

Keyword: Mustard, Organic, inorganic sources.

INTEGRATED PEST MANAGEMENT IN RICE THROW BOTANICALS

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Rice is one of the oldest domesticated crops and due to its importance as a food crop humans took it with them when settling in new areas further removed from flooded river plains extending to the uplands. For thousands of years, rice, with the exception of some dryland systems, was grown in monoculture. The greater incidence of insect pest leads to greater chemical application resulting in higher input cost and agro- ecological imbalance. It is an established fact that SRI has low insect pest and disease incidence resulting in low or nil chemical pesticide application. The farmers are advised to practice the non-chemical managements unless and until the damage does not crossed the threshold limit. Apart from the pest wise management options, few ITKs that have been proved beneficial against certain insect pests. Different control and management practices are utilised in IPM with the objective of achieving long term results - Such as (i) Identification of threshold pest level at which action needs to be taken (ii) Monitoring and identification of pests (iii) Prevention the use of management practices to reduce the likelihood of pests (iv) Control once the pest has been correctly identified, monitoring has shown it has reached a threshold level, and preventative measures are no longer appropriate, control measures will be used.

Keywords: Integrated pest management, Rice

EVALUATION OF DIFFERENT GENOTYPES OF GAILLARDIA (*GAILLARDIA PULCHELLA* FOUG.) UNDER JHALAWAR CONDITION

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An experiment was carried out at the Instructional Farm, Department of Floriculture and Landscaping, College of Horticulture & Forestry, Jhalrapatan, Jhalawar, (Agriculture University, Kota) during the period from March, 2017 to September, 2017 to study the performance of the twelve genotypes of gaillardia. The maximum plant height (81.03 cm) and leaf width (4.38 cm) were recorded in the genotype 'Genotype-3'. The genotype 'Genotype-2' produced the maximum number of primary branches per plant (18.87) fresh weight (1626.93 g) and dry weight (321.46 g) of plant was recorded in 'Genotype-2' respectively. The highest plant spread (73.70 cm) was recorded in the genotype 'Genotype-6'. The maximum leaf length (11.67 cm) was recorded in 'Genotype-7'. The maximum flower diameter (6.29 cm), days taken to first flower opening (42.60 days), days taken to 50 per cent flowering (64.93 days), number of flowers per plant (131.35), weight of flowers per plant (578.72 g), weight of flower per plot (45.89 kg), the highest flower yield per hectare (395.26 q/ha) were recorded in 'Genotype-11'.

Keywords: Gaillardia, Genotype, Dry weight, Spread and Pluckings

TITLE :SOIL HEALTH, NUTRIENT RECOVERY AND PERFORMANCE OF TRANSPLANTED RICE AS INFLUENCED BY EFFICIENT NITROGEN MANAGEMENT**RAHUL KUMAR VERMA (MSc. SOIL SCIENCE)***Department of Soil Science and agricultural chemistry, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P) 250110*

Rice (*Oryza sativa* L.) is one of the most important cereal crop of the India, grown in wide range of climatic zones, to nourish the mankind, but maximizing the yields requires the input of supplemental nutrients and better soil health. The soil health refers to self-regulation, stability, resilience, and lack of stress symptoms in a soil as an ecosystem. Soil health describes the biological integrity of the soil community the balance among organisms within a soil and between soil organisms and their environment, (Acharaya *et al.*, 2008). Soil quality is a term that more often is used to describe physical, chemical and biological attributes of a soil. Efficiency of fertilizer nitrogen is quite low, especially in the tropical regions, where rice is the principal crop (Prasad, 2013). Nitrogen use efficiency can be improved by checking the path ways of losses from soil-plant system, making integrated system of nutrients from all possible sources, optimal allocation of nutrients to crops and maximizing the utilization of applied and native nutrients by the crops (Duttarajan *et al.*, 2014). Rice production and nitrogen recovery is enhanced through soil health management can be achieved by adopting integrated nutrient management, site specific nutrient management, slow-release nitrogenous fertilizers (SRNF) and also conservation agriculture practices. Research reports of long term studies reveal that organic manures in addition to fertilizers sustain high crop yields over long periods compared to application of only fertilizers. (Barik *et al.* 2006). It is concluded that rice production through soil health management in India can be achieved through a proper understanding of the nutrients needs and meeting them through LCC, SPAD and SSNM and use of conservation agriculture technologies. It also enhance fertilizer use efficiency as well as lower the losses of nutrient particularly nitrogen in rice crop.

ECO-FRIENDLY MANAGEMENT OF SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE) OF EGG PLANT BY THE APPLICATION OF ORGANIC MANURES AND BIO-PESTICIDES***RAHUL KUMAR AND FAZAL AHMAD***Department of Entomology, Chandra Shekhar Azad University Of Agriculture And Technology Kanpur 208002, Uttar Pradesh, India*

Aubergine is an important dietary vegetable grown all over the country. The crop is subjected to high degree of instability in production, mainly on account of losses caused by different insect pests at different stages of the crop. The mean data of 2007 and 2008 showed that the minimum shoot borer infestation 21.4 % was recorded in the treatment NSKE 5%. The fruit borer infestation showed the minimum borer infestation of 18.9 % in the treatment NSKE 5%. Nearly 25.82 to 92.50% damage is attributed due to shoot and fruit borer. Among the treatments Chlorpyrifos 20 EC found superior over all the treatments followed by Chlorpyrifos + Neem oil and Chlorpyrifos + NSKE after first, second and third sprays respectively. eco-friendly management of brinjal shoot and fruit borer, *L. orbonalis* through organic manures revealed that maximum (75%) requirement of the nitrogen by the crop provided through the neem cake combined with the inorganic fertilizers. While, FYM recorded the maximum population of natural enemies. Also, maximum yield of healthy brinjal fruits was recorded in the treatment where 75 per cent of the recommended dose of nitrogen was provided through neem cake. More studies on bio-efficacy of bio-pesticides against brinjal shoot and fruit borer, *L. orbonalis* revealed that profenophos (40%) + cypermethrin (4%) 0.04 per cent, NSKE 5 per cent and neemazal 0.005 per cent were found most effective against the pest with minimum shoot and fruit infestation.

PROTECTED CULTIVATION: IMPORTANT STRATEGIES IN HI-TECH HORTICULTURE**RAJ BALA CHOUDHARY¹ AND PRIYA NEGI²***Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner, Jaipur (Raj.) 303329*

Hi-tech horticulture is technology intensive production system. It is time and space dimensions compatible system of production in which inputs and resources are combined judiciously so as to maximize return many times more than the conventional system. Actually, constrained by rhythmic change in climate to grow the crop whenever needed. In protected cultivation, attempt is made to avert incompatibility of climate using artificial means and its benefits is harnessed in terms of harvesting produce out of their normal growing season. Demand of a particular produce all over the year round has provided due back up to the protected cultivation. With boom in retail sector, protected cultivation is catching fast momentum in India. High value, low volume crops are preferential for green house cultivation. A variety of crops like strawberry, capsicum, tomato, cucumber, rose, gerbera, chrysanthemum, cactus, anthurium, orchids etc. are under cultivation in green house. Green house, low tunnels, plastic tunnels, lath house, cold frame, shade net house etc. are the some growing structure and it enables crops could be grown under inclement climatic conditions, efficient utilization of precious inputs like water and nutrients, early nursery and early cropping, superior quality of the produce, effective control against pests-diseases,

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reduced expenditure on weed control and protection against heavy rains, hails, birds etc. Hence, the productivity and quality enhancement of any produce largely depends on level of protection and congenial conditions available to plants. However, the technology being worth increasing yield by as high as 300 per cent, it needs due adoption.

Keywords: Climate, Crops, Growing Structure, Hi-Tech Horticulture.

IMPROVE PRODUCTIVITY USING HIGH DENSITY PLANTING IN FRUIT CROPS

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India is the largest producer of fruits in the world. Now-a-days population of India is continuously increases so require more production per capita. Fruits are rich source of minerals and vitamins. Which is necessary to develop a healthy and good nation but the average productivity of fruits in India is low as compared to many developed countries. The main reasons for the low productivity are old and senile orchards, low yielding varieties, poor orchard management and inadequate technological up-gradation and adoption by the growers. Presently, the continuously decline in the availability of cultivable land, rising energy and land costs together with the mounting demand of horticultural produce, have given thrust to the concept of high density planting (HDP) of horticultural crop. High Density Planting (HDP) is a very intensive form of fruit production which has high relevance to the food and nutritional security of our ever increasing population. Some factors are affecting HDP such as:

1. Methods of HDP., 2. Use genetically dwarf scion cultivars and rootstock, 3. Training and pruning, 4. Use of growth regulators, 5. Use of growth retardant.

KEYWORD: Horticulture orchard management, production, senile orchard, HDP, genetically dwarf scion and rootstock cultivar and PGR.

CROPIMPROVEMENT BY CONVENTIONAL BREEDING OR GENETIC ENGINEERING

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Genetic Engineering has offered tremendous scope and potential to conventional Breeding methods of crop Improvement, crop protection, crop quality management and other horticultural traits. Genetic Engineering extends tremendous opportunities in fruit production by providing new genotypes for breeding purpose, supply of healthy and disease free planting material, improvement in fruit quality, enhancing shelf-life, availability of bio-pesticides, bio-fertilizers, etc. Genetic engineering consists of isolation of a gene of interest, ligating that gene with a desirable vector to form the recombinant-DNA molecule and then transferring that gene into the plant genome to create a new function. Horticultural biotechnology has been a leading example in the following mentioned areas for more than two decades, right from the commercialization of the first ever transgenic crop in the form of Flavr-Savr transgenic tomato with enhanced shelf life trait. Currently transgenic maize, soybean, cotton, and other crops, with genetically modified pest resistance, herbicide resistance, and quality-improved crops, have been developed and grown worldwide. The RNAi technology has found its most powerful expression in plant biology these days. The applications of this technology cover a wide range from producing insect, viral and disease resistant plants to developing designer flower colors by knocking down the expression of certain endogenous genes. Biotechnological interventions that could increase the efficiency of horticultural crop improvement are essential to generate plants with several desirable traits.

Key words: Genetic engineering, Horticultural crops, Insect resistance, RNAi.

EFFECT OF NITROGEN, PHOSPHORUS AND BIO-FERTILIZERS ON GROWTH AND YIELD ATTRIBUTES OF GARDEN PEA (*PISUM SATIVUM* L.)

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The field experiment was conducted at Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *rabi* season year 2017-18. To study the Effect of Nitrogen, Phosphorus and Bio-fertilizers on Growth and Yield Attributes of Garden Pea (*Pisum sativum* L.) cv. Arkel. The experiment was laid out in RBD with 11 treatments in 3 replication on different nitrogen and phosphorus levels and in combination with bio-fertilizers compared to control. The treatment 20 Kg ha⁻¹ N + 40 kg ha⁻¹ P + *Rhizobium* + PSB (T₃) showed significant increase in the growth and yield attributes as compared to control but statistically at par with 20 Kg ha⁻¹ N + 40 kg ha⁻¹ P + *Rhizobium* (T₃) and 20 Kg ha⁻¹ N + 40 kg ha⁻¹ P + PSB (T₄) where as green pod yield (kg/plot and q/ha)

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was found maximum at T₅ being statistically at par with T₃ and T₄.

Keyword- Nitrogen, Phosphorus, *Rhizobium*, PSB, Pea, Growth, Yield, etc.

SCENARIO OF ROOT KNOT NEMATODES AND THEIR MANAGEMENT

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Root knot nematodes (*Meloidogyne* Goeldi) are sedentary endoparasites of diverse group of crops and are one of the most important polyphagous crop pests. Root knot nematodes are the members of phylum Nematoda, class Secernentea, order Tylenchida and family Heteroderidae. They are adapted to feed on large number of plants and over 3000 wild and cultivated plant species are reported to be affected. Their infestation on plant roots induce typical symptoms, popularly known as 'root knot' or 'root gall', so named as 'root knot nematodes'. Root knot nematodes are distributed worldwide from tropical to temperate regions. Over 106 species of root knot nematodes have been recognized from different parts of the world. In India, fourteen species are recorded from different regions whereas in H.P. four species namely, *Meloidogyne incognita* (Kofoed & White) Chitwood, *M. javanica* (Treub) Chitwood, *M. graminicola* Golden & Birchfield and *M. hapla* Chitwood occur. Root knot nematodes have very wide host range and are important pest in different crops such as cereal crops (rice), pulses (blackgram, cowpea, pigeonpea), oilseeds (castor, groundnut, sesamum, sunflower), vegetables (brinjal, carrot, cucurbits, okra, tomato), fruits (citrus, pomegranate, banana, apple, peach, plum), spices (black pepper, cardamom, ginger, turmeric), fiber crops (cotton, jute), plantation crops (tea), ornamental crops (carnation). It has been recorded as a menace for global production and estimated crop losses due to major plant parasitic nematodes in world is over \$157 billion. Losses in India are to the tune of Rupees 21 billion. Root knot nematode cause distinct swelling (gall) by which water and nutrient uptake capacity of the plants reduces. It also allows entries of other pathogens such as fungi and bacteria resulting in secondary disease situation. Sandy loam soil with 24-30°C temperature and optimum moisture favour the multiplication of root knot nematodes. For the management of *Meloidogyne* spp. both preventive and curative measures are practiced. Preventive measures are the cultured methods (fallowing, deep ploughing, crop rotation, soil solarization, steaming, organic amendments, growing antagonistic crops etc.), use of nematode free planting material, sanitation (removal of infested plants along with roots, weeding), host plant resistance (resistant varieties, identification and cloning of R-gene, producing transgenic plants with R-gene, transgenic proteinase inhibitor type resistance, expressing gene producing toxic substance to nematodes) and biological control (*Trichoderma* spp., *Paecilomyces lilacinus*, *Pseudomonas fluorescens*) whereas curative approaches relies on the use of safe, judicious and recommended chemical nematicide namely, Carbofuron 3G, Carbosulfon 25DS, Dazomet.

BEEKEEPING IN INDIA

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Beekeeping plays an important role in the sustainable agriculture as it contributes significantly for diversification of agriculture. Beekeeping is an interesting hobby, an ideal agro-based subsidiary enterprise, providing supplementary and sometimes major source of income to the farmers, especially to the small farmers. It is an ideal, eco-friendly and non-land based rural enterprise, which does not tax the farm resources and provide sustainable livelihood to the rural people, including landless and women. Beekeeping production is affected by indiscriminate use of pesticides, bee diseases and enemies, adverse effects of weather, low price of products, etc. The susceptibility of honey bees to different diseases, pesticide hazards and marketing of bee products were found to be major limiting factors in the prospects of beekeeping. Majority of the beekeepers wanted to increase their level of business. Therefore, the specialized training courses should be organized to overcome these problems and promote their business. The problem of bee diseases and natural enemies is a major constraint in beekeeping industry. Sometimes, the diseases remain undetected for long and when they appear, cause catastrophic destruction. Treatment of bees for disease is a challenge even to the pathologist. The spread, intensity and control of disease are affected by climatic factors, forage availability and quality. India, one of the largest honey producer and exporter in the world, plays an important role in world honey production and trade. In India beekeeping has been mainly forest based. Bee hives neither demand additional land space nor do they compete with agriculture or animal husbandry for any input. The beekeeper needs only to spare a few hours in a week to look after his bee colonies. Beekeeping is therefore ideally suited as a part-time occupation. Beekeeping constitutes a resource of sustainable income generation to the rural and tribal farmers. It provides them valuable nutrition in the form of honey, protein rich pollen and brood. Bee products also constitute important ingredients of folk and traditional medicine. A small quantity has been used in kitchen as an ingredient of pickles, jams and preserves. Forest honey is used in pharmaceutical, food, confectionery, bakery and cosmetic industries. Royal jelly, Bee wax, Bee venom, Propolis, etc. However, there are many constraints which affect the promotion of beekeeping in India

Keywords: Sustainable agriculture, Bee diseases, Enemies, Pesticide hazards and Honey

SCREENING OF PEACH CV. SHAN-E-PUNJAB AGAINST VARIOUS PROPAGATION TECHNIQUES RAJAT SHARMA, D.C. DIMRI, ANKIT DONGARIYAL, SHWETA UNIYAL AND PUSHPENDRA RAJPUT

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Peach is one of the most delicious temperate fruit crop of India occupying prime position in its importance. Its propagation study on different rootstocks was carried out at G.B.P.U.A&T, Pantnagar. The scion of Shan-e-Punjab variety were grafted on Peach seedling with different methods i.e., tongue grafting, chip budding and tongue grafting and time of grafting i.e., January to August under different growing conditions with Factorial Randomized Complete Block Design and three replications. These plants were budded/grafted between January to August, 2017. The results of the study showed that tongue grafting in January was found to be superior compared to all other method and timings. However, results from T-budding show lower values for days taken for 50% sprouting, success percentage, root growth parameter etc. Chip budded plants showed higher cost benefit ratio followed by tongue grafting and T-budding. Sprouting percentage, number of leaves, plant height and number of saleable plants were found to be highest in tongue grafted plants compared to the other propagation techniques. From the study, it was concluded that the peach cv. Shan-e-Punjab responded well to tongue grafting and chip budding than T-budding. Since, all the growth parameter were maximum in case of tongue grafting. Hence, tongue grafting was recommended for the commercial method of propagation for peach cv. Shan-e-Punjab.

COMBINE EFFECT OF CONTAINERS AND GENOTYPES ON UN-GERMINATED SEEDS IN STORAGE IN RICE ¹RAJBIR SINGH AND ²KARUNA VISHUNAVAT

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The present study was undertaken to know the combined effect of different containers (poly bags and cotton bags) and genotypes (CMS 58025 A, CMS 58025 B, IR-66, KMR-3 and Pant Dhan 11) on per cent un-germinated seeds in rice at different storage period (January to May). It has been reported that in irrespective of both the containers, the minimum percentage of un-germinated seeds was in genotype KMR-3, while the maximum percentage of un-germinated seeds has been recorded in CMS 58025 A and CMS 58025 B at all the storage period.

EFFECT OF LENTIL VARIETIES UNDER VARIOUS METHODS OF ESTABLISHMENT IN RAINFED DROUGHT-PRONE CONDITION OF BIHAR.

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Lentil is the most important pulse crop in India that holds key to nutritional security. In Aurangabad district Lentil is a dominating pulse under rice based agricultural system. There is high potential to increase productivity of lentil by selecting suitable variety and better crop raising techniques. Lentil has higher area under paira cropping. Hence probable suitable varieties are being tested in Aurangabad area. The thrust is to have enough pulse production for ever growing need of population. These varieties would be raised following best management practices. The field experiments were carried out at the KVK, Aurangabad and farmers' field (Latitude: 24.50° N, Longitude: 84.70° E, Mean sea level height: 332ft) during rabi season 2013-14 in rainfed lowland having clay loam soil type. Performance of three varieties; HUI-57, PL-06 and PL-08 were evaluated under different method of establishment viz; line sowing with seed drill and sowing with Zero tillage with BMP cultivation practices. The experiment was laid out in a split plot design (SPD) with five replications at KVK and five at farmers' field.

Plant population/m² (65.03) was also recorded maximum in Zero till drill sown which was significantly higher than line sown seed drill method (62.90). Number of branch/plant (13.40) was recorded maximum in ZTD sown method, which was significantly higher over line sown with seed drill method (12.13). Number of pods/plant (61.13) was recorded maximum in Zero till drill sown method which was significantly higher over line sown with seed drill method (58.67). However, plant height was recorded maximum in seed drill sown method (45.31cm) which was no significant deference between ZTD sown method (45.12cm). No of grain/pod (1.64) and test weight (25.22 g) were recorded maximum with ZTD sown method but there is no significant deference with seed drill sown method in both characters. Days taken to maturity (122.93) were recorded maximum in Seed drill sown method and significantly higher over ZTD sown method (119.40). Biological yield in ZTD (3016.23kg/ha) was 3.95% higher than seed drill sown methods. Similarly, the grain yield (1576.67 kg/ha) in ZTD was 3.99 % higher compared to line sowing with seed drill. Straw yield (1439.57 kg/ha) in ZTD was 3.98% more over seed drill sown method. However, harvest index not significantly influenced by ZTD and seed drill sown method. Gross return, net

return and benefit-cost ratio recorded maximum with ZTD sown method. Maximum gross return was recorded with ZTD sown method (Rs. 65842.93/ha) was significantly more over seed drill sown method (Rs.62821.07/ha). Similarly, net return was also recorded significantly higher with (Rs.49789.60/ha) over seed drill sown method (Rs.44267.73/ha). B:C ratio recorded maximum with ZTD sown method (4.13) which was significantly higher over seed drill sown method (3.40). Plant height of PL-08 (48.28cm) was significantly higher over HUL-57 (44.26cm) and PL-06 (43.12cm). Plant population at harvest stage was recorded higher with PL-08 (70.60) was significantly higher over HUL-57 (66.65) and PL-06 (54.65). Number of branch/plant recorded maximum in PL-08 (14.75) which was significantly higher over HUL-57 (13.30) and PL-06 (10.25). Number of pods/plant (66.40) in PL-08 was significantly higher over HUL-57 (62.90) and PL-06 (50.40). Number of grain/pod was also recorded maximum with HUL-57 (1.7) being at par with PL-08 (1.69) and both were significantly more over PL-06 (1.51). However, test weight was recorded maximum in PL-06 (32.17g) was significantly higher over HUL-57 (22.71g) and PL-08 (17.86). Days taken to maturity (128.60) were significantly more in PL-08 being at par with HUL-57 (127.40) both were significantly higher over PL-06 (107.50) at maturity. Biological yield (3262.50 kg/ha), grain yield (1701.00 kg/ha) and straw yield (1561.50 kg/ha) recorded higher with PL-08 being at par with HUL-57 biological yield (3168.15 kg/ha), grain yield (1662.75 kg/ha) and straw yield (1503.90 kg/ha), which were significantly more over PL-06 biological yield (2446.05 kg/ha), grain yield (1275.45 kg/ha) and straw yield (1170.60 kg/ha). Biological, grain and straw yields were 33.37, 33.39 and 33.39%, more in PL-08 and 29.52, 30.36 and 28.47% in HUL-57 than PL-06, respectively. However, HI in three varieties was statistically similar. Maximum gross return (Rs 78246.00/ha), net return (Rs 61176.00/ha) and benefit cost ratio (4.61) recorded with PL-08 being at par with HUL-57 gross return (Rs 76486.50/ha), net return (Rs 59416.50/ha) and benefit cost ratio (4.52) both were significantly more over PL-06 gross return (Rs 38263.50/ha), net return (Rs 20493.50/ha) and benefit cost ratio (2.16).

Key words: Lentil, Variety, Method of establishment

ADSORPTION AND DESORPTION OF ZINC IN SOIL AND ITS IMPLICATION IN PLANT NUTRIENT

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Zinc is an essential element (or nutrient) for plant as well as animal, that is mostly required micro plant nutrient out of total. Zn act as a catalyzing, and necessary for triptophane, a precursor amino acid of indol-3-acetic acid (IAA), a growth promoting plant hormone (Mengel and Kirkby, 2001). Zn consist in soil as available form only near about 0.1 to 0.6 ppm but in earth crust consist near about 71 ppm. Zn availability mostly depended on pH, texture of soil, O.M., Fe and Al (hydr) oxides, submergence of soil, etc. Zn availability mostly regulated through adsorption-desorption on soil (or adsorbent). P can reduces the Zn availability to plant by making a complex i.e. ZnHPO_4 together. Soil encase higher amount of CaCO_3 , high pH, addition of phosphatic fertilizers to soil, etc. These are favorable parameters for adsorption of Zn to soil. Adsorbed Zn can extracted by 0.005 M DTPA, 0.1 HCl, 0.5 M CaCl_2 and 1 M MgCl_2 extractants. The desorption of Zn from the adsorbed soil Zn through these extractants and having different power to desorbed Zn as $0.5 \text{ M CaCl}_2 > 1 \text{ M MgCl}_2 > 0.005 \text{ M DTPA} > 0.1 \text{ HCl}$ (Das and Das, 2015). Acidic soils mostly having Fe and Al (hydr) oxides and are responsible for adsorption of Zn. A little sorption occurring pH value under 6.0 but virtually 100 % sorption occurring over a narrow pH range of 6.0 to 8.0 (Gou W *et al.* 2018). Another fact is increase adsorption of Zn with clay content.

Key Words: Adsorption, Desorption, Zn-PO_4^- -complex etc.

EFFECT OF PUSA HYDROGEL ON PHENOLOGY OF RICE (*ORYZA SATIVA* L.) AT VARIOUS GROWTH STAGES IN SANDY LOAM SOILS OF WESTERN UTTAR PRADESH

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A field experiment was conducted during *kharif* season of 2016 at Crop Research Centre (Chirori) of **Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) India**. The soil of the experimental field was well drained, sandy loam in texture and slightly alkaline in nature. It was low in organic carbon and available nitrogen but medium in available phosphorus and potassium. Rice (*Oryza sativa* L.) belongs to the genus *Oryza* and family Gramineae (Poaceae). The genus *Oryza* is distributed throughout the tropics and subtropics of the world. Rice is the second most widely consumed cereal in the world next to wheat. It is the staple food for two third of the world population. Over two billion people in Asia alone derived 80% carbohydrate, 7-8% protein, 3% fat and 3% fiber. It is occupying 163.20 million hectare of area, producing about 719.73 mt of rough rice with an average productivity of 4.41 t/ha (Anonymous, 2015). **In India, rice occupies an area of 43.95 mha with production and productivity of 106.65 mt and 2.4 t/ha, respectively.** In view of Agriculture specific requirements, scientist at Indian Agriculture Research Institute (IARI), New Delhi,

developed a granular product called Pusa Hydrogel (Synthetic polymer), which is able to absorb and hold 80-180 times of its volume of water for a long time. This technology is suited for farmers growing crops under rainfed and limited water availability areas. Pusa hydrogel (1.5 kg/acre) was applied in rice as fine granules, mixed with soil (1:10 w/w) or mixed with recommended dose of basal fertilizer application and it incorporating into the soil. The moisture conservation practice was recorded significant difference in plant height, dry matter accumulation, relative water content and chlorophyll content at all the stages of crop growth. The application of pusa hydrogel @ 1.5 kg/acre was recorded 3.67%, 1.64% and 4.35% respectively, more plant height (cm) and increased in dry matter production (g/m^2) was 1.8, 43.6 and 57.7 respectively, it was also recorded slightly increased in relative water content (%) and chlorophyll content (SPAD value) at all the stages of crop growth over no application. Application of pusa hydrogel @ 1.5 kg/acre in rice increased the growth at all the stages of crop growth over no application because it is a good synthetic polymer, which was used to conserve the 80 to 180 times more moisture and it helps into the regulating the metabolic activity of the plant under the moisture stress conditions as under treated plots over the control. .

AGRONOMIC TECHNIQUES IN NATURAL FARMING

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Natural farming is an ecological farming approach established by **Masanobu Fukuoka (1913)**, a Japanese farmer and philosopher, introduced in his book *the "One-Straw Revolution"* (1975). Fukuoka described his way of farming as *shizen noho* in Japanese. It is also referred to as **"the Fukuoka Method"**, **"the natural way of farming"** or **"do-nothing farming"**. Natural farming emphasises on efficient use of on-farm biological resources and enrichment of soil with the use of Jeevamrutha to ensure high soil biological activity. Natural farming eliminates chemical fertilizers and pesticides and would help to reduce ocean acidification and marine pollution from land-based activities (Tripathi *et al.*, 2018). In India, Subhash Palekar reported four aspects that are related to ZBNF viz., *beejamrutham*, or microbial coating of seeds using cow dung and urine based formulations, *jeevamrutham*, or the application of a concoction made with cow dung, cow urine, jaggery, pulse flour, water and soil to multiply soil microbes, mulching or applying a layer of organic material to the soil surface in order to prevent water evaporation and to contribute to soil humus formation and *waaphasa* or soil aeration through a favorable microclimate in the soil. Use of Bijamrutha for seed/planting material treatment and Jeevamrutham for soil treatment and foliar spray are important components. Jeevamrutham has been found to be rich in various beneficial micro-organisms. Application of jeevamrutham @ 500 l ha⁻¹ is sufficient for one application, it is applied three times at one month interval during the crop season. It can be applied through irrigation water by flow, by drip and sprinkler or even by drenching of mulches spread over the field or under the tree basin (Naresh *et al.*, 2018). The natural farming now a day is more beneficial as compared to modern Agriculture because of the unjudicious use of chemical fertilizers and pesticides. The population of beneficial microbes is decreasing day by day. The natural farming might also increase the organic matter level into the soil because of efficient utilization of crop residue left on the surface of soil. The naturally grown products are more qualitative and fetch more price than the conventionally grown product.

PHYSIOLOGICAL VARIATIONS IN *DRECHSLERA SETARIAE* CAUSING LEAF SPOT DISEASE OF PEARL MILLET

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Pearl millet is fourth most important cereal after crops like rice, wheat and sorghum and locally known as *bajra*, *sajja*, *bhari*, *combo*, *ganti* or *kambam*, is an allogamous crop having protogynous nature. It belongs to the family in Poaceae. India is the largest producer of pearl millet, Rajasthan occupies first position in area and production in India. The pearl millet grains are very nutritious and staple diet of approximately 10 per cent of the population in India. Among the various diseases of pearl millet, leaf spot caused by the fungus *Drechslera setariae* has attained the status of the economically important disease. Maximum mycelial growth of *Drechslera setariae* was reported on sucrose as compared to glucose, fructose and maltose. The pathogen *Drechslera setariae* having significantly better growth on three nitrogen sources viz., ammonium chloride, L-arginine and L-alanine, compared to glutamic acid. Among the tested nitrogen sources glutamic acid was found at least supportive to the mycelial growth of the pathogen. The maximum mycelial growth of pathogen was observed at 25 °C and minimum mycelial growth was recorded at 35 °C temperature. Similarly optimum mycelial growth of pathogen was found at pH 6.5. These findings showed good growth of pathogen over a range of pH 6.0 to 8.0. These findings will be helpful in understanding the epidemiology of the pathogen and further developing strategies for the control of leaf spot of Pearl millet.

PERFORMANCE OF CERTAIN NOVEL INSECTICIDES AND BIO PESTICIDES AGAINST STEM BORER SCIRPOPHAGAINCERTULUAS (WALKER) IN RICE**RAJENDRASINGH¹, D. K. SHRIVASTAVA², DEEPAK KUMAR¹***1. Department of Entomology, Sardar Vallabhbhai Patel University of Agri. & Tech., Meerut- 250 110, 2. Council of Science and Technology, Lucknow-226018 (U.P.)*

All the treatments were recorded significantly higher yield than untreated control (31.75 q/ha). The results of paddy yield depicted in table 3, showed that the plots treated with fipronil 0.3 GR @ 25 kg/ha gave the highest yield (45.56 q/ha), followed by cartap hydrochloride 50 SP @ 1kg/ha (43.01 q/ha), and imidacloprid 17.8 SL @ 200 ml/ha (42.35). In terms of economics the higher net return was obtained with the treatment of fipronil 0.3 GR @ 25 kg/ha (7.3) followed by cartap hydrochloride 50 SP (6.03) and imidacloprid 17.8 SL @ 250 ml/ha (5.48). The average increase in paddy yield over the control ranged from 5.01 to 11.26 q/ha under different treatments. The results revealed that the plots treated with fipronil 0.3 GR @ 25 kg/ha 5SC had the lowest dead hearts / white ears damage maximum paddy yield, and also gave maximum net return. Hence, the farmer of this zone could apply fipronil 0.3 GR @ 25 kg/ha along with alternate of cartap hydrochloride 50 SP @ 1kg/ha (45.56 q/ha), chlorpyrifos 20 EC and egg parasitids *Trichogramma japonicum* 1.0 lakh/ha for the effective management of YSB in rice crop.

SEASONAL INCIDENCE OF SCIRPOPHAGAINCERTULAS (WALKER) ON PADDY.**RAJENDRASINGH¹, D. K. SHRIVASTAVA², DEEPAK KUMAR¹***1. Department of Entomology, Sardar Vallabhbhai Patel University of Agri. & Tech., Meerut- 250 110, 2. Council of Science and Technology, Lucknow-226018 (U.P.)*

The incidence of yellow stem borer, *Scirpophaga incertulas* (Walker) showed that it was recorded on 31st standard week for the first time and continued till Third week of September i.e. 38th standard week. The infestation of stem borer recorded as dead heart ear heads ranged from 4.85 to 10.55 per cent and white ear head showed that it was recorded on 38th standard week for the first time and continued till second week of October i.e. 42th standard week ranged from 6.59 to 9.48 per cent during the crop season i.e. Kharif 2015-16. The incidence was lowest during the month of July which varied between 4.8 to 9.65 per cent. During the standard week in month of 38 September to October temperature range was 29.47 to 26.47°C, and the relative humidity was 64.89 (Evening) to 94.40 (Morning) and rainfall was 3.84 mm. During this period the weather parameters i.e. temperature, relative humidity and rainfall ranged 29.47 to 26.47°C, 73.53 to 79.64 per cent and 0.0-3.84 mm, respectively. The activity of stem borer suddenly decreased in the last week of October.

GENETIC PARAMETERS OF GRAIN YIELD AND IRON (FE) AND ZINC CONTENT IN PEARL MILLET [Pennisetum glaucum (L.) R. BR.] UNDER VARYING ENVIRONMENTAL CONDITIONS**RAJESH C. JEETERWAL¹, L.D. SHARMA² AND ANJU NEHRA³***^{1&2}Division of Plant Breeding and Genetics, Rajasthan Agricultural Research Institute (SKN Agriculture University), Jaipur (Rajasthan) India, ³Department of Plant Breeding and Genetics, College of Agriculture (RVSKVV, Gwalior), Indore*

Genetic analysis was studied in diallel fashion excluding reciprocals for grain yield and iron and zinc using ten diverse inbreds in pearl millet. Genetic components analysis revealed that additive-dominance model fitted for all the characters in all the environments, both additive (D) and dominance (H_1 and H_2) components were significant for both the characters with seed yield. However, relative magnitude of dominance component (H_1 and H_2) was higher than additive component for all the characters indicated preponderance of dominant gene action. The ratio of mean degree of dominance as measured by $(H_1/D)^{1/2}$ was more than unity in all the environments indicating over dominance. The value of $(H_2/4H_1)$ was less than 0.25 indicating asymmetric distribution of positive and negative alleles. The ratio of dominant to recessive alleles was more than unity in all the environments indicating accumulating of dominant genes. Narrow sense heritability estimates were of low to high magnitude for different traits. Heritability estimates (ns) were high 0.303 in E_2 and 0.528 in E_3 for Fe content and 0.116 in E_1 and 0.117 in E_3 for grain yield per plant. This is suggesting that selection for these traits would lead to rapid genetic improvement. The preponderance of non-additive gene effects of grain yield and its component traits in parents indicated that, heterosis breeding would be practically feasible in pearl millet crop.

Key words: Pearl millet, gene action, Additive, Non-additive variance, heritability, *Pennisetum glaucum***ADVANCE TECHNIQUES FOR IDENTIFICATION OF SEED BORNE DISEASES*****RAJESH SAINI, VIVEK AND VIKAS****Department of Plant Pathology Chaudhary Charan Singh Haryana Agricultural University*

Seed borne disease refers to the particular plant diseases that are transmitted by seed. In some cases the transmission on seed is

insignificant compared to the population of disease organisms that exist in soil or on weed species. In other cases, the transmission on seed is the primary means by which a disease spreads. While we are cautious about any type of disease on seed, it is this latter set of diseases that we must be most vigilant in controlling. Planting infected seed may result in a widespread distribution of disease within the crop, and an increased number of initial infection sites from which the disease can spread. As an example, consider the development of ascochyta blight in a chickpea crop. Since there is a high rate of seed-to-seedling transmission of this disease, even a small percentage of infected seed can result in significant seedling infection in the field. For a seed lot with 0.1 per cent ascochyta infection (one infected seed in 1,000 seeds) and a planting density of three to four plants/ft.², 175 infected seedlings per acre could potentially result. This is a substantial amount of early infection for such an aggressive disease. The diseases that are caused by fungal pathogens which persist (survive) in the soil matrix and in residues on the soil surface are defined as soil borne diseases. Thus the soil is a reservoir of inoculums of these pathogens, the majority of which are widely distributed in agricultural soils. Diseases of plants are caused primarily by three types of pathogens: bacteria, fungi, and viruses. Despite that fungi comprise the largest group of pathogens, the bulk of seed-specific diseases are caused by bacteria or viruses. This is due to the fact that bacteria and viruses are more adept at entering and then traveling through the veins of the plant, a phenomenon known as 'systemic infection,' and from the vascular system may make their way into the developing embryos of seeds. It is recommended to have seed tested at an accredited laboratory to assess the levels of seed-borne diseases. Commercial laboratories can test pulse seed to determine the level of seed-borne fungi that cause ascochyta blight, anthracnose, botrytis seedling blight and grey mould, and Sclerotinia. A parallel test for germination will indicate whether seed quality has been affected by such factors as immaturity, disease, mechanical injury and chemical damage. Testing for vigour may also be beneficial, as it serves as an indication of how seed will respond in less than ideal growing conditions. The best way to ensure success of a disease-management program is to adapt it to the diseases expected and to use integrated disease-control measures. Among these measures are resistant or tolerant varieties, crop rotations, fungicides, nematicides, and suggested agronomic practices. The success of any one or all of these measures may depend on how carefully you scout your crops. Because periodic scouting increases the likelihood that disease controls will be applied properly, it can help prevent loss through disease and unnecessary use of pesticides.

Key words: Seed born, Systematic Infection, Agronomic Practices..

INTEGRATED NUTRIENT MANAGEMENT (INM): NEED OF THE PRESENT AGRICULTURAL ERA.

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The notion of sustainability as an ambition has become extensively accepted but the prevailing agricultural paradigm still believes high yield and reduced environmental impact being in clash with one another. During the past decades, the 3.4-fold increase in agricultural food production can be partly attributed to a 37-fold increase in N fertilization and a 91-fold increase in P fertilization, but the environment costs have been very high. New advances for sustainability of agriculture and ecosystem services will be needed during the upcoming years to improve nutrient use efficiency (NUE) while increasing crop productivity and reducing environmental risk. Integrated nutrient management (INM) based on numerous research studies has been advocated to farmers because the need for continued increase in agriculture production and productivity requires growing application of nutrients and the present level of fertilizer production in India is not enough to meet the entire plant nutrient requirement and moreover, neither the fertilizers nor the organic sources in isolation can achieve sustained production under intensive cropping. In INM approach, the key components comprise (1) optimizing nutrient inputs by taking all possible nutrient sources into consideration, (2) matching nutrient supply in root zone with crop requirements spatially and temporally, (3) reducing N losses in intensively managed cropping systems, and (4) taking all possible yield-increasing measures into consideration. Recent large-scale application of INM for cereal, vegetable, and fruit cropping systems has shed light on how INM can lead to significantly improved NUE, while increasing crop yields and reducing environmental risk. The INM has already influenced global agricultural policy and international actions, and resulted in increasing food production with decreased climb of chemical fertilizer consumption at a national scale over recent years. The interactive advantage of combining organic and inorganic sources of nutrients in INM have proved superior to the sole use of these sources. The INM can thus be considered an effective agricultural model to ensure food security and improve environmental quality worldwide, especially in countries with rapidly developing economies.

Key words: Integrated pest management, agriculture, environment

POTENTIAL UTILITY OF MICRO-ORGANISM IN PEST MANAGEMENT

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Microbial pathogen consists of disease causing organism. Microorganisms or their bioactive agents can be used as active substances and

therefore are referred as Microbial Pest Control Agents (MPCA). Microbial pathogens of insects are intensively investigated to develop environmental friendly pest management strategies in agriculture. In the present day plant protection scenario, development of resistance to chemicals and residue in higher trophic level are major hurdle in insect pest management. In the recent years biopesticides are replacing the chemicals pesticides to overcome the harmful effect of the chemicals on non-target organism. These natural entomopathogenic agents, which have specific modes of action, are generally considered safer as compared to conventional chemical insecticides. Baculoviruses are the only viruses being used as the safest biological control agents. They infect insects and have narrow host ranges. *Bacillus thuringiensis* is the most widely and successfully used bio-insecticide in the integrated pest management programs. Bt mainly produces crystal delta-endotoxin and secreted toxins. However, the Bt toxins are not stable for a very long time and are highly sensitive to solar UV. So genetically modified plants that express toxins have been developed and represent a large part of the phytosanitary biological products. Entomopathogenic fungi and particularly, *Beauveria bassiana* and *Metarhizium anisopliae* are also used for their insecticidal properties.

Key Word: - Entomopathogenic agents, modes of action, NPV.

ATTRACTION OF DIFFERENT COLORED STICKY TRAPS FOR MANGO HOPPERS

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Mango (*Mangifera indica* Linn.) is known as a very important and popular fruit in the world, due to its colour, delicious taste aroma and high nutritive value, is known as king of all fruits. This important fruit crop production is enormously handicapped by the ravages of insect pests from seedling to their maturity. Among the mango pests, mango hoppers *Idioscopus clypealis* (Lethierry), *Idioscopus nitidulus* (Walker) and *Amritodus atkinsoni* (Lethierry) (Hemiptera: Cicadellidae) are the most serious and widespread pests throughout the country. The present investigation was carried out at Horticulture Research Centre, Department of Entomology, G.B. Pant University of Agriculture and Technology, (Uttarakhand). For this experiment seven different colored sticky traps (*viz.*, yellow, light yellow, blue, green, white, brown and pink) were prepared by using tough construction colored paper size of 30x 21 cm². Then, a thin layer of polybutene insect gum was coated on the both sides of the paper. The sticky traps were hung vertically with the help of bamboo and rope under the canopy of mango tree at the height of 2 meters. Total number of colored traps was twenty one; seven colored sticky trap were replicated thrice (7x3=21). Data were recorded on 1, 3, 5, 7, 10 and 15 days after traps hanging. During this investigation period mean number of hopper trapped on sticky traps were recorded 1- 6.83. The result reveals that highest mean numbers of hopper were recorded in the yellow sticky trap followed by blue and white 6.83, 5.16 and 3.33 respectively. In case of brown and light yellow colored traps mean numbers of hoppers were recorded 2.33. While, the lowest mean number of hoppers was recorded 1.00 in pink and green colored traps. It could be concluded that yellow and blue colored sticky trap were found more attractive than pink and green colored traps. While, attraction to other colored traps were less significant. Yellow and blue colored sticky trap can be used for monitoring mango hopper in the mango orchard.

Key words: Mango hoppers, sticky traps, polyisobutene and monitoring

SOIL AND WATER CONSERVATION FOR SUSTAINABLE AGRICULTURE

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Conservation of soil and water resources is important for sustainability of agriculture. Soil and water conservation are those activities which maintain or enhance the productive capacity of the land. Soil and water resources are under immense pressure due to ever increasing population and consequently these resources are being deteriorated. Soil erosion is one of the several major deteriorative processes which results in deterioration of the soil. Soil erosion leads to the significant loss of soil productivity and thus may results into desertification under sever conditions. Water and wind are the major agencies which are responsible of soil erosion. Deforestation, over-grazing, intensive cultivation, mismanagement of cultivated soils and intensive urbanization are major factors enhancing the soil erosion. For sustainable agriculture and environment, it is must to protect the soil resources against erosion. Different control measures should be adopted to protect the soil resources against erosion. The concept of soil conservation cannot be materialized without conserving and efficient use of water resources. It is therefore pre-requisite that soil conservation practices should be adopted. Soil conservation practice include soil management, crop management, engineering, range management and forestry operation. A variety of soil and water conservation measures are well known which ensure agriculture sustainability after these being implemented properly. Physical measures are structures built for soil and water conservation. Biological measures for soil and water conservation work by their protective impact on the vegetation cover. These measures slow soil erosion rate compared with an uncovered soil which shows in general a high soil erosion rate. Some possible agronomic measures are strip cropping, mix cropping, inter cropping, mulching, agro-forestry, contour ploughing etc.

Keywords: Soil erosion; Deforestation; Urbanization; Cropping.

HIGH DENSITY ORCHARDING IN CITRUS FRUITS

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High density planting (HDP) technique is a modern method of fruit cultivation involving planting of fruit trees densely, allowing small or dwarf trees with modified canopy for better light interception and distribution and ease mechanized of field operation. HDP and meadow orcharding gives higher yield and returns per unit area because of increasing the no. of trees per unit area. It is possible by regular pruning and use of plant growth regulators to maintain the size and shape of the tree. HDP is one of the novel methods to achieve high productivity per unit area in citrus crops. High yield and high fruit quality in citrus can be achieved with a high-density orchard. Planting density is one of the most important factors in citrus which determine the yield of an orchard. The main motto of HDP is to get the trees into early bearing as soon as possible from a limited space. This is best accomplished by following proper training and pruning regime combined with a precocious rootstock for obtaining significant production. The important dwarfing rootstocks which are commercially used in citrus high density planting are flying dragon, troyer citrange and trifoliate orange. Kinnow can be grown in high density planting by using troyer citranges as a rootstock by spacing the plants at 1.8 x 1.8 m (3000 plants ha⁻¹). Through high density planting system in citrus one can obtain maximum and quality yield per unit area and also reduce the gestation period and increasing the productivity of the orchards. The selection of the system of planting in the orchard depends on topography, crop, variety, plant density and production technology to be followed.

Key words: Citrus, Dwarf, Orchard, Rootstock, Technology

CONSERVATION AGRICULTURE FOR IMPROVING WATER PRODUCTIVITY IN SEMI ARID REGION

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Increasing human population and uncertainty, large variability in rainfall and long dry spell during the crop growing period are the major limiting factors for crop growth and improving water productivity in semi arid region. Agriculture water management interventions are considered the conservation agriculture (CA) is suitable practice to enhance crop yield, productivity and income in semi arid region. Conservation agriculture is considered an important in situ intervention strategy for improving crop and water productivity in climate smart agriculture. The three basic components of CA are: (A) zero or minimum tillage, (B) incorporation of crop residues on the soil surface and (c) diversification of crop. Minimum tillage reduces volume and velocity of surface runoff, leading to reduction in soil erosion and nutrient loss; incorporation of crop residues enhances soil water availability, reduces evaporation loss, improves infiltration by restricting surface runoff and reduces surface sealing from raindrop impact. Crop diversification reduces the risk of crop failure and is recognized as a cost-effective solution to build resilience into agricultural production system. Diversification also brings stability in soil fertility through cultivating legumes with cereals in rotation or intercropping system. Recent studies have reported that CA improved crop productivity by 20-120% and water productivity by 10-40%. On farm trials showed that the CA not only improved the crop yield, but also generated higher gross returns compared to farmers' practice. However, other studies reported no improvement or at some cases negative effects on crop yield by adopting such techniques.

COMBINING ABILITY ANALYSIS IN PUMPKIN (*CUCURBITA MOSCHATA* DUCH. EX POIR.) FOR SMALL SIZE, THICK FLESH, HIGH YIELD AND BETA CAROTENE CONTENT

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Combining ability studies are more reliable as they provide useful information for the selection of parents in terms of performance of the hybrids and elucidate the nature and magnitude of various types of gene actions involved in the expression of quantitative traits. A line x tester mating design was used to study the combining ability for developing small size, thick flesh, high yield and beta carotene content varieties and hybrids in pumpkin according to consumer preferences. In India consumers prefer dark yellow color, round shaped fruit with thick and deep yellow internal flesh color which have high beta carotene and ascorbic acid content to alleviate the vitamin A deficiency problem. A study was undertaken using nine parents which include 6 lines and 3 testers during 2016-17 at Department of vegetable crops, Horticultural College & Research Institute, Tamil Nadu Agriculture University, Coimbatore to study the heterosis and

combining ability for yield and its contributing characters. Evaluation of parents based on per se and general combining ability (*gca*) effects revealed that the parents CO2, Rajasthan Local and Odisha Local excelled for small size, thick flesh with high yield and beta carotene content respectively. The hybrids viz., Rajasthan Local and Pusa Viswas had registered favourable values of mean and significant *sca* for yield and other important characters. Further these top performing F₁ hybrid can be tested in different seasons over different locations for assessing their stability for high yield and other important characters.

GREEN TECHNOLOGIES FOR THE EXTRACTION OF BIOACTIVE COMPOUNDS IN FRUITS AND VEGETABLES

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Bioactive compounds are extracted from natural sources and they have beneficial effects on human health. Fruits and vegetables are rich in bioactive compounds like carotenoids, phenolic compounds, Vitamin C, among others. Conventional extraction techniques generally require large amounts of organic solvents, high energy expenditure, and are time consuming, which has generated interest in new technologies that are referred to as clean or green technologies. Green extraction processes is to achieve a faster extraction rate, more effective energy use, increased mass and heat transfer, reduced equipment size, and a reduction in the number of processing steps. The following modern green extraction techniques-supercritical fluid extraction (SFE), pressurized liquid extraction (PLE), microwave assisted extraction (MAE), ultrasound-assisted Extraction (UAE), pulse electric field assisted extraction (PEF), high hydrostatic pressure (HHP), natural deep eutectic solvents (NADES), enzyme assisted extraction (EAE) are efficient and environment friendly compared to conventional extraction methods like decoction, maceration, soxhlet extraction, hydrodistillation for bioactive compound extraction. Cyclodextrins (CDs) are known molecular encapsulators and the use of CDs enhanced the extraction of pomegranate polyphenols by 20%. Efficient extraction of antioxidant compounds from blackberry (*Rubus* sp.) bagasse using supercritical CO₂ assisted by ultrasound is also reported. Extraction of juice and polyphenols from citrus fruits has been improved by Pulsed electric field treatment. So the green extraction technologies can be considered as a new concept to meet the challenges of the twenty-first century, to protect both the environment and consumers, and in the meantime to enhance competition of industries to be more ecological, economical, and innovative.

Key words- Antioxidant, bioactive compounds, extraction, techniques.

RESPONSE OF DRIP IRRIGATION METHOD OF GROWTH AND YIELD ON CHILLI CROP CHILLI (*CAPSICUM ANNUUM*)

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Drip irrigation is an irrigation method that saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. It is done through narrow tubes that deliver water directly to the base of the plant. The study was conducted in the research farm in the field located at **IFTM University Moradabad**, during the period of 2015 to 2016 Rabi season. The study area of 0.006 between Field 280 50' 33.826" N latitude, 780 46' 48.535" E longitude studies was conducted during the Rabi season of 2015 to 2016. E. The results shown the drip irrigation system of fruit characteristics recorded after every picking and the average values are expressed under various treatments of fruit yield and quality. At harvesting time, samples of green pepper fruits were randomly harvested from each plot to measure fruit length and fruit diameter. In addition, total weight of fruits in each treatment were recorded by harvesting pepper fruits twice weekly and then the total yield as Kg/fed., was calculated. The maximum yield of crop 900 gm/plant and minimum of yield 600 gm/plant and total yield 52270 gm (52.270 kg). The water use efficiency of the crops has to be increased in order to reduce the water loss from the field and drip irrigation system is considered as the most effective micro irrigation method, as water is applied directly into soil at the crop root zone.

OFF-SEASON CULTIVATION OF VEGETABLE CROPS

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Protected cultivation of vegetables offers distinct advantages of quality, productivity and favourable market price to the growers. Vegetable growers can substantially increase their income by protected cultivation of vegetables in off-season as the vegetables produced during their normal season generally do not fetch good returns due to large availability of these vegetable in the markets. Off-season cultivation of cucurbits under low plastic tunnels is one of the most profitable technologies under northern plains of India. Walk-in tunnels are also suitable and effective to raise off-season nursery and off-season vegetable cultivation due to their low initial cost. Insect proof net houses can be used for virus-free cultivation of tomato, chilli, sweet pepper and other vegetables mainly during the rainy

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season. These low cost structures are also suitable for growing pesticide-free green vegetables. Low cost greenhouses can be used for high quality vegetable cultivation for long duration (6-10 months) mainly in peri-urban areas of the country to fetch commensurate price of produces. Poly-trenches have proved extremely useful for growing vegetables under cold desert conditions in upper region of Himalayas in the country.

Keyword: Off-season cultivation, Environment, Covering materials.

IMPACT OF RICE HUSK BIOCHAR ON WHEAT GROWTH PARAMETER

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Wheat (*Triticum aestivum*) is one of the most important cereal crop whole over the world which is used as a staple food. The biochar is made by biomass via pyrolysis under thermal decomposition. It is charcoal which is used as reclamation of soil's physical condition. Apart from this, biochar can also enhance soil fecundity under low pH condition and also expand the agricultural production and provide protection against some foliar and soil-borne diseases. Due to the presence of more C: N ratio, rice husk not easily degradable to the soil. Biochar application is one of the best solutions for improvement of wheat production. This is the only one alternative source of applying essential nutrients to the plant. It is applied to soil in the form of biochar. The experiment was carried out in Lovely Professional University, Phagwara at experimental field to check out the growth and development of wheat in biochar applied soil. On the basis of field trial, biochar may significantly improve the different morphological parameters like plant height, no. of panicle & panicle length were measured at 45 DAS, 60 DAS, 75 DAS, & 90 DAS. For Further research needs to consecutively understand about the biochar interaction with soil.

KEY POINTS: Biochar, crop, charcoal, nutrient, soil, wheat.

EFFECT OF SOIL MICROBES ON IMPROVING PHYSICAL PROPERTY OF SOIL.

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Soil physical conditions play an important role in retention of water and nutrients in the soil and eventual availability to plants. Soil micro-organisms like bacteria, fungi and mycorrhiza play an important role in improving soil structure by promoting the formation of soil aggregates and pores within. Not only are the soil physical conditions influenced by soil microorganisms, but the demography of soil microorganisms is also influenced by soil physical conditions. Soil aggregate stability is a multifaceted process and is an indicator of many aspects of soil structure including soil water regimes and nutrient availability. The stability of aggregates is controlled by soil physical and microbial community properties and plant roots. Fungal cells release mucilaginous exudates which are mainly composed of extracellular surface polysaccharides; cell wall polysaccharides and somatic or intracellular polysaccharides located inside the cytoplasmic membrane. Extracellular polysaccharides are mainly responsible for the formation of aggregates, which are beneficial for improving porosity and aeration in soil. Bacteria release exo-polysaccharides that form organo-mineral complexes which help in binding soil particles into aggregates. During bacterial growth, extracellular polymeric substances are produced in the form of peripheral slime polymers into the soil solution. These are negatively charged polysaccharides, polyuronic and amino acids with adhesive properties capable of making bond between clay particles in order to form aggregates. These aggregates adhere together to form macro aggregates and thus increase inter-particle cohesion. Additionally, AM Fungi can also alter soil microbes in its surrounding environment as well as the rhizosphere of host plant which are probably involved in soil aggregation. These contributions of AM fungi are often entangled together developed a model for soil aggregation where their simulated results indicate that AM fungi, organic matter and plant roots are key contributors to aggregate formation in soil. They also observed that this group of fungi plays an important role in stabilization of soil aggregates. Thus the soil microbes do improve the physical properties of soils as well as the fact that soil physical conditions influence the soil microbial population in native ecosystems.

EFFECT OF CROP RESIDUE AND NUTRIENT MANAGEMENT ON SOIL PHYSICAL PRODUCTIVITY UNDER RICE-WHEAT CROPPING SYSTEM

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Ricewheat is a major cropping system in north-west India because of the availability of high-yielding rice and wheat varieties and favourable climate conditions. Continuous cropping of ricewheat with increase in rate of fertilizer use & due to alternate tillage practices in this system, the problem of poor aeration and compaction have started emerging which may led to loss of soil productivity and reduction of soil water holding capacity & soil structural stability. Despite of high fertilizer use present productivity potential of

ricewheat cropping system in this region is under threat because of deteriorated physical and hydraulic properties and low organic carbon content of the soil. Soil physical productivity i.e. soil physical properties in relation to crop yields is significantly affected by nutrient and organic residue management. Crop residues are important natural resources, and recycling of these residues improves the soil physical condition of soil. Crop residues are generally regarded as a waste but when utilize properly, they improve the soil condition. There are several management options available, like burning, removal, incorporation, surface retention & mulching. Among these, most of the farmers resort to burning of residue to avoid interference with machinery while planting of next crop, but this result in deterioration of soil hydraulic properties as well as identified as a major health hazard. Effects of incorporation, surface retention and mulching have been widely documented by researchers and found to be effective in improving physical properties of soil in long run due to the presence of carbon pool. However, effect of residue incorporation on soil physical properties is mainly depend on soil texture. Mulching improves the soil physical properties up to certain amount beyond which the increments are considerably small. Soil and location base residue management option will help in conservation of soil, water and agricultural resources to achieve economic, ecological and socially sustainable agricultural production. Crop residues have tremendous potential to improve soil physical condition by improving organic carbon, biotic activity, aggregation status, soil bulk density, total porosity, hydraulic properties, prevents surface sealing and crusting, allows more water to infiltrate by cutting down the runoff and soil loss.

Keywords- Crop residue, management options, soil physical properties

IMPACT OF BORON AND ZINC METALOSATE FOLIAR SPRAY ON POMEGRANATE FRUIT NUTRIENTS AND QUALITY

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Boron and zinc metalosate are the amino acid based liquid boron and zinc fertilizers and hundred percent soluble in water. Inoder to study the influence of boron and zinc metalosate foliar spray on major (N, P and K), secondary (Ca, Mg and S), micronutrients (Zn, Cu, Fe, Mn and B) and quality parameters (TSS, total sugars and titratable acidity) of pomegranate fruit present work was carried out in four year old pomegranate plant (cv. Bhagwa) with seventeen treatments and three replications under randomised block design. Significant increase in the major nutrient like nitrogen, phosphorus and potassium content in the pomegranate fruit was recorded and it was varied from 1.51 to 2.40, 0.13 to 0.64 and 0.95 to 1.64 %, respectively. Among different treatments significantly higher NPK (2.40, 0.64 and 1.64 %) content in the pomegranate fruit was recorded at treatment T₁₅ (NPK+ 0.017% B through boron metalosate+ 0.050 %Zn through zinc metalosate). However, the treatments did not have significant effect on calcium and magnesium content of the fruit expect sulphur content. Non significant difference was observed among the treatments with respect to zinc, iron, copper and manganese content and it was ranged from 24.87 to 26.73, 57.49 to 61.22, 5.74 to 6.44 and 25.25 to 27.62 mg/kg, respectively. However, the boron content in the pomegranate fruit was enhanced significantly and it was recorded between 29.21 to 42.66 mg/kg. Among treatments, treatment T₁₃ which consists of foliar application of boron @ 0.051 % through boron metalosate recorded highest boron content of 42.66 mg/kg compared to rest of the treatments.

Keywords: Boron metalosate, Zinc metalosate, Pomegranate, Major, Secondary, Micronutrients content in fruit and Quality parameters

DOUBLING OF FARMERS INCOME THROUGH NANO-ZEOLITE BASED TECHNOLOGY

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Nitrogen is the “kingpin” of nutrient kingdom and its management is a critical issue across the globe. The atmosphere carries about 78% N₂ which is hardly possible for plants use. The biological N fixers facilitate N cycling in agro-ecosystems. In mineral soil, organic matter possesses 98% N and more than 90% of the arable soils are found deficient in available N. Since major portion of added N got lost through leaching, volatilization and denitrification. The N use efficiency of crops hardly exceeds 30-35%. The applied N through fertilizers undergoes transformation processes. These transformation processes make N management very complex and quite difficult to improve the N use efficiency. Inorder to improve NUE several methods are in practice such as use of slow release nitrogenous fertilizers but the NUE enhance due to these fertilizer technologies are limited. To resolve this situation Nano-technology appears to be a light of hope. Nanotechnology deals with manipulation of materials at atom level, molecular and macromolecular scales which operates at 100 nm. It increases surface area to volume ratio altering mechanical, thermal and catalytic properties of fertilizer materials. The nano particle which is highly compatible to load with presently available synthetic fertilizer and showed positive results on growth and yield of several crops Nano-zeolite. These particles easily carries the fertilizer that is fabricated into the plant system improving its NUE to its maximum thereby reducing excess use of chemical fertilizers. This technology seems to be a lime light for golden era wherein farmers income gets doubled.

INCREASING CHICKPEA QUALITY AND VIGOUR POTENTIAL SUSTAINABILITY USING ORGANIC AND NATURAL RESOURCES**RANVIR***Department of Agronomy, Navsari Agricultural University, (Navsari) Gujrat-396450, India.*

The chickpea (*Cicer arietinum* L.) as a healthy vegetarian food has an important role in human food. It is a cheap source of high quality protein in the diets of millions of people in developing countries. In addition to proteins, it is a good source of carbohydrates, minerals and trace elements [19]. Also chickpea play a key role in organic cropping systems. In such agro ecosystem with limited availability of nitrogen. The growing chickpea in crop rotation increases crop sustainability for the semi-arid region. Organic farming needs to be self-sufficient in nitrogen through the fixation of atmospheric di-nitrogen (N₂) by legumes crops. Green manures application to the soil is considered a good management practice in all agricultural production system because of increasing cropping system via sustainability by reducing soil erosion, improving soil physical properties. A major benefit of green manure and organic fertilizer is the increase organic matter of the soil. They help to recycle other nutrients on the farm. Phosphorous, potassium, calcium, magnesium, sulfur, and other nutrients are accumulated by green manures. During decomposition of organic matter, carbonic and other organic acids are formed as a by product of microbial activities. Organic acids react with insoluble mineral rocks and phosphate precipitates, releasing phosphates. Phosphorus is present as mineral deposits, which are a nonrenewable natural resource. Phosphate solubilizing bacteria are also known to increase phosphorus uptake resulting in better growth and higher yield of crop plants. both *Rhizobium* and phosphate solubilizing bacteria has increase number and size of nodulation, growth and yield in chickpea.

DETERMINATION OF ADOPTER CATEGORIES ON ADOPTION OF HYBRID RICE IN JAMMU DISTRICT**RASHIKA MAHAJAN, Y.S. BAGAL, L.K. SHARMA AND TARIQ IQBAL***Division of Agricultural Extension Education, SKUAST- Jammu, J&K, India*

All potential adopters of a new product do not adopt the innovation at the same time rather they adopt it over a period of time (Rogers, 2003) and on this basis, the degree to which an individual is relatively earlier in adopting the innovation, adopters can be classified into different categories. Development of adopter categories requires determination of the number of adopter categories, the percentage of adopters to include in each category, and a method to define categories. To find out the adopter categories of hybrid rice, a study was conducted in one randomly selected block of Jammu district. A total random sample of 70 respondents was interviewed using a semi-structured interview schedule. Majority of the farmers were of middle age (44-63 years) and studied upto matriculation. The average land holding of farmers was 1.92±2.61 ha. In the study area, adoption of hybrid rice was started in 2005 and maximum adoption was in 2012. Hybrid-6444 was the first hybrid variety adopted by 80% of the adopters irrespective of their year of adoption having an average yield of in their first year, with an average yield of 61.37 q/ha. There are many comparative benefits of hybrid rice reported by the farmers viz; more production, no lodging, early maturity and less water requirement but along with it many constraints were also perceived by the farmers in its cultivation such as more disease and insect pest attack and difficulty in harvesting and threshing, etc. The time variable allows us to classify the respondents into different adopter categories. In the study area, the adopters were plotted on the basis of innovativeness and on cumulative basis and they almost follows the normal curve and s- shaped curve. The percentages of adopter category found in the study area were approximately similar to that of Rogers in adopter categories, i.e., 2.86 percent innovators, 17.14% early adopters, 25.71% early majority, 37.14% late majority and 17.14% laggards. It is suggested that extension agencies have to provide information and remain in contact with farmers for early adoption of innovations.

Keywords: Adoption; hybrid rice; innovativeness; constraints; adopter categories**INFLUENCE OF CMS CYTOPLASM ON HETEROSIS IN HIGH YIELDING VARIETAL CROSSES IN *BRASSICA JUNCEAL*.****RASHMI¹, NEHA DAHIYA¹, DARSHANABISHT², RAM BHAJAN¹ AND USHA PANT¹**

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The basic material required for development of hybrids is production of large number and perfected experimental hybrids to be evaluated in multi-location trials but since, Indian mustard (*Brassica juncea* L.) is self-fertilized crop, there is economical constraint in the form of hand emasculation and pollination. CMS based hybrids can be used to overcome this barrier and hence, therefore, number of CMS systems have been developed for exploitation of heterosis out of *ogu*, *mori* and 126-1 has been utilized to developed hybrids in India so far. The grey area or gap in study was found regarding the effect of CMS cytoplasm on heterosis achieved in CMS based hybrids compared to normal hybrids with only few studies reported so far. Therefore, in the present study *ogu* CMS based hybrids were compared

with normal hybrids made with similar high yielding varieties used as lines and testers for mid parent and better parent heterosis. A cursory view of estimated heterosis over mid-parent as well as over better parent showed a shift in direction of significant heterosis in the two sets of crosses, which varied with cross as well as with character. Such a change in mid-parent heterosis in either direction was observed for 16 crosses for number of primary branches; 11 for silique length; 10 for number of secondary branches; 9 for silique on main raceme while for rest of the characters 5 or less number of crosses were exhibited a such a shift. Similarly, better parent heterosis was also affected in same way in number of crosses for the characters under study. One cross *i.e.* Maya × PR-2006-14 did not show any directional change in both the types of heterosis. Results indicated that heterosis of parental lines with native cytoplasm may or may not remain intact after their conversion into CMS background. Thus, it can be inferred that heterosis of lines converted into CMS background will have to be re-examined for identification of potential crosses for commercialisation of CMS based hybrids. There also exists possibility of finding crosses with negligible or no effect of cyto-nuclear interactions due to reestablishment of harmonious interaction.

EFFECT OF NUTRIENTS, PLANT EXTRACTS AND FUNGICIDES ON ALTERNARIA BLIGHT OF TOMATO CAUSED BY *ALTERNARIA ALTERNATA*

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Alternaria blight of tomato caused by *Alternaria alternata* is one of the major disease causing considerable yield loss. Hence, the present investigations was carried out in the laboratory as well as in the field during *zaid* 2017 and 2018, both at the Horticulture Farm, S.K.N. College of Agriculture, Jobner and Department of Plant Pathology, Sri Karan Narendra Agriculture University, Jobner, Rajasthan. Tomato (*Solanum lycopersicum* L.) ranks first among processing crops. Tomato is the world's second most consumed vegetable after potato. Alternaria blight of tomato caused by *Alternaria alternata* is one of the most important fungal diseases prevalent in tomato growing areas of India particularly in Rajasthan State and is considered as one of the limiting biotic factor for successful cultivation of tomato. Among seven nutrients tested, Copper sulphate gave maximum inhibition of mycelial growth (52.22 %) at all concentrations. In field experiment, two sprays of Copper sulphate (0.5 %) was found most promising in reducing the disease intensity (46.94 %) & increasing yield (45.52 %). Among seven plant extracts tested, *Allium sativum* clove extract gave maximum inhibition of mycelial growth (96.70 %) at all concentrations. In field experiment, two sprays of *Allium sativum* clove extract (10 %) at 15 days interval from disease initiation, was found most promising in reducing the disease intensity (58.16 %) & increasing yield (55.35 %). Among seven fungicides tested, Hexaconazole gave maximum inhibition of mycelial growth (98.81 %) at all concentrations. In field experiment, two sprays of Hexaconazole (0.2 %) at 15 days interval from disease initiation, was found most promising in reducing the disease intensity (79.74 %) & increasing yield (88.51 %).

PACKAGING TECHNOLOGY OF HORTICULTURAL CROPS

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The increasing demand for fresh and quality packaged food, consumer convenience and manufacturers concern for longer shelf life of the food products is driving the market for Global active and smart packaging technology for food Markets. Being perishable, fruits and vegetables require to be preserved until they are sold and used by consumers. This offers challenges in food preservation. The package must not only act as an inert barrier to the external environment but also resist respiration issues. Demands on package performance continue to increase as a result of market and social changes. Active packaging reduces the need for additional preservatives in perishable food stuffs. Thus the shelf-life is extended and the food stuffs maintain freshness longer and are mildly preserved. Packaging technologies with an aim to scavenge or absorb ethylene from the surrounding environment of packaged produce have also been developed. . Oxygen scavengers can be incorporated in the packaging system itself rather than being added as sachets or labels as seen above. The oxygen scavenger can be incorporated into crowns, cans and a variety of metal and plastic closures.

Keywords fresh and quality packaged, perishable food stuffs, shelf-life is extended etc.

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Keywords fresh and quality packaged, perishable food stuffs, shelf-life is extended etc.

EFFECT OF NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF RICE (*ORIZASATAVAL*.)

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The present investigation entitled “Effect of Nutrient Management on Growth, Yield and Economics of Rice (*Oriza satava L.*)” was conducted at Research Farm, School of Agricultural Sciences and Engineering, IFTM University, Moradabad in 2018 during Kharif season to evaluate the impact of continuous use of inorganic fertilizers on productivity, economics and soil fertility status. Growth parameter such as plant height, fresh weight and dry weight, no. of tiller per plant, leaf area, panicle length, no grains per panicle, weight of grains per panicle, test weight, sterility percentage, total yield and economics parameter. The differences in growth attributes were statistically alike between 100 % RDF with (T7). Sustainability of any system requires optimal utilization of resources such as water, fertilizer and soil. Apart from the economic considerations, the adverse effect of injudicious use of water and fertilizers on the environment can have far reached implications. There is a need to develop agro technologies, which will help in sustaining the precious resources and maximize the crop production, without any detrimental impact on the environment.

SCREENING OF GERMPLASM AND EVALUATION OF NEWER INSECTICIDES AGAINST WHITE FLY (*BEMISIA TABACI*) IN MUNGBEAN (*VIGNARADIATAL*.)

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Mungbean is the third most important pulse crop of India after chickpea and pigeonpea. The nutritive value of mungbean is high and easily digestible protein with approximately 25-28% protein, 1.0-1.5% oil, 3.5-4.5% fibre, 4.5-5.5% ash, 62-65% carbohydrate, 9.1% water and vitamins on dry weight basis. Mungbean crop is raised in three seasons viz., *Kharif*, *Rabi* and *Zaid* which cultivated in about 2.71 million hectares with production of 1.19 million tonnes. In Uttar Pradesh, green gram is being cultivated on 0.078 million hectares that produce 0.051 million tonnes with an average productivity of 658 kg/ha. Among major problem known to limit the production of mungbean, incidence of insect-pests is one of the major constraints. Among these whitefly (*Bemisia tabaci*) is one of the most serious pest. The yield loss of mungbean due to whitefly reported as 30-70% in normal weather condition. None germplasm were free from whitefly, both at 50% flowering and 50% pod maturity stage. Lowest 0.90 per plant whitefly population was observed in PUSA 0672 at 50% flowering stage and 0.95 per plant whitefly population were observed in KM13-47, PUSA0672, PUSA0871, PUSA1331, PUSA1332, PUSA1441 and PUSA9531 at 50% pod maturity stage showed resistance (< 1 whitefly per plant) against whitefly. Studied on the field evaluation of newer insecticides against *B. tabaci* on mungbean carried out by using 6 insecticides, in which most effective treatment was Emamectin benzoate 5 SG @ 10 g a.i./ha followed by indoxacarb 14.5 SC @ 60 g a.i./ha, Profenophos 50 EC @ 500 g a.i./ha, Spinosad 45 SC @ 73 g a.i./ha and Novaluron 10 EC @ 30 g a.i./ha. Imidacloprid 17.8 SL @ 210 g a.i./ha.

BIO EFFICACY OF BOTANICALS AGAINST PULSE BEETLE (*CALLOSOBRUCHUS CHINENSIS* LINN.) IN STORED CHICKPEA UNDER AMBIENT CONDITION

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The seed quality of chickpea is deteriorated by infestation of bruchid during storage, which is managed by using botanicals and insecticides as seed protectants. Bio-efficacy viz.; infestation, weight loss, seed moisture content, germination, vigour and insect mortality were effected at different level seed storage. Studies on “Bio efficacy of botanicals against pulse beetle (*Callosobruchus chinensis* Linn.) in stored chickpea under ambient condition” was carried out in the Department of Entomology, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad during 2016-17. Eight seed protectants viz., Neem leaf powder @ (5g kg⁻¹), Nimbecidine @ (5 ml kg⁻¹), Karanj oil @ (5 ml kg⁻¹), Custard apple leaf powder @ (5g kg⁻¹), Castor oil @ (5ml kg⁻¹), Eucalyptus oil @ (5ml kg⁻¹), Gorakhmundi @ (5g kg⁻¹) and Deltamethrin 2.8 EC @ (0.04 ml kg⁻¹) seed were assessed for their effectiveness. Minimum per cent damage and weight loss were observed when the seed treated with Deltamethrin 2.8 EC @ 0.04 ml kg⁻¹ seed followed by Nimbecidine @ 5 ml kg⁻¹ and up to 6 months of storage under ambient condition. Germination percent was found significantly above the IMSCS level up to 6 months of storage when seed was treated with Deltamethrin 2.8 EC @ 0.04 ml kg⁻¹ seed

followed by Nimbecidine @ 5 ml kg⁻¹ seed. Percent seed moisture was depends on nature of seed protectants and storage environment. Seed vigour index was found significantly higher up to 6 months of storage when seed was treated with Deltamethrin 2.8 EC @ 0.04 ml kg⁻¹ followed by Nimbecidine @ 5 ml kg⁻¹. The residual effect Deltamethrin 2.8 EC @ 0.04 ml kg⁻¹ was found up to 6 month of storage. The present investigation advocated that seed protectants viz., Deltamethrin 2.8 EC @ 0.04 ml kg⁻¹, Nimbecidine @ 5 ml kg⁻¹ and Karanj oil @ 5 ml kg⁻¹ may be utilized as suitable seed protectants to maintain the seed quality above IMSCS level, for a long period of 6 months.

ORGANIC MATTER AS A CRITICAL COMPONENT IN SOIL HEALTH MANAGEMENT

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A healthy soil health is referred as the one that has the capacity to support the productivity of plants and animals, maintains air and water quality and health of all other living organisms it is harbouring. Soil organic matter though forming only 2-10 % of soil volume is beyond doubt very significant for maintenance of soil health in terms influencing its physical, chemical and biological properties. In coarse textured sandy soils, organic matter largely determines cation exchange capacity and can influence water holding capacity to a greater extent. In finer textured clay soils, soil organic matter is critical in maintaining soil structure and stability. Soils with optimum levels of organic carbon possess the capacity to resist the changes in pH due to the improved buffering capacity as a result of presence of hydroxyl groups on humic substances. Overall, adequate amounts of soil organic matter maintain soil quality, preserve sustainability of cropping systems and help to decrease environmental pollution by decreasing the toxicity of heavy metals to plants through absorption and also reducing the contamination of water ways and ground water by pesticides through adsorption. Formulating the fertilizer management strategies for the crops, the proper information about the organic matter levels in different soils is of paramount significance. A diverse types of biological processes mediated by microbes is essentially influenced by the presence or absence of organic matter content of soils. Since organic matter is a source of nutrients for soil microbes involved in release of carbon, nitrogen, phosphorus, potassium, sulphur and micronutrient from organic and mineral matter in soils, governs the population of these microbes. Researchers world over have reported that soils functions can be constrained when the organic carbon of a particular soil is less than one percent. The organic fraction of soil thus deserves utmost care with respect to its management for gifting the soil resource to the future generations in a better form.

INTEGRATED MANAGEMENT OF DISEASE IN BEANS

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According to estimates made in India nearly 10-15% of food legumes production is lost due to diseases alone. Among fungi, diseases caused by species of Botrytis and Ascochyta are of great importance to faba bean. Then the lesion enlarged and became concentric. Mature leaves had coalescing necrosis surrounded by yellowing. Older leaves of the plant were particularly affected. In a later stage of the disease, the leaves became blighted from the margin to the center and most of the diseased plants defoliated. In severely infected fields, circular to irregularly shaped lesions also appeared on stems and pods, and plants defoliated completely. All tested isolates were pathogenic to broad bean leaves. Different isolates of the fungus varied in pathogenicity on different broad bean cultivars. In a comparison of symptoms of the disease and morphological characteristics of the isolated fungus with other broad bean diseases, this disease represented a new, as yet undescribed disease of broad bean in Japan. Faba bean (*Vicia faba*) plants showed symptoms of shoe stringed leaves, phyllody and flower abortion in experimental field. Therefore, we propose the name "leaf spot of broad bean". Disease on broad bean in different parts of Uttarakhand.

EFFECT OF FOLIAR APPLICATION OF NUTRIENTS ON FRUIT DROP OF KINNOW MANDARIN

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Citrus crops are relatively high nutrients demanding and highly responsive to applied nutrients in the form of fertilizers. Excessive fruit drop is a serious problem in Kinnow mandarin, which starts from blooming and continues till final harvest due to malnutrition. The experiment comprising of eleven fertilizer treatments in different combinations was conducted on seven years old earmarked plants at Experimental Orchard of the Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2016-17 to study the effect of Urea, K₂SO₄, ZnSO₄, FeSO₄ and boric acid on fruit drop of Kinnow mandarin. The data were recorded on June drop and pre-harvest drop. The recorded data were subjected to statistical analysis using RBD. The results of present investigation indicate that the foliar application of Urea 1.0% + K₂SO₄ 1.0% + ZnSO₄ 0.5% + FeSO₄ 0.5% + H₃BO₃ 0.2% had a significantly positive influence and was quite effective in minimizing June and pre-harvest fruit drop in Kinnow mandarin. The decrease in fruit drop with the application of

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different nutrients in combination might be attributed to the fact that making up the deficiency of these nutrients in the plants, which are required for the synthesis of carbohydrates, which are essential for reducing fruit drop. The significant check on the economically important pre-harvest fruit drop by the combined foliar spray of these nutrients can be accredited to the activation of auxins which results in strengthening the fruit pedicels through their synergistic relationship between them by the retardation of abscission layer formation in pedicel at the point of attachment with fruit.

ORGANIC FOODS

RENU BALASHARMA

Organic food, food raised without chemicals and processed without additives. Organic food refers to crops or livestock that are grown on the farm without the application of synthetic fertilizers or pesticides, and without using genetically modified organisms. In contrast, the type of agriculture followed by most farmers, which does include the use of synthetic pesticides and fertilizers, is termed conventional agriculture. Organic foods are made according to certain production standards. IN 1939, Lord Northbourne coined the term organic farming. Food whose ingredients are at least 95% organic by weight may carry the USDA Organic Label products containing only organic ingredients are labeled 100% organic. Organic gardening uses organic seeds, organic, organic fertilizers, compost, organic root, stimulators and organic pest control.

QUALITY TEST OF MILK

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Quality test is a set of test done to validate ample product quality in various standards. These efforts are done to enhance worth of dairy products and the reason behind performing these tests is that dairy products are very much susceptible to bacterial contamination. Tests are done for maintaining quality and food safety and thus provide technical guidance for milk analysis and testing their compositional, microbiological and adulterant content. Numerous tests are designed like Iodine test for glycogen and starch by using Lugol's iodine reagent, Molish's test for presence of carbohydrate by using reagent which is a mixture of naphthol in ethanol, Transparency test for observing oil content present in milk, Adulterant analysis of milk by finding the starch availability, detection of pulverized soap with the help of phenolphthalein indicator. Further tests include urea test, test for presence of boric acid and borates by using turmeric paper which is mixture of turmeric powder and ethanol, presence of detergent test, identification of synthetic milk test, turbidity test for checking efficiency of sterilization in milk that depends upon the denaturation of proteins and organoleptic test which comprises of all the preliminary quality tests such as sense of sight, smell and touch. In case of micro-organisms tests alkaline phosphatase is an indigenous milk enzyme. The enzyme activity is destroyed at pasteurization temperature and has been adopted as an index of the efficiency of pasteurization. All these tests are done to ensure whether milk is up to the accepted standards for chemical composition, purity and level of different micro-organisms.

Keywords: Adulterant, Denaturation, Pasteurization, Susceptible

LONG -TERM CONTINUOUS USE OF ORGANIC MANURES ON PRODUCTION POTENTIAL AND SUSTAINABILITY OF RICE BASED CROPPING SYSTEMS

RESHMA BORA

Rice is the staple food crop of India. About 90% of rice in the world is produced and consumed by the Asian countries. India has the largest area of 43.2 mha among rice growing countries and stands second in the production i.e, 110.15 mt with the productivity of 2050 kg/ha (Directorates of Economics and Statistics). There are popular rice based cropping systems in India such as rice-wheat, rice-rice-rice, rice-mustard, etc. There are several constraints in rice based cropping system as rice is a nutrient exhaustive crop; hence poor nutritional status and declining response of rice to nutrients are of much concern. In recent times, a plateauing in productivity of Rice-wheat cropping system appeared, possibly due to fatigued exploitation of natural resource base (Ladha et al., 2003). In many areas, yields started declining because of a decrease in factor productivity (Yadav 1998), and farmers have resorted to using higher than the recommended doses of mineral fertilizers to maintain previously attained yield levels. The application of nitrogen fertilizer either in excess or less than optimum rate affects both yield and quality of rice to remarkable extent, hence proper management of crop nutrition is of immense importance. (Meena et al., 2003). Since sustainability of the production system depends on the sustainable use of soil resources, it is necessary to develop and adopt soil management technologies that increase soil organic matter contents and biological activities and improve soil physical conditions to keep lands productive on the sustainable basis. Long term experiments provide the best possible means of studying changes in soil properties and processes and identifying emerging trends in nutrient imbalances and deficiencies to formulate future strategies for maintaining soil health by using organics in combination with inorganics. Bhatt (2017)

reported that treatment NPK+FYM managed to achieve highest soil organic matter (2.28 g/kg), available N, P and K (255.44 g/kg, 27.10 g/kg and 223.09 g/kg respectively) as compared to application of nitrogen alone over a period of ten years. Das et al., 2014, reported that Compost (30 kg N/ha) + Urea-N (90 kg/ha) found to have maximum yield (5.02 t/ha) as compared to the plots where Urea-N alone (120 kg N/ha) was applied.

Therefore, one of the most promising means for increasing yield in the rice-based cropping systems is to develop alternative nutrient management practices, which may increase factor productivity and crop yields. In this direction, application of organic manures can be a useful practice to increase crop yields along with soil fertility.

STUDIES ON COMPARATIVE EFFICACY OF INSECTICIDE AND ENTOMOPATHOGENIC FUNGI AGAINST TERMITE IN WHEAT CROP

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Termites are social insects that live together as colony in a termitarium. They severely damage agricultural crops. Management of termites has largely relied on broad spectrum and persistent chlorinated organophosphate insecticides. Serious health hazards and environmental concerns due to extensive use of insecticides have led to the search for environmentally benign alternative methods of termite management. Among the diverse potential alternatives available for termite management, the use of entomopathogenic fungi is getting momentum. Entomopathogenic fungi, *Metarhizium anisopliae* and *Beauveria bassiana* are effective in the management of different species of termite. A field trial was conducted to evaluate efficacy of Chloropyriphos 20 EC @ 3.5 lit/ha (broadcasted with sand), *M. anisopliae* (@ 5 kg/ha FYM enriched) and *B. bassiana* (@ 5 kg/ha FYM enriched). *M. anisopliae* appeared to be most effective and caused 47.6% decrease in termite incidence and 15.5% increase in yield of wheat crop. In the Chloropyriphos 20 EC treated plot 41.5% decrease in termite incidence was recorded, which resulted into 12.6% increase in yield. Seed germination was significantly higher (91%) in micro plots treated with chloropyriphos 20 EC followed by *M. anisopliae* (89%) and *B. bassiana* (87%).

Key words: Termite, *B. bassiana*, *M. anisopliae*, chloropyriphos, germination.

CHEMICAL AND BIOLOGICAL CONTROL OF ROOT KNOT NEMATODE (*MELOIDOGYNE GRAMINICOLA*) IN PADDY CROP

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The present field experiment was conducted to evaluate the efficacy of bio agents and chemical nematicides viz. *Trichoderma harzianum*, *Pseudomonas fluorescens*, *Bacillus subtilis*, Carbofuran 3G and Phorate 10G for management of rice root-knot nematode *Meloidogyne graminicola* during kharif-2014, 2015 and 2016. The present findings revealed that all the treatments were significantly superior over control with respect to plant growth parameters and nematode population. In control, terminal and spiral galls developed on rice roots, and plants suffered 32-41% decrease in the plant growth parameters and resulted upto 27% yield loss. At harvest greater decrease in soil population was recorded after soil application of *T. harzianum* (51.11%) followed by carbofuran 3G (46.82%). *T. harzianum* and carbofuran 3G were at par in suppression of root gall and egg mass suppression and *T. harzianum* caused 61.11 and 58.28% reduction in root gall and egg mass respectively, whereas, carbofuran 3G caused 59.52% and 62.50% reduction in root gall and egg mass respectively.

Key words: *M. graminicola*, rice, biological control, chemical control, plant growth

EMERGING TRENDS OF PROBIOTICS IN NON-DAIRY PRODUCTS

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There has been substantial development in the industry of probiotics as health drink. The increasing consumer awareness about the various health properties of probiotics has led to its great demand in recent years. They are considered as functional foods because of its nutraceutical properties. Probiotic foods or products are those which contain certain beneficial microorganisms in good amount ranges from 10⁶-10⁹ CFU/ml which mainly belongs to *Lactobacillus* and *Bifidobacterium* genera. They are mainly available as milk based probiotic health drinks in the market and has become successful in delivering the desired product. But there are certain factors which are to be considered before consuming milk based probiotic drinks. Milk based probiotic products have certain limitations such as more fat and cholesterol content. Certain sections of the population are more prone to dairy related allergies due to presence of certain proteins in it and also suffer from the condition like lactose intolerance. Whereas, fruit based probiotic products have none of these factors of consideration and have much more advantages compared to milk based one. Fruits are rich source of vitamins, minerals, along with good

taste, colour and are enjoyed by all age groups. So, along with added benefits of fruit based probiotic products it can add more value to the product and can be a successful venture. But one of the main challenges in the production of fruit based probiotic product is an altered taste and aroma of the product. Probiotic micro-organisms are known to produce different metabolic components such as acetic acid and lactic acid bacteria during fermentation and over the storage period. The quality of products containing probiotic mainly depends on the packaging materials used and the storage conditions under which the products are stored. But successful attempts have been made in recent years despite of such challenges and further research have to be done in exploring different fruits and vegetables crops along with potential and compatible probiotic micro-organisms.

EFFICACY OF NOVEL INSECTICIDES AGAINST CUTWORMS (LEPIDOPTERA: NOCTUIDAE) INFESTING CABBAGE

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Persistence toxicity of seven new insecticides viz; bifenthrin, chlorantraniliprole, cypermethrin, emamectin benzoate, flubendiamide, novaluron and spinosad was evaluated against third instar larvae of *Agrotis ipsilon* (Hufnagel) and *A. segetum* (Denis & Schiffermuller) under laboratory conditions. The result revealed that all the selected insecticides caused mortality of third instar larvae of both the species upto 15th day of spray except emamectin benzoate and cypermethrin where the mortality was recorded upto 10th and 7th day of spray, respectively. Flubendiamide 0.004% showed highest PT value of 1099.975 and 1125 against the third instar larvae of *A. ipsilon* and *A. segetum*, respectively.

CHARACTER ASSOCIATION STUDIES FOR QUANTITATIVE AND QUALITY TRAITS IN KNOLKHOL ((BRASSICA OLERACEA VAR. GONGYLOIDES L.) GENOTYPES UNDER SUBTROPICAL CONDITION OF JAMMU

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Correlation and path coefficient analysis studies was carried out in thirty genotypes of knolkhol collected from various region of the states and some public sector varieties and hybrids at Vegetable Research Farm Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu during 2016-17 and the results revealed that the genotypic correlation coefficients were higher than phenotypic correlation coefficients for all the pairs of characters suggesting a strong inherent relationship between different traits. During the main season the marketable knob yield had positive and highly significant correlation with leaf length, number of leaves per plant, marketable knob diameter and gross weight per plant both at genotypic and phenotypic levels. Significant and negative correlation was observed for days to marketable maturity, beta carotene contents of leaves and calcium contents of knob and leaves and potassium contents of leaves. Path coefficient analysis for various traits showed that gross knob weight/plant had maximum positive direct effect on net knob weight/plant at genotypic level, followed by harvest index, petiole length and marketable knob diameter indicating that increase in marketable knob diameter, petiole length and gross knob weight/plant will improve the net knob weight/plant directly while maximum negative direct effect was recorded for calcium contents of leave followed by leave length, phosphorous contents of leaves, stalk length, leaf width and number of leaves/plant that while improving the net knob weight/plant. These observations suggested the selection of lower values for these traits.

Key Words : Character Association, Path analysis, Knolkhol, Quantitative traits.

“INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)”

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The field experiment was conducted during Rabi season of 2017-18 at the Horticulture Research farm, AKS University, Satna (M.P.). The experiment was laid out in a randomized block design with three replications. The treatments consisted of nine combination of different agro input management practices viz., treatments 100 % RDF (Control) (T₁), 75 % RDF + 25 % N through VC (T₂), 75 % RDF + 25 % N through FYM (T₃), 50 % RDF + 50 % N through VC (T₄), 50 % RDF + 50 % N through FYM (T₅), 100 % RDF + 25 % N through VC (T₆), 100 % RDF + 25 % N through FYM (T₇), 100 % RDF + 25 % N through FYM + *Azotobacter* @ 2 kg ha⁻¹ + PSB @ 2 kg ha⁻¹ (T₈), 100 % RDF + 25 % N through VC + *Azotobacter* @ 2 kg ha⁻¹ + PSB @ 2 kg ha⁻¹ (T₉). The maximum net profit/ha was recorded under treatment T₉ (Rs. 182392.68) while minimum net profit/ha was obtained in treatment T₄ (Rs. 123469.25). The maximum gross profit/ha

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was recorded in treatment T₉ (Rs. 230115.00) whereas, minimum gross profit/ha was recorded in treatment T₄ (Rs. 167260.00). Thus, the maximum income (both gross and net) was obtained with T₁₀. The significantly maximum B:C ratio 4.54 was recorded under the treatment (T₁). And the minimum B:C ratio 2.66 was recorded under the treatment (T₅).

Keywords: *Organic, Inorganic, Biofertilizer, INM and Cabbage.*

BOTANICAL PESTICIDES: CONSEQUENTIAL COMPONENT OF INTEGRATED DISEASE MANAGEMENT **RISHIKADANGI AND SONAKSHI DAHIYA**

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The obtrusive and unfettered use of fungicide has resulted into different types of environmental haphazard, resistance of pest towards fungicides, pest resurgence and toxicological problems. Recently notion of exploitation of plant extract as chemo therapeutants for disease control are gaining popularity. There is growing demand for effective alternatives that present low health risk and conserve ecosystems and biological diversity. Plants are known to contain a number of secondary substances like phenols, flavanoids, quinines, essential oils, alkaloids, saponins, steroids etc. Some of these have anti-microbial properties and are toxic to phyto pathogens, insects and various pests. Use of plant based anti microbial substances provides an alternative method for sustainable agriculture by management of pathogens and pest along with reducing dependency on synthetic fungicides. Neem products such as neem oil are commercially available botanical pesticide. Now some essential oils from plants have also been reported to have antifungal properties. Plant materials, however, are often used inefficiently and their effective use requires optimization but if integrated in the disease management program have potential to be remunerative. Efficacy of botanicals alone or in combination with the fungicides is a sustainable strategy for the management of diseases. In context of agricultural disease management botanical pesticides are best suited and can play much greater role in the production and protection of crops. Plant extracts can prove to be remunerative if embedded into integrated disease management program.

Key words: Biopesticides, IDM, Anti microbial, Remunerative.

ROLE OF EPIGENETICS IN PLANT TISSUE CULTURE AND ITS FUTURE PROSPECTS

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The term 'epigenetic' was originally coined by Waddington to describe the different mechanisms by which genes act together to control a phenotype, this term also has been co-opted by molecular biologists to describe the study of heritable information that is not fully explained by DNA sequence. In-vitro, epigenetic variation reflects that the adaptation process of cells to a different environment which includes the response to signals that may trigger switches in the developmental programme. Epigenetics is a very sensitive regulatory mechanism, which in most of the cases is affected by the environment. Epigenetic theories primarily emphasize the interaction between genes and the environment because the environment has a profound role in determining the epigenetic modifications occurring in an individual's genome that ultimately influence the organism's development and process of the heredity. Epigenetic changes in plant tissue culture are caused by changes in the expression of the information in the DNA brought about by covalent modifications occurring in the chromatin and allowing cells to sustain different traits in spite of containing the same genetic material. Due to interplay among epigenetic mechanisms such as DNA methylation, histone modifications, and micro RNA interference (RNAi). The chromatin structure is also critically affected. These modifications may influence gene transcriptions. If the chromatin is tightly packed (heterochromatin) due to DNA methylation, histone modifications and micro RNA interference (RNAi), the genes those are in the heterochromatin zones would not be available for the transcription machinery. In consequence, the particular gene or genes will be silenced or their expression is markedly decreased. Regulation of these mechanisms influences gene expression by modifying the access to the underlying genetic information, ultimately affecting phenotypes. This is another area of emerging science which helps us in future with several ways to genetic improvement of the plants and animals or living beings.

Keywords: Epigenetics, genetic variation, biotechnology and tissue culture,

VALUE ADDITION IN FLORICULTURE (ESSENTIAL OILS)

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Value addition is to increase the profit value and consumer attraction of a commodity. There are different ways to add value to your goods like by process the raw material, pre-cut wrap and package, take a unique approach, label your product, distinct product appearance, increase shelf life, provide recipes/cookbook, gift baskets or multi-pack, build reputation, relationship. Essential oils, also known as vegetable oils, are complex mixtures of organic substances and are terpene derivatives, phenylpropanoid various hydrocarbons and

straight chain compounds. They are chemically active and take part in metabolic reaction. Essential oils act as attractants for certain pollinating insects or feeding animals against plant parasites, hostile insects, attack by microbes or depredation by browsing animals. Besides, they help in developing allelopathic strategies by preventing the germination and growth of other plants vicinity and even cause the death of encroaching plants in some cases. The application of essential oils are indigenous marketing, export, perfumery, cosmetics, essences, fragrant commodities, medicines. Different essential oil crops are rose, jasmine, tuberose, narcissus, murraya, marigold, calendula etc. Essential oils are known to occur in every organ of the plant, for example, flowers (rose, jasmine, cananga, tuberose), leaves (mint, sage, rosemary), bark (cinnamon), rhizomes (ginger), wood (cedar, sandal wood) etc. the amount of essential oils varies from an infinitely small quantity to as much as 1-2 % (upto 18 % in cloves). There are five methods of extracting essential oils from plants: distillation, enfleurage, maceration, solvent extraction, mechanical expression and adsorption depending upon the nature of plant material, the amount of oil present and the relative stability of various compounds.

Key word: Essential oils, Perfumery, Value addition, Distillation.

DIVERSITY OF INSECT FAUNA IN HORTICULTURAL CROPS OF ASSAM AGRICULTURAL UNIVERSITY, CAMPUS, JORHAT, ASSAM

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A study was conducted to know the status of abundance of various insect species under different orders in banana, citrus, brinjal, tomato, cabbage and okra crops present in experimental garden, Department of Horticulture, Assam Agricultural University, Jorhat, Assam. Insects were collected by sweeping nets and hand picking from January 2016 to November 2016. Altogether 85 species of insects belonging to 8 orders and 34 families have been recorded. Per cent relative species abundance for different orders were 31.76% (Lepidoptera), 38.82% (Coleoptera), 10.58% (Hymenoptera), 14.11 % (Hemiptera), 7.05% (Orthoptera), 5.8% (Odonata), 3.5% (Diptera), 1.1% (Neuroptera). Among the orders, Coleoptera was the dominant one followed by Lepidoptera, Hemiptera and the lowest abundant one was Neuroptera. Among the families, Coccinellidae was the dominant one with six species and lowest one was Chrysopidae with one species i.e. *Chrysoperla carnea*. Among the crops highest number of insect species were found in Brinjal (12 species) followed by cabbage and okra (11 species) and lowest was found in Banana (3 species). In this experiment, diversity indices i.e. species richness, species evenness and species diversity were also calculated. The seasonal abundance of different species was also studied. In case of banana and citrus, insect abundance was highest in the month of July-August. In case of cabbage, tomato and brinjal abundance was highest in March and in okra it was May-June. Key words: Relative species abundance, seasonal abundance, diversity indices

SOIL CONDITIONER - A CONTRIVANCE FOR IMPROVING SOIL QUALITY

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A soil conditioner is a product which is added to soil to improve the soil's physical qualities, usually its fertility (ability to provide nutrition for plants) and sometimes its mechanics. In general usage, the term "soil conditioner" is often thought of as a subset of the category soil amendments, which more often is understood to include a wide range of fertilizers and non-organic materials. Soil conditioners can be used to improve poor soils, or to rebuild soils which have been damaged by improper soil management. They can make poor soils more usable, and can be used to maintain soils in peak condition. Soil quality is the capacity of a specific kind of soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality, and sustain plant, animal and human health. Soil conditioner improves the physical, chemical and biological quality of soil. It includes Minerals (e.g. gypsum, lime, etc.), Modified rocks and minerals (e.g. sand, clay, rockwool, pumice, etc.), Industrial by-products (e.g. steel mill slag, press mud), Organics (e.g. compost, sea weeds, humates, etc.), Microbes (e.g. Blue green algae- *Anabaena*, *Spirulina*, etc.) and Synthetic Polymers (e.g. polyacrylamide, poly vinyl alcohol, Hydrogels, etc). Soil conditioners optimize one or more soil physical properties, such as bulk density, porosity, aggregate stability, dispersivity parameter, erodibility, rain splash detachment, soil crusting, hydraulic conductivity, water retention characteristics, plant-available water capacity, air capacity, infiltration rate and cumulative evaporation. Many of the soil conditioners increase total microbial counts of sandy and calcareous soils. Application of Cyanobacteria as soil conditioner in salt affected soil resulted in significant improvement in the aggregation status of soil by producing exo-polysaccharides and brought down appreciably the pH, electric conductivity and exchangeable sodium, furthermore they increased considerably the hydraulic conductivity of soil. In this era of intensive agriculture where our soil and environment are under threat of degradation, soil conditioners are helpful to improve its quality.

Key words- Soil conditioner, Soil Quality, Soil properties

RESPONSE OF RICE TO EFFICIENT NITROGEN MANAGEMENT UNDER IRRIGATED CONDITIONS**ROHIT KUMAR¹, ADESH SINGH¹, R.B. YADAV¹ AND ATIN KUMAR²**¹Department of Agronomy, ²Department of Soil Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh-(250 110), India

A field experiment was conducted during *kharif* season of 2015 at Crop Research Centre (Chirauri), Meerut (U.P.) on the effect of efficient nitrogen management in rice. The soil of the experimental field was well drained, sandy loam in texture and slightly alkaline in reaction. It was medium in organic carbon, available phosphorus and available potassium but low in available nitrogen with an electrical conductivity (1:2, soil: water) of 1.65 dS/m. Ten treatments comprised of splitting of nitrogen as basal, at tillering, panicle initiation and milking stage in different proportions including foliar spray, use of LCC (<4) and control were tested in a randomized block design with 3 replications. The results indicated that the growth and development parameters (plant height, tiller/m², leaf area and index, dry matter accumulation, CGR, RGR, and NAR), yields (grain, straw and biological) per ha and uptake of nitrogen in rice were significantly superior with the application of 1/4 as basal + 1/4 at tillering + 1/4 at panicle initiation and 1/4 at milking stage (T₃) as compared to rest of the treatments, except T₂ (1/2 N as basal, 1/4 at tillering, 1/4 at panicle initiation and 1/4 at milking stage) and T₁₀ (1/4 N as basal, rest through leaf colour chart). However, T₃ treatment gave 60 and 32 kg/ha higher grain and straw yields as compared to T₂ (existing recommendation of N), respectively. However, the highest crop growth rate and photosynthetic rate was between 30 to 60 days in T₃ treatment. The rice also accumulated significantly higher nitrogen in grains, straw as well as total (75.98, 49.15 kg/ha and 125 kg/ha, respectively) in T₃ as compared to all the treatments, except T₂ and T₁₀. Besides, partial factor productivity, agronomic and recovery efficiency in T₃ was improved by 1.43, 2.41 and 3.69 per cent, respectively as compared to T₂ (existing recommended N schedule). The split application of nitrogen as 1/4 basal, 1/4 at tillering, 1/4 at panicle initiation and 1/4 at milking stage (T₃) brought Rs 97569, 64189/ha and 1.78 as gross, net returns and B:C ratio, respectively, being highest among all the treatments followed by application of nitrogen in three equal splits (T₂).

Keyword: Response, accumulation, photosynthetic, development, nitrogen and rice**EFFECT OF SMART TECHNOLOGY ON HONEYBEE COMMUNICATION****ROHIT KUMAR NAYAK¹, PARAM VEER SINGH² AND SHITAL YADAV³**^{1,2}Department of Entomology, ¹SKN Agriculture University, Jobner, Jaipur (Raj)-303329, ²Dr. Y S Parmar University of Horticulture & Forestry, Nauni, Solan (H.P.) 173230, ³Department of Soil Science, ³SKAU, Bikaner (Raj) - 334006

Honeybees are social insects; this is due to they live in the colonies and each caste have a special work in the colony. Good communication is necessary for a successful survival of colonies. During last few years, honey bees are disappearing in the world. Many reasons are responsible for this environment disaster like climate changes, pesticides and bacterial- fungal pathogen. But in recent years, smart technology becomes an emerging factor that affects the communication of honey bees. Bees use cryptochrome for navigation. They follow it to sense the direction of the earth's magnetic field and sources of food. Microwaves and radiations generated through various wireless smart technologies affects the specific sense organs, enabling them to navigate using their own compass. So bees do not find their way back to the hive. These technologies also disturbing the life cycle, reproduction system and honey production.

Keywords: Smart technology, honeybee communication, cryptochrome, radiations, sense organs**SOIL AND WATER CONSERVATION FOR SUSTAINABLE AGRICULTURE****ROHIT KUMAR SINGH¹, VED PRAKASH², AMIT KUMAR SHUKLA³, THOTA DIVYASREE⁴, ANANDITA SUPRIYA⁵**¹Department of Agronomy, University of Lucknow, Lucknow, U. P. (India), ²Department of Agronomy, BAU, Sabour-813210, Bhagalpur, Bihar (India), ³Department of Crop Physiology, NDUAT, Kumarganj, Faizabad-224 229, U. P. (India) ⁴AIMT, Dehradun, Uttarakhand, (India), ⁵ITM University, Gwalior, M.P. (India)

Soil and water are the most valuable natural resources and an important to human being. The natural resources of the State involve land, water, soil and biodiversity, which dictate the opportunities for livelihoods and income for the peoples. Both are facing threats of decay due to unrelenting human pressure and utilization incompatible with its capacity. Soil profile play role as storage for all water. Degradation and unscientific cultivation practices result in decrease of top fertile soil. This cause to depletion of nutrients in fertile soil, resulting in low yield, unviable agriculture, sedimentation in reservoirs leading to reduction in storage capacity, decrease cultivable area and finally influences the cycle of power generation, ecological imbalance, environmental pollution, drought and floods. Conservation tillage technique include less soil disturbance, permanent soil cover through crop residues or cover crops, and crop rotations for achieving higher productivity. Water loss occur through mainly Evaporation and Transpiration. Other factors like Solar radiation, wind speed, available soil moisture, depth of root, types of soil and season also reduce the moisture availability in soil. For conserving the soil and water to use the organic manures, green manure crops and also reduce tillage operations. For conserving soil use contour farming,

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direction of tillage, use minimum tillage or zero tillage also use windbreaks and shelterbelts. Practices to conserve both soil and water is covering the soil with cover crops, planting pattern, use conservation tillage practices, grow deep rooted crops and crop residues cover etc.

Key worlds: Biodiversity, Conservation, Environment, Natural resources, Tillage

IMPORTANCE OF PRUNNING IN HORTICULTURE CROPS

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Pruning is the practice of removing specific portions of a tree or shrub (such as root, buds, branches, stem) that are dead due to pests, disease and lack of sunlight and aesthetic purpose. In pruning the removal or reduction of parts of a plant, tree, is common practice in orchard and vineyard management for the improvement of flowering and fruiting. It is started in later part of plant life, when it becomes capable to produce flower and fruits on tree and shrubs will often grow to size that exceed the space which is limited. Regularity of this method is necessary on a formal plant and hedge to maintain a plant for health reason. Pruning includes many methods viz. - Heading back, Thinning, Ringing or Girdling, Notching, Nicking.

MATURITY INDICES, HARVESTING AND POST HARVEST HANDLING OF FRUITS AND VEGETABLES

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Maturity is the stage of fully development of tissue of fruit and vegetables only after which it will ripen normally. During the process of maturation the fruit receives a regular supply of food material from the plant. When mature, the abscission or corky layer which forms at the stem end stops this inflow. Afterwards, the fruit depend on its own reserves, carbohydrates are dehydrated and sugars accumulate until the sugar acid ratio form. In addition to this, typical flavour and characteristic colour also develop. It has been determined that the stage of maturity at the time of picking influence the storage life and quality of fruit, when picked immature like mango develop white patches or air pockets during ripening and lacking in normal brix acid ratio or sugar acid ratio, taste and flavour on the other hand if the fruits are harvested over mature or full ripe they are easy susceptible to microbial and physiological spoilage and their storage life is considerably reduce. Such fruits persist numerous problems during handling, storage and transportation. Therefore, it is necessary or essential to pick up the fruits or vegetables at correct stage of maturity to facilitate proper ripening, distant transportation and maximum storage life.

Keywords - development of tissue, characteristic, maturation etc.

EFFECT OF WHEAT INTERCROPPING WITH CHICKPEA AND MUSTARD ON YIELD ATTRIBUTES

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Wheat is one of the most important cereals around the world and most suitable for intercropping. Intercropping is an advanced agronomic technique that allows two or more crops to yield from the same area of land. On the basis of above statement, the effect of different intercropping of wheat with chick pea and mustard in different row proportion provide the qualitative biological yield. An experiment is started in the experimental field of Lovely Professional University based on completely randomized design with three replications. The three treatments are arranged in different row proportion i.e. (1:1,3:2,4:1). In this experiment we focused on different physiological, biological attributes, effect of different row proportion on yield and weed Index. The combination system of wheat with chickpea and mustard decrease the disease infestation and attributed higher production. On the behalf of research trial we conclude that intercropping may significantly enhance the crop productivity. Further research needs to consecutively understand about the intercropping interaction with soil and plant.

Keywords: Chickpea, intercropping, mustard, wheat, yield

NANO-FERTILIZERS FOR HIGHER NUTRIENT USE EFFICIENCY AND ENVIRONMENTAL SUSTAINABILITY

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Nanotechnology, emerging as an escalating technology, seeks nano-scale or nano-structured materials which act as vectors or carriers for the controlled release of fertilizers and hence gives way to "smart fertilizers" which not only amplifies the nutrient use efficiency but also curtails the cost of environmental pollution. Nano-fertilizer, a product in nanometer regime and having particle size of less than 100 nm, is aimed to deliver nutrients to crops. They emerge as a precise nutrient management tool by providing nutrients all through the crop growth period in synchronization with the nutrient requirement during a particular crop growth stage. Chemical fertilizers do not present a suitable option for increasing the crop productivity for feeding the ever growing population due to its pernicious consequences on the soil health and biodiversity. Accordingly, nano fertilizers come to our rescue by supplying nutrients in a controlled manner in accordance with the crop demand. It is estimated that about 40-70% of nitrogen, 80 -90% of phosphorus, and 50-70% of potassium of the applied fertilizer is lost to the environment. Nano-fertilizers reduce the rate of dissolution of the fertilizer by slow, sustained release of coated fertilizer, resulting in efficient absorption of these fertilizers by the plant roots. Iron nanoparticles increases the number of pods/ plant (47%), weight of 1000 seeds (7%), chlorophyll (10%). Silver nanoparticles enhance seed germination (76.11%), root length (76.94mm) at 10ug/ml. Zinc oxide nanoparticles increase zinc dissolution and its bioavailability in soils with calcium carbonate. In the field of research considering higher nutrient use efficiency and environmental sustainability nano-fertilizer is emerging as an important core subject, thereby large scale production of physiologically important metals should be thrust. Nanoparticles come with high surface area, sorption capacity, and controlled release kinetics which makes them "smart delivery system", releasing their active ingredients only in response to environmental triggers and biological demands. Thus, nano-fertilizer has become a paramount alternative for evolution of environment friendly and sustainable agriculture.

Keywords: environmental sustainability, nano-fertilizers, nanoparticles, nutrient use efficiency, smart fertilizers, sustained release.

SCREENING OF COTTON GENOTYPES AGAINST WHITEFLY (*BEMISIA TABACI*)

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Cotton crop has a global significance as it is commercially cultivated on large scale for fibre purpose and also known as "White gold". Cotton is infested by a number of sucking insects including the whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae), which is one of the most notorious pests in tropical and subtropical agriculture. Both nymphs and adults cause direct damage by piercing and sucking of sap from the foliage of plants. *B. tabaci* is considered the most common and important vector of cotton leaf curl virus that spread the cotton leaf curl disease. To control this pest a large no of insecticidal spray are used. But continuous and indiscriminate application of these insecticides had resulted in development of resistance in whitefly to these insecticides. So the best option is to development of genotypes which can resist the attack of this pest. Current experiment was conducted at cotton section, Department of Genetics and Plant Breeding, CCSHAU, Hisar during 2017. Ten cotton genotypes (CSH3088, CSH3129, CSH3158, PUSA5760, SUFLUM, PBH47, CNH108, ARBH1601, HS294, F 2501) were screened against whitefly. Pusa 5760 genotype showed minimum population of whitefly (8 adults/leaf) amongst all genotypes. It was followed by PBH 47 (9.25 adults/leaf), SUFLUM (10.21 adults/leaf) and CSH 3158 (11 adults/leaf). Maximum population of whitefly was recorded on HS294 (18.25 adults/leaf) followed by CNH-108 (17.75 adults/leaf) and CNH 3129 (17.25 adults/leaf).

POPULATION DYNAMICS OF SPOTTED BOLLWORMS ON COTTON GENOTYPES AND THEIR CORRELATION WITH ENVIRONMENTAL FACTORS

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Cotton is a major fibre crop, called white gold. Spotted bollworm is an important pest of cotton causing damage to fruiting bodies and shedding of squares, flowers and bolls. This pest not only reduces the yield but also adversely affect the quality of lint and seed. Their damage differs in *Bt* and non-*Bt* cotton genotypes. Therefore the current study was done to evaluate reaction of seven cotton genotypes comprising of five *Bt* hybrids, one conventional hybrid and one variety for resistance against spotted bollworm at Cotton Section, Department of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar under unsprayed condition. Sowing was done on May, 2014 using standard package of practices with randomized block design (RBD). To record the larval population of spotted bollworm, five plants from each treatment per replication were physically searched. For this all the available green bolls were taken in to account as these bollworms are basically found to feed on these plant parts. Pest population was recorded at weekly intervals. It was started from 30th SMW and continued till harvesting of crop. It was found that incidence of bollworm started from 33rd standard meteorological week and continued till 41st SMW. Bollworm larval population reached to its peak during 40th SMW with larval population (1.36 larvae/plant). Larval population showed significant and negative correlation with minimum temperature and sunshine hours.

INTEGRATED FARMING SYSTEM AN ECOFRIENDLY APPROACH FOR SUSTAINABLE AGRICULTURE ENVIRONMENT

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Sustainable development in agriculture must include integrated farming system (IFS) with efficient soil, water crop and pest management practices, which are environmentally friendly and cost effective. In IFS, the waste of one enterprise becomes the input of another for making better use of resources. In integrated crop livestock farming system, crop residues can be used for animal feed, While manure from livestock can enhance agricultural productivity. IFS also play an important role in improving the soil health by increasing the nitrogen, phosphorous, organic carbon and microbial count of soil and thus, reduces the use of chemical fertilizers. Moreover, IFS component are known to control the weed and regarded as an important element of IPM and thus minimize the use of weed killers as well as pesticide and thus protects the environment. The water use efficiency and water quality of IFS was better than conventional systems.

STUDIES OF INTEGRATED NUTRIENT MANAGEMENT ON SUGAR BEET (*BETA VULGARIS* L.) CV. DETROIT DARK RED.

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The Sugar beet (*Beta vulgaris*) belongs to the family *Chenopodeaceae* which is a herbaceous biennial and winter vegetable crop. It is native to central and southern Europe and has now spread all over the world. It is a newly introduced modified root crop in our country. Sugar beet has considerable nutritive value compared to other Cole crops that we commonly use in our daily diet. The fleshy root and young leaves are the main edible portion. Keeping these importance's the present study was under taken at the Department of Horticulture Raja Balwant Singh College, Bichpuri, Agra during 2016 - 2017. The experimental variety D.D.R. was sowing at the distance of 40 X 10 cm. The trails have 8 treatment combinations viz. T1(80%RDF+FYM), T2(80%RDF+FYM+ Vermicompost), T3(,60%RDF+FYM),T4(60%RDF+FYM+Vermicompost),T5(50%RDF FYM),T6(50%RDF+FYM+Vermicompost),T7(Full dose of RDF)and T8(Control No organic, NO fertilizer). The experiment was conducted under Randomized Block Design which was replicated three times. On the basis of data recorded during experimentation it was found that significant effect among treatment and maximum inhance in plant height (18.03 cm), total no. of leaf per plant (10.66), the number of fully opened leaves per plant (09), length of the largest leaves (21.4cm), width of the largest leaf (9.86cm) and fresh weight of leaf per plant (9.66) at harvest. Besides, the fresh weight of root(343gm), length of the whole root (7.33cm), diameter of storage root the shoulder point(7.42cm) and total root yield 355.9 Q/ha. Were recorded under T2 80%RDF+FYM+Vermicompost) followed by T4 (60%RDF+FYM+Vermicompost).

PESTICIDES: ITS DETRIMENTAL EFFECT ON EARTHWORMS AND SUSTAINABLE AGRICULTURE

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The natural resources are finite and highly prone to degradation by the misuse of land and mismanagement of soil. The world is in great need of a healthy ecosystem that provides with fertile soil, clean water, food and other natural resources. Anthropogenic activities like intensification of industrial and agricultural practices, chiefly the use of pesticides have lead to increased contamination of land. Earthworms are considered as important bio-indicators of chemical toxicity. Also they help in a number of tasks that support many services that favour agro-system sustainability but are degraded by exhaustive practices like use of pesticides. They are impacted by pesticides at all organizational levels, for example ;pesticides disrupt their enzymatic activities, increase individual mortality, decrease functionality and growth, change individual behaviour such as feeding habit and decrease the overall community biomass density. Some pesticides have drastic effect on the nervous system of the Earthworm. Earthworms can accumulate heavy metals from soil in higher levels than any other animals. Therefore, we strictly need to rethink on the policies and norms devised by us on sustainable ecology. The natural resources should be utilized in an equivalent way and further essential ways for betterment of present and future livelihood should be sought.

Keywords: Natural resource, Mismanagement, Pesticides, Earthworms, Organizational levels, Heavy metals.

EFFECT OF GA₃ PRIMED SEEDS ON YIELD AND QUALITY OF SOYBEAN (*GLYCINE MAX* L.) UNDER VARYING SEED RATE AND SOWING METHODS**¹RUPINDER KAUR JASSAL* AND ¹HARMEET SINGH**¹Dept. of Agronomy, Punjab Agricultural University, Ludhiana (141004), Punjab, India

The influence of seed priming on yield and quality of 'SL 958' soybean was studied during 2015 and 2016. Experiment comprise of two sowing methods namely bed planting (67.5 cm wide, 2 rows per bed) and flat sowing (45 cm spacing) and three seeding rates i.e. 50, 62.5 and 75 kg ha⁻¹ in soybean [*Glycine max* (L.) Merrill]. The results showed that bed planted method recorded 15.6 % increase in seed yield than flat planting method. This enhancement in yield is due to significantly more number of pods per plant (25.8 and 26.1) and comparative more seeds per pod and 100 seed weight. With respect to seed priming treatments, primed seeds recorded significantly maximum seed yield i.e. 2278 kg ha⁻¹ as compared to non-primed seeds i.e. 1849 kg ha⁻¹ which was 23.2 % more as compared to non primed seeds. Significantly maximum seed yield was recorded when 62.5 kg ha⁻¹ (2177 kg ha⁻¹) seed rate was used as compared to 50 (1934 kg ha⁻¹) and 75 kg ha⁻¹ (2081 kg ha⁻¹). Seed rate of 62.5 kg ha⁻¹ recorded increase of 4.61 % in seed yield than 75 kg ha⁻¹ and 12.6 % with 50 kg ha⁻¹ seed rate. Similarly, the quality parameters of soybean like protein content, starch content and oil percentage recorded better results with primed seeds at the seed rate of 62.5 kg ha⁻¹ under bed planting method.

Keywords: soybean, seed priming, planting methods, seed rate, yield**ADVANCE TOOLS AND TECHNIQUES FOR EFFICIENT RESOURCE MANAGEMENT IN DRYLAND AGRICULTURE
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India has 78 million hectare (mha) of drylands that account for 64% of the total net sown area (NRAA, 2018). Nearly 40% of the human population and 60% livestock depend on rainfed agriculture. Rainfed agriculture in India contribute ~42% of the total food grain production, 75% oilseeds, 90% pulses and ~70% of cotton. In the past, greater attention had been given towards the development of irrigated areas and rainfed areas were either ignored or given inadequate importance due to intrinsic risks involved investment on the development of rainfed/ drylands. With the productivity of irrigated crops reaching a plateau due to declining factor productivity, rainfed agriculture still offers scope for enhancing productivity. By the end of the 21st century, the contribution of drylands will have to be 60% if India is to provide adequate food to its over 1 billion people. Hence, tremendous efforts both in the development and research fronts are essential to achieve this target. In order to achieve these goals and to overcome the problems (less moisture, soil erosion and low soil fertility, etc.) in dryland agriculture, there is need for efficient resource management with advance tools and techniques. Agriculture practicers must harness the advances in modern science tools and techniques like remote sensing, geographical information system, global positioning system, conservation agriculture, plastic mulching, solar powered micro-irrigation, laser land levelling, aqua-sowing, hydrogels/ polymers and site-specific nutrient management to improve productivity and profitability, and resource-use efficiency of the dry land areas. Conservation agriculture, one of the most emphasized production systems, is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment. Among the nutrient management options, Nutrient Expert® based site specific nutrient management (SSNM) had a much larger effects on crop productivity, water-use and incident radiation conversion efficiency compared to other practices. Aqua-sowing-cum-fertilization increase the supply of nutrients and water to the growing seedlings, thus helps in better establishment and gives early boost to the plants and ultimately increase the productivity. Therefore, adoption of available tools and technologies is necessary for increasing the productivity of dryland regions for ensuring food and nutritional security of ever multiplying population vis-à-vis sustainability of natural resources.

**GENETIC DIVERSITY STUDIES IN WHEAT (*TRITICUM AESTIVUM* L.) FOR GRAIN YIELD AND RELATED TRAITS.
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Wheat is the second major food crop of the world in importance next to rice. The field experiment under present investigation was conducted during rabi 2017-18 at Agricultural Research Farm of B.R.D.P.G. College, Deoria (U.P). The experiment was conducted to evaluate 81 wheat germplasm line in normal soil under timely sown and irrigated condition with Augmented Block Design. 81 wheat genotypes were investigated to understand the extent of genetic diversity through 14 quantitative traits Mahalanobis's D² analysis established the presence of wide genetic diversity among these genotypes by the formation of 10 different non-overlapping clusters. Cluster 10 had the maximum number of genotypes i.e. 17 and cluster 4 had only one genotype. Maximum intra cluster distance was observed in cluster 4 indicated that genotypes are having diverse genetic architecture. The cluster value between cluster IV (2850.68), cluster VII (2617.85) cluster III (2417.44) and cluster II (2336.23) were also very high. The minimum inter cluster D² value (393.406) was recorded. In case of cluster IV (2850.60) higher inter cluster distance indicated greater genetic diverse between the genotypes of

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those cluster while lower inter cluster values between the clusters suggested that the genotypes of the clusters were not much genetically diverse from each other. On the bases of inter cluster distances and *per se* performance observed in the present study a hybridization programme involving genotypes for specific characters can be selected using cluster mean values.

RELATIONSHIP BETWEEN CONCENTRATION AND EXPOSURE PERIOD IN THE TOXICITY OF PHOSPHINE TO *TROGODERMA GRANARIUM* EVERTS

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The experiments were conducted to determine the effects of phosphine concentration and exposure period on susceptible and resistant strains of *Trogoderma granarium* by the equation $C^*t = k$. *T. granarium* is one of the major insect pests of stored products causing considerable loss in India. Fourth instar larvae were exposed to a range of concentrations for fixed exposure periods of 6, 12, 24, 48, 72 and 96 h for the susceptible strain and 12, 24, 48, 72, 96, 120 and 144 h for resistant strains, and to a range of exposure periods for fixed concentrations range from 0.01 to 4.5 mg/l for susceptible strain and 0.10 to 9.0 mg/l for resistant strain at 35°C. C^*t relationships of the form $C^*t = k$ showed that the toxicity index, n was less than one in all cases indicating that time was more important variable in the toxicity of phosphine in these ranges of exposure periods and concentrations for both susceptible and resistant strains.

Key words: probit analysis, aluminium phosphide, fumigation, resistance, mortality

EVALUATION OF ENRICHED VERMICOMPOST ON GROWTH AND YIELD OF CHICKPEA (*CICERARIETINUM* L.)

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Managing soil health is an important aspect of sustainable crop production. The physical, chemical and biological processes govern the productivity. Soil organic matters integrate these three important processes. Apart from the integration of organic matter provides nutrition for the organisms exist with the soil. On the other hand, production of nitrogenous fertilizers emit out certain harmful GHGs. The total GHGs emission from production and application of fertilizers ranging from 1.5 to 16.7 kg. Co₂ eq per kg. fertilizer N. Therefore escalating the fertilizer use efficiency and curtailing the input dependency, are the primary way to reduce the cost of input and optimize the productivity. In this regard, recycling of degradable bio-waste through the action of flora and fauna is the key technology for production and use of quality vermicompost. A field experiment was carried out with thirteen treatments consisted of vermicompost prepared from soyabean straw and paddy stover as well as these were inoculated with Trichoderma + PSB, Trichoderma + cow dung, Trichoderma + PSB + cow dung, RP+PSB, RP+PSB+Trichoderma compared with un-inoculated vermicompost and RDF (20:60:20 kg NPK/ha) for plant population, pods/plants, seeds/pod, grain yield/plant as well as grain and straw yield/ha. These treatments were arranged in a randomized block design with three replications. The results of study revealed that addition of vermicompost prepared from inoculation of Trichoderma either of the substrata proved beneficial in order to maintain the plant population through out the crop period. The reduction in plant population (68%) was observed where the RDF of NPK alone was applied. The maximum plant height (43.50 cm.) and branches (11.2 per plant) were recorded under the use of vermicompost of soybean straw inoculated with Trichoderma + PSB + cow dung. Similarly, yield attributes pods per plant, seeds per pod and grain yield per plant was higher in same treatment. The maximum grain and straw yields of chickpea (15.08 and 18.52 q/ha) respectively was recorded under top ranking treatment. Vermicompost prepared from soybean substrata and simultaneously enriched with cow dung and inoculated with Trichoderma and PSB reduced the mortality rate of plants 48.9 per cent and enhanced the grain yield.

EFFICACY OF DIFFERENT MANAGEMENT TACTICS AGAINST EARLY BLIGHT OF TOMATO IN MID-HILLY AREAS OF UTTARAKHAND

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Tomato is one of the most popular warm season vegetable crop grown throughout the world because of its wider adaptability and suitability for variety of cuisines in fresh as well as in preserved form. Early blight is one of the most important foliar diseases of tomato; it is caused by *Alternaria solani* Sorauer. It may cause yield losses of up to 78% in India. The present experiment was conducted in Vegetable Research and Demonstration Block, College of Horticulture, VCSG, UHF Bharsar (Pauri Garhwal) Uttarakhand, during kharif season 2016. In this investigation, field experiments were conducted to evaluate the efficacy of two chemicals Carbendazim and Captan, two bioagents Trichoderma harzianum and Pseudomonas fluorescens, two botanicals Neem oil, Mustard oil and animal product Cow dung and Cow urine against *A. solani* Sorauer with different concentration (100, 200, 300, 400, 600, 800 ppm). Carbendazim proved best treatment in field condition for highest no. of fruits (19.56), maximum fruit weight (57.10 g) and minimum percent of fruit infection (23.83%) at 800 ppm as compare to other treatments like captan, Trichoderma harzianum, Pseudomonas

fluorescens and animal product. Similarly minimum disease intensity was recorded in carbendazim (46.40, 51.10 & 56.97%) at 75, 90 and 105 (DAT) respectively at 800 ppm concentration, followed by captan (49.20, 54.67 & 58.92%) and *T. harzianum*. (55.34, 63.88 & 69.56%) at 75, 90 and 105 (DAT) respectively

POTASSIUM DYNAMICS IN RESIDUE AMENDED RICE-WHEAT SOILS UNDER LONG-TERM POOR QUALITY WATER IRRIGATION

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The present research was conducted to study the influence of long-term poor quality water and crop residue incorporation on physico-chemical properties and potassium dynamics of the soil through a field investigation and an incubation study. The long-term experiment had 16 treatments involving four irrigation water qualities: canal water irrigation (SW1), sodic water (SW2), sodic water plus gypsum (SW3) and saline water (SW4). The crop residue treatments were wheat straw @ 6 t ha⁻¹ to rice crop (T1), rice straw @ 6 t ha⁻¹ to wheat crop (T2), both rice and wheat straw @ 6 t ha⁻¹ each (T3) and the unamended control (T4). Irrigation with SW2 and saline SW4 significantly increased soil pH, EC, soluble salts, sodium adsorption ratio (SAR), exchangeable sodium percentage (ESP) and CaCO₃, and decreased organic carbon while application of gypsum with sodic water decreased pH, SAR and ESP in soil after wheat and rice harvest in 2016-17. Bulk density increased with SW2 irrigation and soil depth and decreased with the addition of crop residues. Saline and sodic water irrigation lowered all the K fractions viz. water soluble K (WSK), exchangeable K (ExK), non-exchangeable K (NEK) in the soils, whereas application of crop residues increased these K fractions. The water soluble K and ExK decreased with depth while NEK and total K increased with soil depth. Incorporation of both rice and wheat residues (T3) significantly increased all the K fractions over the unamended control (T4). Simple Elovich model best represented the cumulative release of K as evidenced by higher R² values (≈0.98) and higher value of kinetics parameters than other models. Potassium concentration and uptake by wheat and rice grain was lowered when irrigated with saline and sodic waters while the Na content in grain and straw of both crops increased. Crop residue amendments improved rice and wheat yield as well as K uptake in saline and sodic water irrigated soils; the effects were pronounced in soils amended with both crop residues. The study showed that the adverse effects of saline and sodic irrigation on K fertility can be effectively managed by incorporation of crop residues.

Key words: Crop residues, potassium dynamics, rice-wheat, saline water, sodic water, soil properties.

PERFORMANCE OF PROMISING GENOTYPES OF GAILLARDIA (GAILLARDIA PULCHELLA L.) IN RESPECT OF GROWTH AND FLOWERING ATTRIBUTES

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The present investigation was carried out during the year 2016-2017 at Modibaug garden of Horticulture Section, College of Agriculture, Pune. The experiment was laid out in Randomized Block Design with three replications. The genotype MG-2-2 recorded significantly highest plant height (83.40 cm), (103.60 cm) and (110.00 cm) at 90, 120 and 150 days after transplanting respectively. The genotype MG-9-1 recorded significantly maximum plant spread at (E-W) direction (68.17 cm) and at (N-S) direction (59.40 cm) at 90 DAT. Significantly maximum numbers of primary branches per plant was recorded in the genotype MG-10-4 (19.15) and the maximum number of secondary branches per plant was recorded in the genotype MG-9-1 (54.51). The genotype MG-10-2 showed significantly early initiation of flowering (51.33 days) after transplanting. The genotype MG-6-2 showed early 50 percent flowering (62.24 days) after transplanting. The genotype MG-9-1 recorded significantly maximum flower diameter (6.02 cm) followed by the genotype MG-7-2 and MG-5-5 (6.00 cm) and both genotypes are on par with MG-9-1. Significantly more number of ray florets per flower were noticed in the genotypes MG-9-1 (156.53), MG-2-2 (155.80) and MG-6-2 (154.50). The genotype MG-2-2 recorded significantly maximum flower stalk length (17.92 cm). The flower stalk thickness of different genotypes of gaillardia ranged from 2.8 to 3.0 mm but the treatment differences were non-significant for this character.

Key words: Gaillardia genotypes, growth and flowering attributes.

PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) IN AGRICULTURAL SUSTAINABILITY

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The need of today's world is high production of the crop as well as fertility of soil to get in an ecofriendly manner. Both biotic and abiotic factors are affecting plant health very much and causing greater losses in yields. Now a days, the utilization of chemical fertilizers in the

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agriculture is elevated to increase yield and to kill pathogens, pests, and weeds and simultaneously which shows harmful impact on the ecosystem. Because of current public concerns about the side effects of agrochemicals, there is an increasing interest in improving the perception of cooperative activities among plants and rhizosphere microbial populations. So, there is an urgent need of biological agents to accept worldwide. The use of plant growth promoting rhizobacteria (PGPR) is a better alternative to solve this problem. They play an vital role either direct or indirectly to increase in soil fertility, plant growth promotion, and suppression of phytopathogens for development of ecofriendly sustainable agriculture. The addition of ice-nucleating plant growth promoting rhizobacteria ought to be a fantastic science for improving plant growth at low temperature. So, there is a need to start new generation with environment friendly approach to increase crop production and for better health.

Key words: plant growth promoting rhizobacteria, ecofriendly, rhizosphere, sustainable agriculture

PLANT HEIGHT AND DRY MATTER OF FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM*) AS INFLUENCED BY PHOSPHORUS, ZINC AND ZINC SOLUBILIZER

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Fenugreek (*Trigonella foenum-græcum* L.) popularly known by its vernacular name “methi” has been in culinary and medicinal uses due to its restorative and nutraceutical properties for more than 2500 years. Phosphorus deficiency is usually the most important single factor which is responsible for poor yield of legume crops on all types of soil. Zinc is one of the imperative micronutrients required relatively in small concentrations (5-100 mg/kg) in tissues for healthy growth and reproduction of plants. Microbes are potential alternate that could cater plant zinc requirement by solubilising the complex zinc in soil. An experiment was conducted at *Rajasthan Agriculture Research Institute (RARI), Durgapura-Jaipur*, during *rabi* and *kharif* seasons of 2015-16 and 2016-17. The treatments comprises of four levels of phosphorus (0, 20, 40 and 60 kg P₂O₅/ha) and six treatments of zinc and zinc solubilizer [0, 2.5 and 5.0 kg Zn/ha, zinc solubilizer (*Bacillus endophyticus*), 2.5 kg Zn/ha + zinc solubilizer & 5 kg Zn/ha + zinc solubilizer] in split plot design with three replications. A uniform dose of 20 kg N/ha along with phosphorous and zinc as per treatments were drilled through diammonium phosphate and zinc sulphate (21%), respectively. To compensate the sulphur obtained from different levels of Zinc compensatory dose of sulphur will be applied through elemental sulphur before 21 days of sowing. The fenugreek variety Rmt-305 was sown on 03 November 2015 and 15 November 2016, with 30 cm row to row and 10 cm plant to plant spacing. Results revealed that application of 40 kg P₂O₅/ha and 5 kg Zn/ha + zinc solubilizer resulted in significant increase in plant height and dry matter. Application of 60 kg P₂O₅/ha and 5 kg Zn/ha + zinc solubilizer increased 19.4 % and 21.5 % higher plant height of fenugreek, during 2015-16 and 40.1 % and 31.3 %, during 2016-17 when compared with control.

Key words: Dry matter, Fenugreek, Plant height, Phosphorus, Zinc and Zinc solubilizer

APPLICATION OF BIOCHAR AS A SOIL AMMENDMENT FOR SUSTAINABLE AGRICULTURE AND ENVIRONMENT

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Biochar is produced by the pyrolysis of biomass, contributes to carbon sequestration and also provides usable biofuels in addition to its creation. The majority of the biomass used in biochar manufacturing is obtained from the waste produced from farm fields like the leaves and stalks of corn, sorghum, soybean etc. as well as diseased and fallen trees removed by forestry. If these feedstocks were left to decompose naturally a higher percentage of carbon content would be converted to carbon dioxide and released into the atmosphere, carbon dioxide being a greenhouse gas leads to global warming. On the other hand the conversion of biochar locks the carbon in a stable form that will not react with oxygen to produce carbon dioxide. This carbon based porous material helps to improve soil health due to the high organic content, causes retention of the nitrogen and phosphorus fertilizer components by preventing their leaching into the ground water and also provides environments for beneficial microbes to grow thus causing higher crop yields along with increased cation exchange capacity.

VERMICOMPOST AN EXCELLENT OPTION FOR SUSTAINABLE NUTRIENT MANAGEMENT

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Indiscriminate use of chemical fertilizers and pesticides for the last few decades made the soil unproductive with loss of biodiversity and the environment polluted. So, rejection or reduced use of chemicals and practice of organic farming for recovery of soil health, increase in food grain production and biodiversity conservation have been suggested. Organic manures play an importance role in crop

production and sustainable agriculture development. Vermicompost has been emerging as an important source in Supplementing/substituting chemical fertilizers in agriculture. Besides higher concentration of available nutrients (macro, secondary and micro) than the ordinary FYM. Millions of tones of agricultural and industrial wastes are discarded every year at considerable financial and environmental cost. Instead of discarding the food scraps and wastes, we can recycle these with the help of earthworms. Vermiculture technology involves the beneficial use of earthworms for the production vermicompost from agricultural and industrial wastes which is rich in macronutrients, micronutrients and beneficial micro-organisms. Agriculture provides plenty of wastes amounting to nearly 320 million tones annually. With the help of vermicomposting we can convert all such wastes to wealth by producing highly marketable castings. Integrated use of vermicompost alongwith FYM, biofertilizer and chemical fertilizer in french bean may improve soil health and production by saving costly inorganic fertilizers. Research reveals that vermin-technology has a prominent role in the development of ideal soil structure, nutrient and water management, waste management, better crop response, plant disease and pest control pollution abatement and production of chief animal protein in the form of earthworms for poultry farming and aquaculture. The fruits, flowers and vegetables and other plant products grown using vermi-compost are reported to have better keeping quality. Organic manures play an importance role in crop production and sustainable agriculture development.

EFFECT OF LEVELS AND SOURCES OF ZINC ON ZINC FRACTIONS IN SOIL AND PRODUCTIVITY OF RICE (*ORIZA SATIVA* L.)

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A field trial was conducted during *kharif* 2016 to investigate the effect of levels and sources of zinc on zinc fractions in soil and productivity of rice (*Oriza sativa* L.). To this effect ten treatment consisting various zinc fraction were tested in a randomized block design (RBD) with three replication. The area lie at a latitude of 29° 40' North and longitude of 77° 42' East with an elevation of 237 meters above mean sea level. The soil of experimental field was well drained, sandy loam in texture (sand 52.3 %, silt 28.2 % and clay 19.5 %) and slightly alkaline in reaction (pH 8.03). It was low in available Zinc with an electrical conductivity (1:2.5, soil: water extract) of 0.21 dSm⁻¹. The data on growth, yield and its contributing traits were calculated on plot area basis (15 m²), whereas content, uptake of nutrients at various stages and NUE along with Zinc fractions were recorded as per the standard procedure. Remarkable effect was noted where growth attributes (plant height, numbers of tillers), yield attributing traits (panicles length, number of grains per panicle and test weight), yields viz., grain, straw and biological and uptake of (ZnSO₄.7H₂O @ 7.5 kg ha⁻¹). Although, this treatment also noticed imminence improvement in soil available Zinc fraction and organic carbon. Moreover, significantly highest grain (40 q ha⁻¹) and biological yield (106.60 q ha⁻¹) was registered under the application of (ZnSO₄.7H₂O @ 7.5 kg ha⁻¹), at maximum tillering and panicle initiation respectively as compared to all other treatments. While, higher straw yield (66.6 q ha⁻¹) was produced under application of (ZnSO₄.7H₂O @ 7.5 kg ha⁻¹), at maximum tillering and panicle initiation respectively. Thus (ZnSO₄.7H₂O @ 7.5 kg ha⁻¹), at maximum tillering and panicle initiation, respectively, is best option for achieving maximum yield and Zinc use efficiency. Besides, it will also improve soil health.

Key Words: Texture, electrical conductivity, Zinc fraction and Zinc use efficiency etc.

BIOTECHNOLOGICAL APPROACHES IN INTEGRATED PEST MANAGEMENT

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World agriculture is passing through a distinct phase of transformation, called the 'Second Green Revolution' in which modern biotechnology enables the production of genetically modified (GM) crops that are claimed to help and resolve the pressing problems of food security, malnutrition and abject poverty in different parts of the world. Crop losses caused by pests are a major problem in both developed and developing countries. Over the years the extensive use of pesticides has led to pesticide resistant insects, reduction in beneficial insect populations (Natural enemies) and many harmful effects to humans and the environment. Genetic modification through biotechnology can potentially provide a much larger array of novel insecticidal genes that are new beyond the scope of conventional breeding. Modern agricultural biotechnology or genetic engineering includes manipulation of the genetic make-up of organisms for use in the production or processing of agricultural products. The biotechnological tools have been applied to study various issues such insect identification, insect control and insect genetic relationships. It has a significant role in improving efficacy, cost-effectiveness and in expanding the markets for the bio insecticides. Biotechnology provides opportunities for the development of insect natural enemies conferring beneficial traits such as pesticide resistance, cold hardiness and sex ratio alteration. Genetic manipulation of *Bacillus thuringiensis* (*Bt*) genes encoding for proteins toxic to insects offers an opportunity to produce genetically modified strains with more potent and transgenic plant expressing *Bt* toxin. In addition to the *Bt* delta-endotoxin, several proteins that are effective against certain

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insects such as the vegetative insecticidal proteins (VIP), alpha-endotoxin, a variety of secondary metabolites and proteins of plant origin are amenable to genetic manipulation. The concept of DNA fingerprinting has been recently used in insect field. The chemical structure of everyone's DNA is the same. Ecological agriculture could be achieved not only through proper agricultural practices but also through continuous research and development of new technologies, particularly agricultural biotechnology, which is probably a very important investment to achieve greater effectiveness in the world market.

Keywords: Biotechnology, Integrated Pest Management, Genetic Engineering

STUDIES ON ANTIOXIDANT PROPERTY OF BEETROOT (*BETA VULGARIS L.*) MIXED PANEER WHEY BEVERAGE

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Milk the first nutrient of the new born, provides adequate amounts of all nutrients required by infants. The milk proteins are divided into two main groups' caseins and whey proteins. Milk whey proteins have been demonstrated to have antioxidant properties and hypothesized their use in the food industry as a natural conservant. Beetroot *paneer* whey beverage was prepared from different proportions of beetroot extract using with *paneer* whey. The product obtained was subjected for chemical analysis. The average antioxidant activity was 0.42 and 2.68 of *paneer* whey and beetroot extract respectively. It was further observed that as the antioxidant activity in the beetroot extract more than the *paneer* whey. The average antioxidant activity of beetroot whey beverage was 0.37, 0.85, 0.96 and 0.98 for treatment T₁, T₂, T₃ and T₄, respectively. The highest antioxidant activity was recorded for treatment T₄ i.e. 0.98 ± 0.008^a TEAC (μmol)/mg protein). Antioxidant activity were at par with each other in treatment T₄ and T₃ in which whey is used in 75 and 80 parts and beetroot extract as 25 and 20. The lowest antioxidant activity was recorded for treatment T₁ i.e. 0.37 ± 0.008^b TEAC (μmol)/mg protein. The quantity of beetroot extract used in it is directly proportional to antioxidant activity.

Key word: Antioxidant, beetroot whey beverage and *paneer* whey.

ISOLATION OF ENTOMOPATHOGENIC NEMATODES (EPNS) FROM RICE ECOSYSTEMS OF TRICHY DISTRICT, TAMIL NADU AND THEIR EFFICACY ON RICE LEAF FOLDER, *CNAPHALOCROCIS MEDINALIS* GUENEE (LEPIDOPTERA: PYRALIDAE)

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The present study was conducted for surveying the entomopathogenic nematodes from the selected rice ecosystems of Trichy district, Tamil Nadu, India. A total of 270 samples were collected from the field used for isolation of nematodes during 2014-2015. Hence, two different species (*Steinernema* & *Heterorhabditis*) of entomopathogenic nematodes were isolated from the soil samples using the Corcyra baiting technique. Now a days we are using more pesticides to control pest which are harmful to human, soil and micro organisms. Hence to mitigate the harmful effects of chemical pesticides, entomopathogenic nematodes (EPNs) plays important role in controlling the rice leaf folder and the other lepidopteran pests. Here we tested leaf folder mortality to different EPNs treatments with comparison to time (24, 48 and 72 hrs after). The results of the present investigation indicated that effectiveness of the both entomopathogenic nematodes on rice leaf folder larvae mortality was equal. But the nematode recovery from the dead rice leaf folder larvae was high in *Heterorhabditis* (159 nematode/ 5 leaf folder larva) compared to *Steinernema* (153 nematodes / 5 leaf folder larvae). But in case of adult leaf folder moths the effectiveness of the *Steinernema* was high (3 dead moths/ 5 moths) compared to *Heterorhabditis* (2 dead moths / 5 moths) , but the nematode recovery from the dead rice leaf folder adult moths was high in *Heterorhabditis* (57 nematodes / adult) compared to *Steinernema* (47 nematodes/ adult). Hence, use of the EPNs is recommended to reduce the lepidopteran pests of rice and also to conserve the natural enemies and ecofriendly nature in the rice ecosystem.

Key words: Rice, eco systems, leaf folder, entomopathogenic nematodes, mortality

THE CRISPR-CAS9 SYSTEM: A CRISPER DEBATES IN GENOME EDITING

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The CRISPR-Cas9 (clustered regularly interspaced short palindromic repeats with CRISPR associated protein) is a rapidly developing genome editing technology that is easy to design, highly specific, efficient, robust, extremely versatile and well suited for high throughput gene editing for a variety of cell types and organisms. The system was first identified in bacterial immune system. It was developed as a gene editing technology in 2013. Site specific modification is achieved by a single guide RNA (usually about 20

nucleotides) that is complementary to a target gene or locus and anchored by a protospacer-adjacent motif. This targeted DNA is then cleaved by Cas9 nuclease to generate double-strand breaks (DSBs), followed by subsequent DNA repair via non-homologous end joining (NHEJ) or homology-directed repair (HDR) mechanisms leading to the disruption of gene functions in plants. Multiplexed CRISPR-Cas9 exploits multiple gRNA sequences for simultaneous editing of multiple sites within the same genome. Development of genetically edited (GE) crops provides a sustainable productive agriculture for better feeding of rapidly growing population in a changing climate. In this chapter, we briefly survey the history of the CRISPR/Cas9 system invention and its genome editing mechanism and briefly emphasizes on the potentiality of this gamechanging technology.

Keywords: Genome editing, CRISPR/Cas9, guide RNA, DSBs, DNA repair, NHEJ, HDR and GE crops.

AN ECONOMIC ANALYSIS OF RICE BASED CROPPING SYSTEMS IN RATNAGIRI DISTRICT OF MAHARASHTRA S.A. DIWATE, S.C. PHUGE *, S.J. MHATARE, J.M. YADAV, V.N. ANAPAND J.M. TALATHI

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The study was conducted at Department of Agricultural Economics, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli Dist. Ratnagiri with objectives to estimate cost, return and profitability of rice based cropping systems in Ratnagiri district of Maharashtra. In this study, primary data were collected from 120 farmers by personal interview method with the help of pre-tested schedule. Simple tabular analysis was applied for the comparison of yields and inputs used by the farmers. Economics of individual crop and crop combination was worked out. The standard cost concepts used in farm management studies. Results showed that in study area six farming systems followed by farmers. From the finding of present study, total cost higher found in FS-I (Rs. 109617) and least total cost in FS-IV (Rs. 68436). The per farm gross returns were maximum in FS-III (Rs. 148377) followed by FS-II (Rs. 128837), FS-I (Rs. 126304), FS-VI (Rs. 115794), FS-IV (Rs. 87787) and FS-V (Rs. 76876), which indicated higher returns in farming systems in which irrigated plantations were undertake. Among all the farming systems FS-III, FS-II and FS-VI were found highly profitable than other farming systems. The FS-II (Paddy+Pulses+Irrigated plantation) and FS- III (Paddy + Irrigated plantations) plays a major role in profitability of the farming systems. Which underline its importance and need to concentrate on these enterprises for making farming systems more profitable. Therefore, the proper balance between livestock enterprises and crop enterprises need to be encouraged to bring remaining farming systems more profitable.

Keywords: Rice, farming systems, cost and profitably.

ROLE OF HOST PLANT RESISTANCE IN INTEGRATED PEST MANAGEMENT

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Host plant resistance (HPR) is a cumulative, effective and eco-friendly method of pest management. HPR is usually specific against a particular insect pest or pest complex and does not exert any adverse effect on non-target or beneficial organism. The application techniques adopted by farmers does not need any skill and also not require much higher cost which is the most attractive trait of HPR. HPR will not only cause a major reduction in pesticide use and slowdown the rate of development of resistance to insecticides in insect populations, but also lead to increased activity of beneficial organisms and reduction in pesticide residues in food and food products. Extensive progress has been made in identification and development of crop cultivars with resistance to the major pests in different crops. There is a need to incorporate resistance genes into high-yielding cultivars with adaptation to different agro-ecosystems. An insect resistance variety with high yielding potential should available for cultivation by the farmers.

KEY WORDS: Host plant resistance (HPR), Integrated pest management (IPM), Cumulative, Eco-friendly, Resistance genes.

EFFECT OF SULPHUR ON GROWTH, YIELD AND QUALITY OF LINSEED (*Linum usitatissimum* L.)

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The present investigation entitled "Effect of sulphur on growth, yield and quality of linseed (*Linum usitatissimum* L.)" was conducted at Department of Agronomy farm, College of Agriculture, Nagpur during *rabiseason* 2017-18. The soil was clayey in nature with pH 7.9 indicating slightly alkaline in reaction, low in available nitrogen; medium in available phosphorus and very high in available potassium. The Experiment was laid out in Randomised Block Design with T₁- RDF (60:30:00 NPK kg ha⁻¹), T₂- RDF + 15 Kg S ha⁻¹ through gypsum, T₃- RDF + 20 kg S ha⁻¹ through gypsum, T₄- RDF + 25 kg S ha⁻¹ through gypsum, T₅- RDF + 15 kg S ha⁻¹ through bensulf, T₆- RDF + 20 kg S ha⁻¹ through bensulf, T₇- RDF + 25 kg S ha⁻¹ through bensulf, T₈- No Fertilizer (control). There was eight treatments replicated thrice. The results of the study indicated that application of RDF + 25Kg S ha⁻¹ through bensulf recorded higher growth, yield attributing characters and quality. GMR, NMR and B: C ratio were significantly higher in the treatment RDF + 25 kg S ha⁻¹ through

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bensulf. Growth contributing character viz., plant height, number of branches plant⁻¹, no. of days to 50% flowering, dry matter plant⁻¹ and yield contributing characters such as grain yield plant⁻¹, straw yield plant⁻¹, biological yield, harvesting index, seed and straw yield (kg ha⁻¹) were significantly higher by the treatment RDF + 25 kg S ha⁻¹ through bensulf (T₇).

Keyword: Effect, Sulphur, Growth, yield, linseed.

MICRO-IRRIGATION SYSTEM FOR SUSTAINABLE AGRICULTURE

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Micro-irrigation, also called localized irrigation, low volume irrigation, low-flow irrigation, or trickle irrigation is an irrigation method with lower pressure and flow than a traditional sprinkler system. Low volume irrigation is used in agriculture for row crops, orchards, and vineyards. It is also used in horticulture in wholesale nurseries, in landscaping for civic, commercial, and private landscapes and gardens, and in the science and practice of restoration ecology and environmental remediation. Micro-irrigation has high uniformity with water supply. Though, uniformity alone cannot accomplish the motive of irrigation. In India a high proportion of water resources are used for agricultural production, so micro-irrigation systems designed with high uniformity is must to achieve water conservation as well as environmental protection. For drip irrigation, the best ranking is for systems having lower costs, mainly with double rows per lateral and larger emitter spacing. Comparing surface and drip irrigation systems, despite low cost, drip alternatives may lead to 28-35% water saving relative to improved graded furrows, and increase water productivity from 0.43 kg m³ to 0.61 kg m³, surface irrigation provides higher farm returns. The drip method of irrigation has been found to have a significant impact on resources saving, cost of cultivation, yield of crops and farm profitability. Drip irrigation is completely suitable for cultivating vegetable crops that are mostly cultivated by small farmers. It would curtail the distress of the small farmers as well. The Agricultural sector is the largest user of water, followed by the domestic sector and the industrial sector. Using sprinkler irrigation system, 30.8% and 28.3% higher water use efficiency and 21.1% and 9.0% more water application efficiency was achieved as compared furrow irrigation system. Water scarcity in various parts of the country has created awareness about micro-irrigation systems and its implementation results in significant economic and social benefits in the country. The saved water can be used to increase the area under irrigation or for the reclamation of degraded/ waste land. Hence, micro-irrigation has been considered as an innovative technology for sustainable agricultural growth.

Key Word: Micro irrigation, Water use efficiency, Drip irrigation, Sprinkler irrigation

EFFECT OF FRUIT THINNING ON QUALITY OF PEACH (*PRUNUS PERSICA* (L.) BATSCH) CV. RED JUNE

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The present investigation was carried out during the year 2013 in the Research Block of Department of Horticulture, VCSG Uttarakhand University of Horticulture and Forestry, Ranichauri, Tehri Garhwal, Uttarakhand. The experiment was laid out in a Randomized Block Design (RBD) with three replications and 13 treatments. The fruit thinning treatments consisted of foliar spray of NAA at 25, 50 and 75 ppm, ethrel at 100, 200 and 300 ppm, thidiazuron at 10, 20 and 30 ppm at two weeks after petal fall and hand thinning of fruits to the intensity of 10, 20 and 30 percent at pea stage and unthinned control. The result revealed that foliar spray of ethrel @ 300ppm significantly increased the fruit thinning (29.05 %). Hand thinning of 30% fruits recorded significantly higher values for increased tree height (43.63 cm), tree spread (41.66 cm), tree volume (4.13 m³), shoot extension growth (52.61 cm) and leaf to fruit ratio (36.71) over the control. Whereas, tree sprayed with NAA @ 75 ppm resulted least fruit drop (5.87 %) over the control. Thus, it can be concluded that spray of ethrel @ 300 ppm was found as the most effective chemical thinner when applied two weeks after petal fall in peach cv. Red June as it produced superior quality of fruits.

CROP RESIDUE MANAGEMENT FOR NUTRIENT CYCLING AND IMPROVING SOIL PRODUCTIVITY

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Crop residue is defined as the vegetative crop material left on the field after a crop is harvested, pruned or processed. India being an agriculture dominant country produces more than 500 million tons of crop residue annually. These residues are used as animal feed, for thatching of homes and as a source of domestic and industrial fuel. A large portion of unused crop residue are burnt in the fields primarily to clear the left over straw and stubbles after the harvest. Non availability of labour, high cost of residue removal from the field and

increasing use of combines in harvesting the crops are main reasons behind burning of crop residues in the fields. Burning of crop residues causes environmental pollution which is hazardous to human health, produces greenhouse gases causing global warming and results in loss of plant nutrients like N, P, K and S. Therefore, appropriate management of crop residues assumes a great significance. The residues of rice, wheat, cotton, maize, millet, sugarcane, jute and rapeseed-mustard are typically burnt on-farm across different states of the country. The problem is more severe in the irrigated agriculture, particularly in the mechanized Rice-wheat cropping system of the north-west India. Crop residue can be managed by following strategies incorporation of crop residue in soil, use of crop residue for compost / vermi-compost / FYM / mushroom cultivation, use in power generation and production of ethanol, use for paper/board and packing material, promotion of collection of crop residue for feed bricks making and its transport to fodder deficient areas. The crop residue incorporation improves physical, chemical, and biological properties of soil. In long term incorporation of crop residue increases the nutrient cycling and productivity.

Keywords: Crop residue, environmental pollution, vermi-compost, productivity.

“ROLE OF FLORICULTURE AS THERAPEUTIC VALUE IN MODERN ERA”

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Floricultural plants are grown both in indoor and outdoor gardens and in landscaping projects, for beautification purpose. Besides, horticultural plants have positive physiological impact on human beings. These plants are helpful in air purification, water conservation, avoiding soil erosion, and providing shelters to natural fauna. Hence, these plants play important role in proper functioning of ecosystems. In modern era, people are becoming more conscious about health and for maintaining good health a trend has emerged to use medicinal plants and plants related activities instead of using synthetic drugs due to side effect and contraindication in use. The colour, shape, smell, touch and taste of the plants stimulate the sensory organs leading the brain to activate and release several enzymes or chemicals which enhances mood and make the people to feel comfortable. People of all age groups when exposed to plants have both positive thinking as well as positive emotions. The students of a school with gardening facilities feel much comfortable and confident and also show improvement in learning skills. Learning abilities, concentration, creativity communication skills, and decision making and leadership qualities improves subsequently. The overall performance of students engaged in gardening activities was higher as compared to students of a school lacking gardening facilities. Scenic beauty of gardens attracts people to visit repeatedly for longer time and spend quality time with nature. Hence, gardens and gardening activities which allow interaction with nature can have positive impact on psychology as well as on physiology and thus help to live better life.

EFFICACY AND PHYTOTONIC EFFECT OF FIPRONIL 0.3 G(MAHAVER 0.3GR) AND 5 SC (MAHAVER 5 SC) IN RICE CROP (ORYZASATIVAL.)

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The experiment was conducted to evaluate the Efficacy and Phytotonic effect of Fipronil 0.3 G (Mahaveer 0.3GR) and 5 SC (Mahaveer 5 SC) in rice crop (*Oryza sativa* L.) at Pilkhani (Rampur Maniharan), Saharanpur (U.P.). To observe phytotonic and insecticidal properties of fipronil, data were recorded on plant height, number of roots/plant, root length, number of tillers / hill and insect infestation at 15 days interval. Observations were started from 20 days after transplanting and continued up to maturity. The experiment was conducted in Randomized Block Design with Six treatments on rice variety Basmati 999. Fipronil 0.3G (Mahaveer 0.3 GR) and Fipronil 5SC (Mahaveer 5 SC) insecticide alone and in combinations were used. Fipronil 0.3G @ 25 kg/ha at 20 DAT days after transplanting enhanced growth parameters and combination of it with spraying of 5SC @ 1000 ml/ha at 45 days after transplanting acted as boosting dose and also reduces insect infestation resulting maximum yield. Therefore, Fipronil 0.3G @ 25 kg/ha at 20 DAT followed by Fipronil 5SC @ 1000 ml/ha at 45 DAT was best for reducing the insect infestation and improving the plant growth and yield recommended for better response.

KEYWORDS: Efficacy, Fipronil 5 SC, Fipronil 0.3GR, Growth parameters, and Rice

PERFORMANCE OF MAJOR FOOD GRAINS PRODUCTION IN TRIPURA: AN OVERVIEW

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The agro climatic condition of Tripura offers immense potential for production of number of food grains in the state. The production of food grains provides gainful employment for small farmers and agricultural labor throughout the year. In this study an attempt were made to estimate the gap between production and requirement of food grains in the state. The secondary data on major food grains in the state

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over the decade (2001-2014) were collected. Compound growth rate, moving averages ratio and regression analysis was done to achieve the objective. The annual growth rate in per cent for yield of rice in Tripura is 1.87 per cent which is at par with the growth rate of yield of rice in national level (1.87%). Similarly, maize and pulses growth rate (2.46% and 1.02%) were positive and it is mainly because of the introduction of high yielding varieties but the yield of pulses in the state was lesser than the national level. However, the growth rate for production of wheat (-10.48%) and oilseeds (-0.41%) in the state were negative as the farmers are not very much willing to grow wheat and oilseeds extensively. In the year 2014-15, gap reduced to 0.19 lakh tons (LT) with production and requirement of 8.60 and 8.79 LT respectively, whereas the production and requirement was 6.12, 7.66 LT, respectively in 2004-05. The results showed that there was significant growth of food grains production in the state. The state has potentiality for the reducing the gap between production and requirement of food grains which showing the possibility of value addition through establishing processing units in the state that would help to boost farmers income and employment. Hence, government initiatives along with growers and processors interest needs to be developed for exploring the vast potentiality of this sector in the state.

Key word: Food grains, availability, gap, moving averages, Tripura

INTEGRATED MANAGEMENT OF WEB BLIGHT DISEASE OF MUNGBEAN INCITED BY *RHIZOCTONIA SOLANI* KÜHN

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Mungbean or Green gram [*Vigna radiata* (L.) Wilczek] is one of the most important pulse crops of India. Web blight disease caused by *Rhizoctonia solani* Kühn [*Thanatephorus cucumeris* (Frank) Donk] is one of the major serious constraints in its production causing heavy yield losses. Investigations were undertaken with an objective to develop suitable management strategy against web blight disease of mungbean. *In vitro*, Propiconazole was most effective against *R. solani* showing 93.33 per cent inhibition at 20 ppm concentration. Among the botanicals, Calotropis @ 35 per cent was most effective in mycelial growth inhibition of *R. solani* i.e. 86.00 per cent. *Trichoderma harzianum* showed better performance over *Pseudomonas fluorescens* in inhibiting mycelial growth of *R. solani* i.e. 61.29 per cent. Under controlled glasshouse conditions, seed treatment with Thiram+Carbendazim (2:1) @ 3 g/kg seeds followed by three foliar sprays of Propiconazole @ 0.1 per cent at 15 days interval gave maximum reduction in web blight disease severity i.e. 70.47 per cent. Under *in vivo* conditions, three foliar sprays of Propiconazole @ 0.1 per cent at 15 days interval gave maximum reduction in disease severity and maximum per cent increase in grain yield over check i.e. 65.54 per cent and 61.94 per cent, respectively.

CHECKLIST OF ACRIDIDAE (ACRIDOIDEA) OF UTTAR PRADESH

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Grasshoppers and locusts have long term association with human beings as they have been the major pest of almost every type of vegetation. They belong to suborder Caelifera under order Orthoptera. They destroy crops over a wide area when they swarm in millions as locusts. Due to the devastating effect they can also be the reason of famine. Even in small number they can be serious pests. The Acrididae are the major group of grasshoppers, containing about 6,701 valid species of the 8,132 species out of whole Superfamily Acridoidea (Cigliano et al., 2017). Due to great significance of Acridids as important agricultural pests, it is aimed to prepare a checklist of Acridid fauna of Uttar Pradesh, India. Therefore, a checklist of Acrididae of Uttar Pradesh was prepared in light of distributed data and published literature gathered from various resources and in addition to identified specimens deposited in Department of Zoology, Aligarh Muslim University, Aligarh. A sum of 78 species/subspecies were recorded comprising of 49 genera and 12 subfamilies. The most predominant subfamily was observed to be Oedipodinae. Species were arranged under their respective subfamilies and their percentage of occurrence was calculated subfamily wise.

Keywords: Acrididae, Pests, Checklist, Uttar Pradesh

APPLICATION OF AMELIORATION TECHNOLOGY IN SOIL SUSTAINABILITY

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The impacts of climate change and population growth are the increasing human pressure on land forces conversion of natural landscapes to agricultural fields and pastures while simultaneously depleting land currently under agricultural use. Therefore, a brutal loop develops; further aggravating climate change, soil degradation, and erosion, loss of soil organic matter and leaching of nutrients. Therefore, sustainable concepts for increased crop production are immediately needed to lower pressure on soils, in order to reduce or prevent the negative environmental impacts of rigorous agriculture. One efficient way to increase organic matter in soil is amelioration in soil like compost, biochar, Fly ash, Red mud, Phosphate rock and other rock minerals, etc. On the one hand, growth of livestock breeding

and intensification of crop production has occurred while an increasing shortage of resources, i.e. fossil fuels, fossil nutrients stocks and arable land, can be recognized. On the other hand, urbanization and growing population interconnected with an increased amount of waste output is responsible for environmental hazards and pollution. Therefore, soil amelioration became an efficient means of waste processing and environmental improvement.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH CHARACTERS OF CROPS UNDER VARIOUS OAT-LATHYRUS INTERCROPPING SYSTEM

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One field experiment was conducted at Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during *Rabi* season of 2015-16 and 2016-17 to evaluate the effect of integrated nutrient management on various growth characters of oat and lathyrus under different cereal-legume based cropping system. The experiment was placed in split plot design with 3 replications comprising 4 levels of cropping system (CS₁- Sole oat, CS₂- Sole lathyrus, CS₃- Intercropping of oat with lathyrus in 3:2 row ratio and CS₄- Intercropping of oat with lathyrus in 3:3 row ratio) in the main plot and 4 levels of nutrient management (N₁- Full RDF through inorganic source (urea), N₂- 75% N through urea + rest N through FYM, N₃- 75% N through urea + rest N through vermi-compost and N₄- 75% N through urea + rest N through mustard oilcake) in the sub plot. Results revealed that maximum vegetative growth in terms of plant height (99.4 cm and 57.8 cm), leaf area index (4.20 and 1.94), root length (11.60 cm and 15.50 cm) and weight (7.42 g and 0.409 g), dry matter accumulation (246.87 g/m² and 308.09 g/m²) was recorded for both oat and lathyrus respectively, when 75% N through urea + rest N through vermi-compost was applied. Oat performed better under 3:3 intercropping system due to the advantage of biological nitrogen fixation while, sole lathyrus showed highest performance compared to their other cropping situations. Growth rates of oat and lathyrus were highest in combination of 3:3 intercropping system and sole lathyrus respectively, with 75% N through urea + rest N through vermi-compost.

Key words: Growth characters, Integrated Nutrient Management, Intercropping, Lathyrus, Oat

ORGANIC FARMING IN INDIA: RELEVANCE, RESISTANCE AND STRATEGIES FOR PROMOTION

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Organic farming is rapidly gaining ground in both developed and developing countries to overcome the challenges arising from chemical fertilizer based farming. India is not an exception from this recent trend. On the other hand increasing consciousness about conservation of environment as well as health hazards associated with agrochemicals has changed the consumers' preference towards safe and hazard-free food which is also major factor that lead to the growing interest in alternate forms of agriculture in the world. Under Indian condition, rapid spread of organic farming is possible because of some key geographical, cultural and economic advantages like traditional nature of farming and indigenous technical knowledge and practices followed by Indian farmers etc. vast stretches of arable land, which are mainly rain-fed and where negligible amount of fertilizers and pesticides are being used and have low productivity, could be exploited as potential areas for organic agriculture. However, there are certain issues under Indian context that should be taken care of before we go for a large-scale conversion to organic agriculture. The most important issues are- can organic farming produces enough food for everybody? Is it possible to meet the nutrient requirements of crops entirely from organic sources? Are there any significant environmental benefits that accrue from organic farming? Is it economically feasible? Prevalence of small and marginal dairy farmers also poses many challenges for faster proliferation of organic farming along with some other shortcomings. Present article provide some insight into these aspects along with some potential strategies to overcome these weaknesses and threats.

HEAVY METAL CONTAMINATION AND HEALTH RISK IN VEGETABLE CROPS

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Vegetables being rich sources of essential nutrients and antioxidants are taken as a common diet by populations throughout the world. However, now a days vegetables grown in industrial areas are getting contaminated with heavy metals which disturbing biological and biochemical processes in the human body. Heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Although heavy metals are naturally present in the soil but geologic and anthropogenic activities mainly increases the concentration of these elements to amounts that are harmful to plants, animals and human beings. Some of these activities include mining, smelting of metals, burning of fossil fuels, use of chemical fertilizers and pesticides in agriculture, production of batteries and other metal products in industries, sewage sludge and municipal waste disposal. Heavy metals bioavailability

to plants is strongly related to the concentration and specification of the element in the soil solution because this is from where the plants uptake the heavy metals. The excessive intake of heavy metals from the soil creates dual problems; first the harvested crops get contaminated, which in turn serve as a source of heavy metal in our diet, and secondly the crop yield declines due to the inhibition of metabolic processes. Based on metal accumulation in edible parts and whole plants, root vegetables such as radish and carrot recorded lower accumulation of almost all heavy metals except zinc (Zn) in radish root whereas, leafy vegetables namely spinach, amaranthus, mustard and fenugreek recorded higher accumulation of both essential and non-essential heavy metals. Consumption of vegetables grown in polluted sites can cause serious consequences on human health. Once entered, heavy metals are deposited in bone and fat tissues, overlapping noble minerals and slowly released into the body and can cause an array of diseases. Therefore, possible remediation measures such as growing of hyperaccumulator plants, use of nano technology, addition of organic matter and lime in soil etc should be adopted. There is a relevant necessity for regular assessment and monitoring of these heavy metals in urban grown vegetables especially in industrially polluted areas to ascertain the level of heavy metal contaminants. Besides emphasis should be given in selection of vegetables for cultivation on such contaminated soils depending on their metal uptake potential and their distribution to edible part.

EFFECT OF PLANT GROWTH REGULATORS ON FRUIT SET, YIELD EFFICIENCY, FRUIT SIZE AND RUSSET FORMATION IN APPLE CV. SCARLET SPUR II

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The field experiment was conducted during 2017 and 2018 to study the effect of GA₄₊₇+BA and CPPU on fruit set, fruit retention, yield efficiency, fruit size and russet control in apple cv. Scarlet Spur II. Experimental trees were subjected to ten treatments viz., T₁: GA₄₊₇+BA at 1ppm (2 sprays: PF+ 10 days later), T₂: GA₄₊₇+BA at 1ppm (3 sprays: PF+ later at 10 days intervals), T₃: GA₄₊₇+BA at 2.5ppm (2 sprays), T₄: GA₄₊₇+BA at 2.5ppm (3 sprays), T₅: GA₄₊₇+BA at 5ppm (2 sprays), T₆: GA₄₊₇+BA at 5ppm (3 sprays), T₇: CPPU at 2.5ppm (single spray at PF), T₈: CPPU at 5ppm (spray at PF), T₉: CPPU at 10ppm (spray at PF), and T₁₀: control (no spray). Among different treatments, GA₄₊₇+BA at 5ppm when applied thrice was most effective in reducing the russet formation and increasing fruit shape index (L/D ratio). However, higher increase fruit set, fruit retention, yield efficiency, fruit diameter and fruit weight observed with the treatments of CPPU at 10ppm applied at petal fall stage. Therefore, multiple application of GA₄₊₇+BA at 5ppm seems to be useful for controlling russetting and improving the fruit shape whereas single application of CPPU at 10ppm was most effective for increasing yield efficiency and fruit weight in apple.

Keywords : Apple, Promalin, CPPU, Petal fall stage, Russetting

RECENT ADVANCES IN FRUIT CROP IMPROVEMENT THROUGH TRANSGENIC APPROACHES

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The world population is predicted to double in the next 50 years according to the world population prospects. Ensuring an adequate food supply is going to be a major challenge, therefore, genetically modified fruit crops may pave a way to meet these challenges in a number of possible paths. There are various ways where the genetic engineering can be employed in fruit crop improvement such as transferring pest and disease resistance from the wild relatives which are sexually not compatible, conferring herbicide tolerance where manual weeding is a difficult task in case of large scale cultivation (Cranberry), imparting abiotic stress tolerance (*Poncirus trifoliata* showed enhanced salt tolerance after transformed with *nptII*, *AhBADH* gene), production of edible vaccines and reduction of juvenile phase. Most commonly used methods for transformation are agrobacterium mediated transformation, microinjection, particle bombardment and electroporation. There are several reports where the genetic compositions of different fruit crops are modified to get the desired traits such as Papaya (PRSV coat protein), Banana (*Musa DHN1*), Grape (*DREB1*) and Apple (*MdTFL-1*). Recent advanced methods used for transformation are gene silencing and gene editing technologies. Gene silencing includes antisense RNA and RNA silencing where the expression of the gene is prevented by interfering with the translation machinery. Gene editing technologies include Zinc finger nucleases, TALENs and CRISPR or Cas 9 which mainly rely on the engineered endonucleases which cleave the DNA due to the presence of sequence specific DNA binding domains. As the fruit crops are perennial in nature, these transgenic tools can be used to overcome various hurdles in fruit crop improvement such as long juvenile phase, heterozygosity etc. Genetically-modified fruit crops in addition to other horticultural crops have the potential to solve many of the world's hunger and malnutrition problems, and to help protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides.

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HEAT TOLERANCE IN WHEAT GERMPLASM LINES**SAMITA***Choudhary Charan Singh Haryana Agriculture University, Hisar, Haryana, India*

Wheat (*Triticum aestivum*) is the staple food of more than a third of global human population and account for almost 20% of the total calories and protein consumed by human worldwide, more than any single food source. Wheat production need to be increased 70% by 2050 to feed world population. India is the second largest producer of wheat after china. In India Wheat is gamble with temperature. Due to global warming the world has been facing linear trends of increasing maximum and minimum temperature per decades by 0.3 and 0.2°C respectively. Such increase in temperature induced by climate change is expected to reduce wheat production. High temperature reduces yield by 3-4% per °C rise in temperature. Accordingly decline in South Asia is expected to be 50% by 2050. Reduction in yield is associated with both chronically high temperature during early grain filling as well as during late reproductive stage including grain filling. A field experiment comprised of 64 germplasm line was conducted at wheat research station, department of genetics and plant breeding, CCS HAU, Hisar, Haryana during crop season 2017-18 under late sown condition. Average grain filling duration in heat tolerant genotype was 45 days under late sown less by 19.8% than timely sown during 2017-18 crop seasons. Grain filling duration varied from 28 to 38 days under late sown condition. However, significant negative correlation was obtained for GFD with GFR that indicated reduction in grain filling duration enhances the rate of grain filling. Estimate of genetic parameters revealed low GCV and PCV over the years for individual and HSI of traits GFD. While moderate to high GCV and PCV for most of the grain yield and its component trait and for its HIS indicated additive gene action suggesting improvement through selection. Selecting more heat-tolerant cultivars traditionally grown in warmer regions may reduce heat related losses under global warming.

Keywords: temperature & grain filling duration(GFD).

ENHANCING AGRICULTURE THROUGH AGRIBUSINESS MANAGEMENT**SANDEEPACHARYA¹, JEEBAN KUMAR BISWAL² AND DEBASIS JAYAPURIA³**

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Agribusiness is the business of agricultural production. It includes crop production, seed supply, agrochemicals, farm machinery, distribution, processing, marketing and retailing of agricultural produce to ultimate consumers. Agribusiness is used simply as a carry all agriculture and business within the agriculture industry, referring to the range of activities and disciplines encompassed by modern food production. Agribusiness has evolved from agriculture and has become a vast and complex system that reaches for beyond the farm to include all those who are involved in bringing food and fiber to consumers. Agribusiness Management programmes for critical management and entrepreneurial competencies to agricultural graduates for enabling them to own and manage Agribusiness enterprises of global standards. Agribusiness managers have great opportunities in agriculture production, agricultural marketing, food processing, supply chain, dairying and retailing sector in national and Multinational Corporation. These MNCs are very interested to investment in industries like agrochemical, organic farming, cattle feed industry, horticultural based industries, poultry, plantation, agroforestry, and ayurvedic industry in order to exploit the potentials of market access in India. So, Agribusiness management is necessary for developing trained manpower, to create business opportunities, reduce poverty through employment generation and industrial growth for the true development of Indian agriculture.

Keywords: Agribusiness, consumers, employment.

POPULATION DYNAMICS OF *BAGRADA HILARIS* (BRUMEISTER) ON INDIAN MUSTARD UNDER SEMI ARID CONDITIONS**SANDEEP KUMAR AND VISHVENDRA**

Population dynamics study of *Bagrada hilaris* on RH 40 showed that the pest reached its peak population twice in the cropping season, once at the seedling stage, and another at the maturity stage on both early, and late sown crop. The maximum population on early sown crop was observed with its first, and second peak observed on 43th SW, and 14th SW, respectively. While in the late sown crop the peaks in the pest population were noticed on 54th SW, and 19th SW of 2016-17, and 2017-18. The pest population had significant positive correlation with maximum temperature, and sun shine hours on both early, and late sown crops. However, the correlation with minimum temperature was non-significantly positive in early sown crop compared to significant positive correlation in late sown crop. Morning, and evening relative humidity showed highly negative significant correlation with the pest population. Wind speed had a significant negative effect on painted bug population in crop sown early in the season while the effect was positive, and non-significant in late sown crop. All weather parameters contributed to *B. hilaris* population fluctuation to the extent of 55 to 61, and 42 to 79 per Cent.

Keywords: Bagrada hilaris, correlation, Indian mustard, population dynamics

INVESTIGATIONS ON MAJOR INSECT PESTS OF PEARL MILLET [*PENNISETUM GLAUCUM* (L.) R. BR.] IN SEMI-ARID REGION OF RAJASTHAN

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Investigations on "Survey of major insect pests of pearl millet in semi-arid region of Rajasthan" were conducted at Division of Entomology, RARI Durgapura during 2014 and 2015. The two years survey during Kharif 2014 and 2015 on insect-pests of pearl millet in Semi-arid Eastern Plain of Rajasthan revealed that nine insect species, viz., shoot fly, stem borer, white grub, termite, grey weevil, leaf roller, chaffer beetle, grasshopper and *Helicoverpa* larvae appeared on pearl millet. The incidence of shoot fly, stem borer and white grub was observed as major pests; however, the incidence of other pests was meagre.

Key words: Pearl millet, survey, insect pests, incidence

PRECISION AGRICULTURE: SUSTAINABLE AND INTENSIVE CROP PRODUCTION

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Precision agriculture comprises a set of technologies that combines sensors, information systems, enhanced machinery, and informed management to optimize production by accounting for variability and uncertainties within agricultural systems. Precision agriculture provides a means to monitor the food production chain and manage both the quantity and quality of agricultural produce. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other Precision agriculture has generated a very high profile in the agricultural industry over the last decade of the second millennium but the fact of 'within-field spatial variability', has been known for centuries conditions. To improve the application of fertilizers by varying rates and blends as needed within fields. Socio-economical barriers are principally costs and lack of skills. Agronomical challenges are lack of basic information, inadequate sampling and scouting procedures, absence of site-specific fertilizer recommendations, misuse of information, and lack of qualified agronomic services. The doubling of agricultural food production during the past 35 years was associated with a 6.87-fold increase in nitrogen fertilization, a 3.48-fold increase in phosphorus fertilization, a 1.68-fold increase in the amount of irrigated cropland, and a 1.1-fold increase in land in cultivation. Based on a simple linear extension of past trends, the anticipated next doubling of global food production would be associated with approximately 3-fold increases in nitrogen and phosphorus fertilization rates, a doubling of the irrigated land area, and an 18% increase in cropland.

IDENTIFICATION OF TOXIC AND NON TOXIC LINES IN JATROPHA

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Interspecific hybridization as prebreeding approach has been proved as an important approach to widen variability and potential plants emerged as derivatives have been effectively utilized in genetic improvement of Jatropha. The genetic approach proved applicable for utilizing nontoxic source applying conventional breeding and HPLC analysis of Phorbol 12-Myristate 13-Acetate (PMA) to develop nontoxic, high oil yielding lines for the commercial use. The research was conducted on plants comprising selected crosses involving non-toxic lines, old crosses and backcrosses with and without nontoxic parents in early and late flowering, advanced lines and its clones on quantitative and qualitative traits. Performance of plants among crosses under study revealed utilization of plants from different the crosses for plant height (52-5×61-3), branches and number of seed/plant (61-3×21-8, 61-3×? and 9-1×61-3×B1-11) capsule weight and seed index (GF×34-23×34-6) number of capsules (14-16×34-6) seed yield (21-8×52-2) and cross 13-17×small for hulling percentage. The cross JC13×NT-6, 9-1×61-3 and H1-6-2-4 are identified for increasing oil content. One plant of the cross (52-2×61-3) has been identified for more number of traits viz. Capsule yield, seed yield, seed index and high oil content (53.40%) followed by cross 21-8×52-2 have been identified for a high number of the capsule, seed yield, seed index and acceptable level of oil content (41.4% kernel basis). Most of the crosses exhibited more than 30% of oil content, capsule yield >51.259 g, seed yield > 516.25 g and seed index > 60.00g. The detailed analysis of PMA in seeds and its part precisely contributed in establishing the genetic basis (maternal inheritance) and also hypothesizing involvement of more than one dominant genes controlling PMA content in Jatropha.

EFFICACY OF DIFFERENT INSECTICIDES AND BIORATIONALS AGAINST MUSTARD APHID, LIPAPHIS ERYSIMI UNDER NATURAL CONDITION.**SANDEEP KUMAR AND VISHVENDRA**

A field experiment on mustard var. Pusa bold was conducted during Rabi season of year 2016-17 and 2017-18 at S.V.P.U. Of Ag. & T., Meerut. The observations were recorded at 3, 7 and 10 days after spraying of insecticides after each spray. Among the various insecticides evaluated against the mustard aphid, *Lipaphis erysimi* Kalt, thiamethoxam 25 WDG @ 100 g/ha showed minimum (28.67) number of aphids thiamethoxam 25 WDG @ 150 g/ha mustard aphid followed by imidacloprid 17.8 SL @ 150 m/ha (31.33) number of aphids at 3 days after second spray, respectively. Similarly same trend was noticed after 7 days of spraying in which both the chemicals registered 13.33 and 14.67 minimum number of aphids. The experiment was repeated after 15 days to check the aphid population and it was observed that thiamethoxam 25 WDG @ 100 g/ha was found best followed by imidacloprid 17.8 SL @ 150 m/ha and dimethoate 30 EC @ 1000 ml/ha, when the data was recorded after 7 and 15 DAS.

BIODYNAMICS FARMING FOR SUSTAINABLE AGRICULTURE**SANDEEPYADAV, DINESH K. SINGH, SMRITI SINGH, ASHISH K. SINGH, LAVLESH**

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India is one of the agricultural based nation with more than 58% of the population pertaining to agricultural sector. Before 1960, in India only organic farming practice was followed without chemical fertilizers and pesticides. During late 1960s, there was threaten to food security due to population raise and frequent draughts. Government of India had entered collaboration with USA for reforming farming practices by adding chemical products for cultivation, diseases and weed management. The introduction of a reckless chemical in the recent decades has adverse impact on the Indian agricultural practices and serious environmental concerns have been raised. All these factors completely come against the sustainable agriculture. To escape from the harmful effects of chemicals, the concept of organic farming was emerged. In organic production system biodynamics farming is a good source for sustainable agriculture. Biodynamic Agriculture is an advanced organic farming system that is gaining increased attention for its emphasis on food quality and soil health. Among the many tested models of agriculture, biodynamic agriculture has taken highest prominence in the development of international principles and standards. There is a wide body of knowledge and scientific research proving the soundness of biodynamic principles. The goal of a Biodynamic farming is to be able to support just the right balance of people, plants and animals. In the organic production system, in general, micronutrients are not taken care, there is every doubt that over long duration, there deficiencies may create production constraints and these technologies might be a failure rather than a sustainable alternative. Biodynamics agriculture, under the present scenario appears to be sound alternative.

KEY ROLE OF SOIL HEALTH IN AGRICULTURAL PRODUCTION**SANDEEP BEDWAL¹, ANKUSH¹, VIKRAM SINGH² AND D.S. JAKHAR¹**

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Soil is an important component of terrestrial ecosystems that supports life on the earth. A healthy soil is fundamental for sustained agricultural productivity and environmental resiliency. Feed the soil to feed the plant is the basic principle for better health of soil. Soil health is an integrative property that reflects the capacity of soil to respond to agricultural intervention but with the increasing and juxtaposed challenges of population growth, the pressures of constantly increasing production have resulted in a persistent decline in soil fertility which is a major challenge that Indian agriculture is facing. It resulted in overuse of chemical fertilizers, excessive tillage, jettisoning of age-old organic soil revival practices and lack of appropriate crop rotation which leads to soil degradation and loss of fertility. Soil flora-fauna plays a critical role in maintaining soil health, ecosystem functioning and productivity. Decline in soil organic matter causes limited soil life and poor soil structure. Managing for soil health is mostly a matter of maintaining suitable habitat for the myriad of creatures that comprise the soil food web. This can be accomplished by disturbing the soil as little as possible, growing as many different species of plants as practical, keeping living plants in the soil as often as possible, and keeping the soil covered all the time.

RESPONSE OF ORGANIC MANURE ON GREEN GRAM (*PHASEOLUS RADIATA* L.) UNDER RAIN-FED CONDITION OF CHITRAKOOT***SANDEEP MOHBE *C.K. DOTANIYA, R.K. DOUTANIYA**

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The field experiment was carried out during kharif season under semi arid climatic zone situated at 21°06' to 26°30' north latitude and 82°48' longitude 2014 at rajaula instructional farm to evaluate the appropriate dose of suitable organic matters used on green gram under rain-fed condition. Nine different organic matter (FYM, Vermicompost, Goat Manure and Poultry Manure) treatments along with one

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control were tested in Randomized Block Design with three replications. After analysis of data shifted in various table results revealed that poultry manure (T_8) showed, best performance in initial plant height at 15 DAS, pod formation 8.0 and 17.53 at 45 and 60 DAS respectively, Highest nodule formation at 60 DAS 27.27, maximum yield per plant 9.31 gram and maximum seed yield per plot 1368 gm. In this experiment it can be concluded that treatment T_8 with Poultry manure increased the yield with maximum formation of nodule on plants of green gram.

Keyword- Organic Manure and Yield Parameters

NUTRIENT RETURN UNDER DIFFERENT SPACING OF *EUCALYPTUS TERETICORNIS* BASED AGROFORESTRY SYSTEM

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The present study was conducted at Research Farm, Department of Forestry CCS HAU, Hisar to assess the effect of *Eucalyptus tereticornis* spacings on litter production, nutrient content and nutrient addition. The maximum leaf litter production was found at 3×3 m followed by 6×1.5 m and 17×1×1 m spacing. Nitrogen, phosphorus and potassium were ranged from 1.09 to 1.14, 0.14 to 0.16 and 0.18 to 0.21%, respectively. The *Eucalyptus* planted at 3×3 m spacing produced the highest amount of N, P, K, Ca and Mg through leaf litter as compared to wider spacing. The nutrient addition through leaf litter of *Eucalyptus* differed significantly to each other. As the distance increased the nutrient addition decreased significantly and it was found minimum at 17×1×1 m spacing. The close spacing of *Eucalyptus* returned substantial amount of N (107.4 kg/ha/year) while the average annual input of N, P and K were 95.6, 12.9 and 17.6 kg/ha/year, respectively. The input of Ca and Mg ranged from 96.8 (17×1×1m) to 122.9 (3×3 m) and from 50.4 (17×1×1m) to 63.3 (3×3 m) kg/ha/year, respectively. The amount of micronutrients returned through annual litter fall in different spacing of *Eucalyptus*-based agroforestry system differed significantly. The total mean micronutrients (Zn, Mn, Cu and Fe) return through leaf litter was 6.0 kg/ha/year out of which maximum contribution was of Mn (45%). Thus close spacing of *Eucalyptus tereticornis* based agroforestry system produced highest litterfall which also resulted into more nutrient addition to the soil.

Keywords: Eucalyptus, agroforestry, litterfall, spacing and nutrient return

NANOTECHNOLOGY- INNOVATIVE APPROACH IN AGRICULTURE

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Agriculture is an area where new technologies are often applied to improve the yield of crops. Nano agriculture involves the employment of nano particles in agriculture. Nano technology has been extensively used in food production, plant protection, processing, packaging, transportation of agricultural products and quality control and environmental management. It has great potential to make agriculture more efficient by using nano sensors and nano agricultural chemical. Nano biotechnology is advancing towards the ability to sequence DNA in nano fabricated gel-free systems, which would allow for significantly more DNA sequencing of crop germ plasm can potentially provide highly useful information about molecular markers associated with agronomically and economically important traits. Thus, nano biotechnology can enhance the pace of progress in molecular marker assisted breeding for crop improvement. Also nano particles are materials that small enough to fall within the nano metric range with at least one of their dimension being less than a few hundred nano meters. These materials would release pesticides and fertilizers at a specific time and targeted location. Nano particles tagged to agro chemicals or other substances could reduce the damage to other plant tissues and the amount of chemicals release to the environment. With the current application and advancements soon to come, nano technology will have a great impact on the direction that agriculture will take.

DEVELOPMENT OF INSECT RESISTANCE PLANT VARIETIES BY PLANT BREEDING TECHNIQUE

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Insect are major biotic factor which cause significant losses in various crops. The insecticides are used by farmers for their management but over use of chemical insecticides results in many problems such as development of insecticide resistance, reduction in population of natural enemies, resurgence, environmental pollution, human health hazards etc. All these problems can overcome by development of Insect resistance plant varieties. The basic mechanism of resistance are non-preference, antibiosis and tolerance. The resistance can be due to morphology, physiological, biochemical and genetical factors of plants. The genetic factors are mainly of three type monogenic, oligogenic and polygenic. For development of resistant plant varieties breeder should know the major sources of resistance. The main sources of resistance found in nature are cultivated varieties, wild species, germplasm collections, mutations and introduction of

microorganism. The method of breeding to develop insect resistant plants are introduction, selection and hybridization. The field screening is done before released of varieties for commercial purpose. This technology of insect pest management is found to be associated with following advantages like compatible to all other management techniques, much cheaper as compared insecticides and it is the simplest seed based technology do not need any extra skill for application.

MECHANIZED RICE CULTIVATION PROBLEMS AND PROSPECTS

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Asian countries are occupying 89% of world total rice area producing 90% of total rice production. Mechanization saves time in completing different operations with increasing precision and production, reducing drudgery and cost of cultivation. Laser land leveler smoothers land surface, enhanced rice-wheat system productivity by 10 per cent and saving of water by 22 per cent, increases water productivity from 0.55 to 0.91 kg grain m⁻¹ (Naresh *et al.*, 2011). Three percent higher grain yield (40.35 q ha⁻¹) using multi crop seed cum ferti drill compared to traditional method of crop establishment (Tarun K.M, 2006). Drum seeder reduces *cost of cultivation* by 11,708 ha⁻¹, *increases net income* by 14,673 ha⁻¹ and *yield* by 243 kg ha⁻¹, labour and time saving of 90 per cent and 75 per cent *respectively over conventional method of transplanting* (Senthikumar *et al.*, 2010). The paddy transplanter saves seed quantity by 21 kg ha⁻¹, labour of 40 per cent, net returns increased by Rs.7664 ha⁻¹ and grain yield was increased by 0.87 t/ha over traditional transplanter (Sing, R.S and Rao, K.V.R.). Cono weeder increases weed control efficiency up to 85.5 per cent over manual weeding (Anantachar *et al.*, 2016). Combined harvester saves average time, cost and grain over manual methods by 97.5 per cent, 35 per cent and 2.75 per cent, respectively (Hossain *et al.*, 2015). Hold on type paddy pedal thresher showed 96.7 per cent threshing recovery, 98.8 per cent threshing efficiency and 90.7 per cent cleaning efficiency over traditional method of threshing (Weerasooriya *et al.*, 2011). Mechanization plays a very crucial role in agricultural sector, in rice cultivation.

Key words : Laser land leveler, Drum seeder, Paddy transplanter, Cono weeder, Combined harvester

MODE OF ZINC APPLICATION ON GROWTH AND BIOCHEMICAL CHANGES IN YIELD OF RICE

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The treatments include viz- Control, ZnSO₄ 15 kg ha⁻¹ (recommended), 2% ZnSO₄-foliar spray at 30 DAT, 3% ZnSO₄-foliar spray at 30 DAT, 5% Zinc oxide- aqueous slurry, 4% Zinc oxide- aqueous slurry, 3% Zinc oxide - aqueous slurry. soil of the experimental field was salty loam in texture, poor in organic carbon and nitrogen, medium in available P (35 kg ha⁻¹) and potash (260 kg ha⁻¹). The observations were recorded 25, 50, 75 and at maturity stage of crop. Data regarding growth parameters as plant height (cm), tiller production hill⁻¹, dry biomass hill⁻¹, relative water content (%) and biochemical changes as chlorophyll (SPAD Value), and sodium and potassium uptake by leaves were taken. Yield and yield attributing parameters were also recorded at crop harvest as panicle length (cm), number of panicle hill⁻¹, number of grain hill⁻¹, grain yield plant (g), grain yield qha⁻¹, test weight (g) and harvest index (%). Statistically significant plant height (cm), tiller production hill⁻¹, dry biomass plant⁻¹, relative water content (%), chlorophyll content (SPAD Value), carbohydrate content (mg g⁻¹ dry weight) were recorded with 3% ZnSO₄ foliar sprayed at 25 DAT followed by 2% ZnSO₄ foliar sprayed at 25 DAT. Regarding sodium and potassium content by leaf there were no any influence of zinc application. Yield and yield attributing parameters such as panicle length (cm), number of panicle hill-1 number of grains hill-1, grain yield plant (g), grain yield qha-1, and harvest index (%). Were significantly recorded with 4% ZnSO₄ foliar sprayed followed by 3% ZnSO₄ foliar sprayed at 25 DAT, while 1000 grain weight was found non-significant.

“EFFECT OF INTEGRATED NUTRIENTS MANAGEMENT ON YIELD, QUALITY AND NUTRIENTS UPTAKE BY MUSTARD (BRASSICA JUNCEA L.)”

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A field experiment was conducted to study the effect of organic and inorganic sources of nutrients on yield, quality and nutrients uptake by mustard (*Brassica juncea* L.) variety Pusa Mustard 30 (LES-43) at Crop Research Centre Chirori, Meerut during rabi season, 2016-17. The soil of experimental field was sandy loam texture, alkaline in nature with pH (8.2), low in organic carbon (0.41%) and available nitrogen (180.50 kg ha⁻¹), available phosphorus (16.80 kg ha⁻¹), available potassium (231.47 kg ha⁻¹), available sulphur (7.38 kg ha⁻¹). Fourteen treatments of different nutrient management practices consisting (T₁) Control, (T₂) Bio-fertilizers (Azotobacter + PSB), (T₃)

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100% RDF (120:60:60: 40, N:P:K:S,kg/ha), (T₄) 100% RDF + Bio-fertilizers, (T₅) 75% RDF + FYM 6 t/ha, (T₆) 75% RDF + FYM 6 t/ha + Bio-fertilizers, (T₇) 75% RDF + Vermicompost 2 t/ha, (T₈) 75% RDF + Vermicompost 2 t/ha + Bio-fertilizers, (T₉) 50% RDF + FYM 12 t/ha, (T₁₀) 50% RDF + FYM 12 t/ha + Bio-fertilizers, (T₁₁) 50% RDF + Vermicompost 4 t/ha, (T₁₂) 50% RDF + Vermicompost 4 t/ha + Bio-fertilizers, (T₁₃) 50% RDF+ FYM 6 t/ha + Vermicompost 2 t/ha and (T₁₄) 50% RDF+ FYM 6 t/ha + Vermicompost 2 t/ha+ bio-fertilizer were tested in randomized block design with three replication. The experimental results revealed that maximum growth parameters (plant height, branches plant⁻¹, dry matter accumulation and leaf area index), yield attributes (siliqua length, siliqua plant⁻¹, seeds siliqua⁻¹ and test weight), yield (grain and stover), nutrient uptake (N, P, K and S) by grain and stover and available soil nutrient (N, P, K and S), were recorded with application of 50% RDF+ FYM 6 t/ha + Vermicompost 2 t/ha+ bio-fertilizer higher than the rest of the treatments. The increment in seed yield with application of 50% RDF+ FYM 6 t/ha + Vermicompost 2 t/ha+ Bio-fertilizers was 168.35% over control. Maximum gross return, net return were recorded with the application of 50% RDF+ FYM 6 t/ha + Vermicompost 2 t/ha+ Bio-fertilizers, however B:C ratio was lower than the use of RDF only but in application of FYM and Vermicompost improved the physiochemical properties of soil which may improved the sustainability of production system.

OPTIMIZATION OF ENVIRONMENTAL FACTORS FOR PRODUCTION OF PLANT GROWTH REGULATORS BY *PSEUDOMONAS* AND *BACILLUS* SPECIES.

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Under the present study, an attempt was made to study production of bacterial plant growth regulators viz. auxins, gibberellins and cytokinins produced by indigenous strains of *Pseudomonas* and *Bacillus* species isolated from the rhizosphere of carnation and three medicinal plants viz., *Achryanthus aspera*, *Elaeagnus umbellata* and *Heracelum candicans* in the laboratory of Microbiology section in Department of Basic Science Dr YSP UHF Nauni, Solan H P. The effect of five factors viz. media, incubation period, temperature, pH, shake and stationary conditions were observed. The selected isolate preferred media for the growth and high production of plant growth regulators i.e. succinate media by both *Pseudomonas* strains for all the three growth regulators. Peptone water by both the *Bacillus* strains for production of auxins and cytokinins and *Bacillus* medium by *Bacillus* sp. for production of gibberellins. All the four bacterial strains produced maximum plant growth regulators at 72 h of incubation period at pH 7.0 under shake condition while the optimum temperature for the production of growth regulators was 30°C for both the *Pseudomonas* species and was 40°C for both the *Bacillus* sp. Two strains each of *Pseudomonas* and *Bacillus* species (*Pseudomonas* Mc, PS-II and *Bacillus* UF₂ and KN₆) were selected for further studies with the aim to find out the best indigenous plant growth regulators producing bacterial strains for application in field in order to increase yield and crop productivity and also to find out industrially important strains for the production of plant growth regulators.

VARIOUS ARTIFICIAL INOCULATION METHODS FOR DOWNY MILDEW AND WHITE RUST IN MUSTARD

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Indian mustard [*Brassica juncea* (L.) Czern and Coss.] is an important oil seed crop. The major fungal diseases are white rust (WR) *Albugo candida* and downy mildew (DM) *Hyaloperonospora brassicae*. The experiment was conducted at Oil seed laboratory and Glass house-Plant Pathology, College of Agriculture, GBPUA&T Pantnagar. Infected staghead samples were collected from *B. juncea* cv Varuna at NEB-CRC, Pantnagar. Suitable methods of inoculation for test pathogen, inoculation materials were prepared alone: seed, soil and spray; combination seed+ soil, soil+spray, seed+spray including check. Per cent disease index (PDI) was calculated (0-9) rating scale. PDI (Downy mildew): For (DM) in combination soil+spray treatment was most effective, given highest per cent disease index (48.33 %) and followed by seed +spray (43.67 %) and lower in alone, Seed (27.67 %). PDI (White rust): For (WR) disease index was highest in case of soil+spray (57.67 %) at 21 DAI (Days after inoculation) and followed by seed+spray (51.67 %) at 21 DAI and seed + soil (48.33 %) at 21 DAI. In case of soil+spray (44.67 %) at 14 DAI, followed by seed+spray (39.33 %) and seed + soil (35.33%) treatments. It was found that combination of treatments were effective at both 14&21 DAI. Incubation period (IP): Observed (IP) was most effective in case of combination soil+ spray treatment for both DM and WR. Alone: Spray treatment incubation period is most effective and followed by soil and seed treatment. (WR) pustule size: At 14 DAI, observed the pustule size small (S: 0.5-1.0 mm) in alone treatments viz., seed, soil and spray; medium in soil+spray, seed+spray and seed+soil mixed treatments. At 21 DAI, the pustule size went to medium (M: 1-3mm) in seed, soil and spray treatments and became large (L: 3-4mm) in case of mixed treatments viz., soil+spray, seed +spray and seed+soil indicating them as effective treatments to increase disease indices.

EVALUATION OF GROWTH AND YIELD COMPONENTS OF *BRASSICA JUNCEA* (L.) IN TARAI REGION OF UTTARAKHAND**SANJEEV RAVI* AND R.P. AWASTHI**

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Indian mustard [*Brassica juncea* (L.) Czern and Coss.] is an important oil seed crop. Popularly known as rai, raya or laha is one of the most important oil seed crops of the country. Evaluation of eight genotypes of (*B. juncea*) were selected and measured under different parameters, unprotected field condition at NEB-Crop Research Centre GBPUA&T, Pantnagar. Plant height: was observed maximum in EC-399301 (182.67cm) and lower in Divya (105.00 cm), both of the year. Racemes length: It was maximum recorded in Kranti (51.67 cm) and lower in EC-399302 (33.33cm), in second cropping season observed maximum in Divya and lower in EC-399296. Primary branches: Observed in Varuna (7.33), Kranti (6.67) and EC-399302(6.33) and lower in Divya (4.33). In next year more in EC-399313 and lower in Divya. Secondary branches: More in Varuna (9.33) and lower in EC-399299 (4.67). In next cropping season found that maximum in EC-399301 and minimum in EC-399313 and Varuna. Total number of pods per plant: Pods were found maximum in Kranti (188.00) and minimum in EC-399302 (147.33). In next year more in Divya and minimum number in EC-399302. Number of pods on main raceme: Maximum number of pods on main raceme in EC-399301(41.67) and significantly lower in Divya (23.33). In second cropping season more number of pods on main raceme, EC-399301 and minimum number in Varuna. Yield per plot: Yield was observed significantly higher in EC-399301 (870.00 gm) and followed by EC-399296 (786.67gm) and significantly lower in Divya (443.33gm). In next year observed high yield in EC-399301 and significantly lower in Kranti, Varuna and Divya. Yield per hectare was calculated on the basis of per plot yield. 1000 -seed weight: It was observed that seed weight maximum in Varuna and minimum in Divya. In next season, revealed that maximum in Kranti and minimum in Divya. It was found that both of the cropping season resistance genotypes EC-399301 and EC-399296 came out much yield per plot and then susceptible genotypes significantly lower yield was found in Divya and Varuna.

LIGHT TRAP USED IN INTEGRATED PEST MANAGEMENT AS MECHANICAL DEVICE IN RICE ECOSYSTEM**SANJU SINGH* AND AMIT KUMAR SHARMA**

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The field experiment was conducted at Jawaharlal Nehru Agriculture University, Jabalpur (M.P) during *kharif* season 2016, and using light trap tool as mechanical method in rice ecosystem for integrated pest management. Light trap is one of the very effective mechanical methods of insect pest management in sustainable agriculture. Light traps are mainly used at night in the field to collect various phototactic diversity of insects like moths, Coleopteran beetles and other Hemipteran bugs etc. For the taxonomic documentation, the light trap was operated every night and collection was observed on the next day morning. Total insect fauna was observed and sorted out on the basis of 2 major categories of economic importance: - I) Harmful insects- as crop pests. II) Beneficial insects- as bio-control agents (Predators and parasites). An insect pest of paddy and predator & parasite was observed on daily basis. Taxonomic analysis revealed that these 40 insect pest species of belonging to 3 orders and 17 families recorded throughout the *kharif* season June to October (2016). Based on number of species collected order Lepidoptera 22 species of 8 families, Hemiptera 6 species of 5 families and biocontrol agents of order coleoptera 12 species of 4 families. In Madhya Pradesh, rice is cultivated on 1.76 million hectares with annual production of 3.00 million tones and productivity of 1807 kg ha⁻¹. Majority of the insects are positively phototrophic in nature and use of light traps for insect catches produces valuable data. The objective of this study was to identify phototactic harmful insect fauna using light trap tool in rice ecosystem and describe them on the basis of taxonomic and economic aspects.

KEYWORDS:- Light trap, Rice, Taxonomic, Phototactic, Mechanical method

EFFECT OF SUSTAINABLE PRODUCTION MODEL ON PEARLMILLET (*PENNISETUM GLAUCUM*) WHEAT (*TRITICUM AESTIVUM* L.) CROPPING SYSTEM IN NORTH WESTERN PLAINS ZONE.**SANT BAHADUR SINGH AND RAJ VIR SINGH**

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The experiment was conducted at Agricultural Research Farm, R.B.S. College, Bichpuri (Agra) in the year 2014-15. There were four treatments i.e. T₁ - Recommended dose of NPK + Full package of practices (except weed control); T₂ - Recommended dose of NPK + Full package of practices + FYM; T₃ - Recommended dose of NPK + Full package of practices + Weed Control (Chemical/ Hand weeding); T₄ Soil test based fertilizer application + Full package of practices + nutrient deficiency, if any tested in Randomized Block Design. The maximum grain yield (29.10 q ha⁻¹) of pearl millet was obtained with T₂ (100% RDF-NPK + Full package of practices + FYM 10 t ha⁻¹), followed by T₄ (Soil test based fertilizer + Full package of practices + macro/micro nutrient deficiency, if any) and the minimum grain yield was recorded with T₁ (- Recommended dose of fertilizer NPK + Full package of practices without weed control). The response of

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FYM application @ 10 t ha⁻¹ was appeared quite clear and along with the relevance of soil test based fertilizer recommendation, correcting marginal deficiency of Zinc and Sulphur. The wheat yield was obtained maximum (53.40 q ha⁻¹) with T₂ - (RDF NPK + full package of practices + FYM 10 t ha⁻¹), closely followed by T₄ (Soil test based fertilizer + full package of practices + Macro/Micro nutrients deficiency, if any) and the minimum grain yield was recorded with T₁ (RDF -NPK+ Full package of practices without weed control).

STUDY ON CROP-WEED COMPETITION IN DIFFERENT CROPPING SITUATIONS

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A weed is important biological factor in crop production that cause yield reduction and it contributes around 45% of crop yield loss. Weed life cycle similar with crops and some weeds have same morphological character with crop plants and farmers difficult to identify it at early crop growth stage. So the main concern of this review is to know critical time for crop weed competition, effect of weeds on plant growth and development, physiological changes, yield performance weeds studies includes density, different weed floras and its dry matter accumulation, finally why and purpose of weeds compete with crops. Increasing initial weed competition period reduces crop germination and at later stage of crop growth reduces the growth and development parameters like plant height, dry matter accumulation, leaf area index, physiological parameters like CGR, RGR, NAR, Chlorophyll content, leaf thickness are reduces. Similarly, increasing weeds competition reduces crop yield drastically.

Key words: physiological, critical period, weed flora, dry matter, chlorophyll, competition, yield

INFLUENCE OF WEED DENSITY ON NUTRIENT UPTAKE OF GROUNDNUT IN MID HILLS OF NORTHEAST INDIA

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Groundnut is an important oilseed crop in India which grows almost all agro climatic situations of India. It supplies food, fodder and industrial raw materials. The ICGS-76 groundnut variety developed by ICRISAT, Hyderabad which is most suitable for rainfed situations due to mid season drought tolerance, photo insensitive and early duration in nature. Weeds are major problem in rainfed groundnut due to more water availability and which competes with crop to resources for their development and suppresses the crop growth. Here results are clearly showed that the highest weed density was observed in weeds up to 75 DAE treatment (385 m⁻²) at 75 DAE stage in *kharif*. While, at 60 DAE stage, weeds up to 60 DAE treatment gave higher weed density (501 m⁻²) in *rabi* season and highest weed density was observed in *rabi* as compare to *kharif*. Similarly, uptake of N, P, K and S from kernel (49.27, 11.67, 14.65 and 2.98 Kg/ha in *kharif*; 34.69, 8.58, 10.90 and 2.27 Kg/ha in *rabi*) and stover (75.93, 7.90, 76.18 and 6.42 Kg/ha in *kharif*; 71.80, 7.1, 70.46 and 6.42 Kg/ha in *rabi*) of crop was maximum in weed free check in both *kharif* and *rabi* season but, increasing the period of weeds competition with crop, reduces the crop uptake of Nitrogen, phosphorus, potassium and sulphur drastically.

Key words: Kernel, Stover, Compete, Density, Nutrients, Suppress.

RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT IN FRENCH BEAN (*PHASEOLUS VULGARIS* L.) FOR GREEN PODS PRODUCTION UNDER LATE SOWN CONDITION

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A field study was carried out at Vegetable Research Farm of C. S. Azad University of Agriculture and Technology, Kalyanpur, Kanpur *Rabi* during-2017, to assess the effect a field experiment was conducted in randomized block design with ten treatments and three replications. The field experiment consisted of 10 treatments viz. T₁ FYM @ 10 t ha⁻¹, T₂ Vermicompost @ 5 t ha⁻¹, T₃ Neem cake @ 2 t ha⁻¹, T₄ FYM @ 5 t ha⁻¹ + Neem cake @ 1 t ha⁻¹, T₅ Neem cake @ 1 t ha⁻¹ + Bio-fertilizer PSB @ 5 kg ha⁻¹, T₆ FYM @ 5 t ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹, T₇ FYM @ 5 t ha⁻¹ + Bio-fertilizer PSB @ 2.5 kg ha⁻¹, T₈ Half RDF of N, P, K @ 1 kg ha⁻¹ + FYM @ 2.5 t ha⁻¹, T₉ Half RDF of N, P, K @ 1 kg ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹ + Bio-fertilizer PSB @ 2.5 kg ha⁻¹, T₁₀ RDF of NPK kg ha⁻¹ through chemical fertilizers. The field observations (plant height, number of branches, dry weight of the plant, number of green pods per plant, length of per pods, number of grain per plant and green pods yield (q ha⁻¹)). Were recorded among the treatments. T₈, the present study finally it is concluded that application of Half RDF of N, P, K kg ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹ + Bio-fertilizer PSB @ 2.5 kg ha⁻¹ could be recommended for higher production of French bean.

EFFECT OF NPK LEVEL AND BIOFERTILIZER ON QUALITY PARAMETER AND SEED YIELD OF LINSEED (*LINUM USITATISSIMUM* L.) VARIETIES UNDER IRRIGATED CONDITION**SANTOSH KUMAR¹, J.K.SINGH², VIVEK¹, N.S. RANA¹**¹Department of Agronomy, ¹Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut 250110, ²Department of Agronomy, IAS, BHU Varanasi 221 005, Uttar Pradesh

Oilseeds occupy an important position in the agricultural economy of India. Currently India's total oilseed production is expected to grow 6.4 per cent to 37 million tons in 2015-16. Strong market prices for oilseeds and yield improvements will likely increase oilseed crush and push total oil meal production to 17.8 million tons, an increase of 6 per cent in 2015-16. Growing international demand for animal feed is also expected to push Indian oil meal exports to 5.6 million tons. Edible vegetable oil production and consumption are expected to increase to 7.6 million tons and 18.6 million tons, respectively. As a result, imports will increase to reach almost 11 million tons annually. A field experiment was conducted at Banaras Hindu University, Varanasi with treatment combinations of three NPK levels (50-30-20; 75-45-40 and 100-60-60 kg NPK/ha) in main plots and three levels of biofertilizers [Azotobacter, phosphate solubilizing bacteria (PSB) and combination of the both] in sub plots replicated in the thrice under split plot design. Results revealed that growth parameters, yield attributes and seed and stover yields were significantly higher under medium level of fertility (75-45-40 kg NPK/ha) as compared to low and higher level of fertility. The magnitude of increase in seed yield under medium over low and high levels of fertility was 22.4 and 13%, respectively. The maximum oil content (40%) and total NPK removal was observed under 50-30-20 kg and 75-45-40 kg NPK/ha, respectively. The iodine value which indicates the degree of unsaturation was decreased with either of increasing levels of NPK from 50-30-20 to 100-60-60 kg/ha or dual inoculation of seed with Azotobacter and PSB. The interaction effect indicated that the maximum seed yield (1318 kg/ha) and net return (38.92x103 Rs/ha) were observed from 'Sweta' variety of linseed fertilized by 75-45-40 kg NPK/ha along with dual inoculation of seed with Azotobacter and PSB grown under irrigated condition.

Key Words: Biofertilizers, Linseed, NPK levels, Oil quality and Yields.

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Seed is a basic agricultural input and it is an embryo, embedded in the food storage tissue. Seed is also defined as a matured ovule which consists of an embryonic plant with storage of food and surrounded by a protective seed coat. Every farmer should be able to access healthy seeds which are genetically pure, with high seed vigour and good germination percentage. Timely availability of good quality seeds at reasonable price ensures good yield and profit to the farmers. The seeds play a vital role in agriculture and acts as a carrier of the genetic potential of varieties. Quality seed production which follows efficient certification procedures plays a major role in the increase of food production of our country. To ensure this, the Government has prescribed standards and has brought in seed production techniques, testing, certification and marketing procedures through the Seeds Act, 1966. In the current scenario, the demand for good quality certified seeds far exceeds the availability in the market. This manual provides details about production and procurement of good quality seeds.

Key Words: Seed, Seed Production and Seed certification

ADOPTION OF NEW TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE**SANTOSHI KUMARI BALAGA¹ AND DR. DEEPAK KUMAR MOHANTY²***1: M S Swaminathan School of Agriculture, Centurion University, Paralakhemundi, Gajapati, Odisha, 2: Dept. of Ag. Engineering, Krishi Vigyan Kendra Mayurbhanj-II, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha*

Indian economy made many long strides towards its socio-economic progress and made substantial development in almost all the sectors of its economy during the last fifty years. However, the success was heavily dependent on the success of the primary sector i.e., agriculture. Agriculture is essential for inclusive development because it produces food as well as economic wealth for many of the world's poorest people that allows for improved livelihoods through better health care, education, infrastructure improvements and greater investment in environmentally sound practices. At the global level, the adoption of improved agricultural technology is now considered critical to the attainment of the Millennium Development Goal (MDG) of reducing extreme poverty and hunger. Agricultural new technologies are the factors of production which have undergone some form of amendment from their original state with the intent of enhancing their performance. Adoption of improved agricultural technologies has been associated with higher earnings and lower poverty. Therefore the adoption of improved technology, key to agricultural development or increased productivity, basically depends on farmers' decision.

Keywords: Adoption, new technology and decision.

WATER MANAGEMENT STUDIES OF BARLEY CROP CULTIVARS UNDER WARMING CLIMATE SCENARIOS

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Moisture requirement of barley (*Hordeum vulgare* L.) during *rabi* 2016-17 for Ludhiana and Gurdaspur districts of Punjab were computed using FAO developed windows based decision support system namely CROPWAT (v. 8.0) involving various weather parameters. The experiment was laid out in split plot design with three replications comprising of three sowing environments D₁ (25th October), D₂ (10th November), D₃ (25th November); two varieties V₁ (DWRUB 52) & V₂ (PL 807) and three irrigation levels viz. I₁ (Recommended irrigation), I₂ (Skip at vegetative stage) and I₃ (Skip at anthesis stage). ET_o along with radiation use efficiency was also estimated for both the region and the value stayed higher for Ludhiana as compared to Gurdaspur. Ludhiana recorded ET_o and RUE 2.74 mm day⁻¹ and 14 MJ/m²/day respectively followed by Gurdaspur to the tune of 2.17 mm day⁻¹ & 12 MJ/m²/day respectively. With the existing temperature, average crop irrigation water requirement computed by CROPWAT using crop coefficient approach was found maximum for Ludhiana (299 mm/dec) than that of Gurdaspur district (173 mm/dec). Increase in temperature up to +2°C from the present state simulated the seasonal ET rate @ 2.85 mm day⁻¹ for Ludhiana and for Gurdaspur region, the value was found @ 2.24 mm day⁻¹. Similarly, seasonal irrigation water requirement was increased from 299.9 mm to 316.6 mm for Ludhiana and for Gurdaspur, the same increased from 173 mm to 185.3 mm with the enhancement of temperature up to +2 °C from the existing conditions. Percent departure of ET_o was also measured which stipulated that the irrigation requirement and ET of barley will be influenced significantly more in Ludhiana as compared to Gurdaspur region in the backdrop of prevailing climate change scenarios.

Keywords: CROPWAT, Barley, FAO, RUE, DSS, Irrigation water requirement.

ROLE OF BIOFERTILIZERS IN INCREASING NUTRITIONAL STATUS OF CEREALS

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In 1960s, India was known to world as begging bowl but now has managed to achieve the status of food secured nation in the world. In present scenario, nutritional security is a buzz word which seeks attention particularly, nutritional status of cereals is a big concern as these are consumed around 52% by Indian population in their daily diet of Indian population. Nutrient deficient crops lead to malnutrition. According to WFS, about 45% of children deaths are associated with poor nutrition in 2012. Therefore, to minimize this problem the nutritional status of cereals needs to be improved. In this regard, biofortification may play a significant role, which aims to increase nutrient level in crops during plant growth. Use of biofertilizers is one of the potential management strategies to boost nutritional status of the cereals. The protein, starch and gluten content in wheat grains were found significantly higher in Super Granules of bio-fertilizer (SGBF) treated plots as compared to application of urea alone (Kumar *et al.*, 2014). Bio-fertilizer (*Azospirillum brasilense*) in combination with 50% NPK and 5 t FYM/ha recorded significantly higher NPK uptake in kodo millet than application of 100% inorganic fertilizers (Dwivedi *et al.*, 2016). Biofertilizers viz., *Azotobacter spp.*, *Azospirillum brasilense* in combination with 50% NPK managed to achieve higher β -carotene (precursor of vitamin A) and protein content as compared to 50%NPK alone (Behra *et al.*, 2009). Thus use of bio-fertilizers is one of the promising ways to biofortify the cereals. Integration of biofertilizers with half of recommended NPK along with organic manure is the best bet option for higher crop and nutritional productivity.

'BEEKEEPING: A SUSTAINABLE APPROACH IN AGRICULTURE'

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The potentiality of beekeeping is enormous in favor of agriculture based rural economy of India. Though, beekeeping is best known for the production of honey and other bee products like royal jelly, bee wax, propolis, bee pollen and bee venom, its contribution in crop production by ensuring the cross pollination is also incredible. It not only ensures the supplementary nutritional intake but also offers the supplementary income and employment to the rural farmers. It also plays an indispensable role in sustaining the biodiversity in forest ecosystem by the pollination of trees and other natural vegetation. Beekeeping have proved to be as 5th input for agriculture which regulates the efficacy of other four inputs i.e. land, labour, capital and management including seed, fertilizer, pesticides, water, machinery, etc. The cross pollination by honeybees increases average agricultural yield by 20 to 25%. A number of varieties of apples, pear, plum, peaches and cherries are known to be self sterile and benefitted by bee pollination. Besides, a potential increase in yield also occurs in many other crops like mustard, rai, toria, sarson, rapeseed, safflower, linseed, niger, sunflower, alfalfa, berseem, broad beans,

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dwarf beans, kidney beans, runner beans, arahar, radish, cabbage and turnip due to the bee pollination. The sustainable development of agriculture has demanded the reorientation of the current status of crop production technologies and the bee pollination is a key constraint to the sustainability of contemporary agriculture. Thus the necessity of beekeeping, its expansion and development is requisite in the view of sustainable future.

DOUBLING THE FARMERS' INCOME THROUGH INTEGRATED FARMING SYSTEM

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Livelihood security, nutritional improvement, agricultural sustainability and environmental safety have been major concern of Indian agriculture in context of small-farm holders representing more than 86% of farm families. Past experience has clearly demonstrated that the income from cropping alone is hardly sufficient to sustain the farmers' needs. The integrated farming systems (IFS) approach is considered to be the most powerful tool to enhance the profitability of farming systems, especially for small and marginal farm-holders. It can be concluded that diversification of existing farming systems with changes, addition or improvement of crop and livestock components and inclusion of horticulture are essential to improve on-farm income of small holders with environmental restitution. Diversification of existing farming systems clearly demonstrated the advantages in terms of production increase and employment generation. IFS paves way for meeting with the household demands of balanced food, improved recycling of nutrients and water besides increasing the on-farm employment for family. Recycling and intermittent use of products and by-products within the system could save in cost to the extent of 45% and even more.

Key words; IFS, diversification, employment generation, profitability, nutrient recycling

“ROLE OF ON-LINE COMMUNICATION TECHNOLOGY IN AGRICULTURE DEVELOPMENT”

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On-line Communication technology has been considered as a tool that can be used to achieve development goals in developing countries. These technologies may help to fight against disease, unemployment, poverty, agriculture and other development problems. Agriculture plays a huge role in the society and the economy of the country. Nowadays, new advanced technologies are used for agricultural development, such as satellites, the Internet, mobile phone and social media. On-line Communication Technology can be used to improve agricultural information and farming methods with transformational development. In India around 70% of population earns its livelihood from agriculture. Agriculture needs continuous diffusion of new technology to meet global food security, poverty reduction and environment sustainability. On-line Communication Technologies in agriculture have the potential to facilitate greater access to information that support knowledge sharing. They facilitate the creation, storage, retrieval, and dissemination of any relevant data, and information that may have been already been processed and adapted. On-line Communication Technology in agriculture is an emerging field focusing on the enhancement of agriculture development in India. They can provide accurate information for the farmers which facilitates better agriculture output. But in Indian still in growing stage and evolving as an emerging trend the benefit of On-line Communication Technology is yet to reach all the farmers. Perhaps technological innovation many farmers, especially who are share croppers are not getting proper information and service due to poor economic condition and social constraints. Other factors are illiteracy, language barriers and unwillingness to adopt the new technology. The way in which On-line Communication Technology projects access, assess, apply, and deliver content may increase the likelihood of On-line Communication Technology used by farmers and thus may become an important factor in a project success. To address the information needs of farmers, relevant content is a key component of On-line Communication Technology projects.

ITK FOR CONSERVATION IN AGRICULTURE

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Indigenous technical knowledge (ITK) is the local knowledge that people have gained through inheritance from their ancestors. It is a people derived science and represents people's creativity, innovations and skills. We have many indigenous techniques for conserving natural resources. These have been in practice for number of years as presented in the write up. Therefore there is a need to enmesh these practices along with conventional soil and water conservation measures for promoting sustainable development of agriculture. It may not be out of place to mention that some of these ITKs may need minor modifications in different watershed situations as well as socio-economic fabrics across the country. Inclusion of these ITKs would ensure sustainability of different eco-systems, befitting the man-

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animal plant-land-water complex in each watershed. Indigenous technological knowledge pertains to various cultural norms, social roles or physical conditions. Many ITKs on in-situ soil and moisture conservation are not adopted everywhere throughout India because of constraints in adoption and unawareness of the effectiveness of such practices. The promotion of appropriate technology with indigenous knowledge base will be effective in the natural resource management programme for increasing their adaptability/acceptability and to bring down the dependence on cost intensive technologies and help conservation of natural resources in agriculture.

Keywords: ITK, sustainability, conservation.

TRANSFER OF AGRICULTURAL TECHNOLOGIES THROUGH RECENT EXTENSION COMMUNICATION TECHNIQUES FOR FARMER'S PROSPERITY

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The effective transformation of technologies is high need of the hour to save food which may helpful to feed the mounting population of country. Effective extension in agricultural development requires a change of extension approach as a sole strategy in achieving effective and competitive agricultural development. Extension, in the current faces challenges of tackling objectives like promoting environmentally sustainable agricultural practices and efficiently linking of farmers to local and international markets including non-farm employment and enterprise expansion pairing technology transfer with other services relating to both input and output markets. Extension should play the key role to transfer of technical knowledge among the different entities to improve the overall performance of the innovation system. The recent advances in ICT can be used effectively in extension education for transfer to technologies by using digital extension paradigm for transfer of technology. The technology transfer involves a toptown approach that delivers specific recommendations to farmers about the practices they should adopt by 1. Mobile access for audio interaction and messaging 2. Television (audio-video) 3. Interactive video chat through android mobile phones 4. Tele-conferencing 5. E-mail 6. Face book 7. Whatsapp 6. Computer etc. In the present scientific era the technology, which is profitable, demonstrable, compatible and its dissemination should be quick. The Internet and other forms of computer networking can be of much useful for exchange of markets and other kinds of technical information to ascertain the prosperity and profitability of the farmers.

Keywords: Extension paradigms, food security, Prosperity of farmers, transfer of technology

INTEGRATED FARMING SYSTEMS APPROACH PROVES BACKBONE FOR DOUBLING INCOME OF SMALL AND MARGINAL FARMERS

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The integrated farming approach leads to sustainable agriculture to increase farm yield and managing resources in order to address all three critical aspects of sustainability like economic, environmental and social with multiple objectives of sustainability, food security, farmer security and poverty reduction. It involves use of outputs of one enterprise component as inputs for other related enterprises wherever feasible, for example, cattle dung mixed with crop residues and farm waste can be converted in to nutrient-rich vermi-compost. The salient features of IFS include innovation in farming for maximizing production through optimal use of local resources, effective recycling of farm waste for productive purposes, community-led local systems for water conservation, organic farming, and developing a judicious mix of income-generating activities such as dairy, poultry, fishery, goat-rearing, vermin-composting and others. Presently small and marginal farmers struggling for better economic progress from small piece of land which is quite difficult without making agriculture high tech and full of innovations which is again not be possible without investing good amount of money. And with this farmers should also get remunerative price of their produce then only agriculture may be profitable venture. But now economic boost of farmers may be possible by using multidimensional approach in agriculture. The integrated farming approach may play very crucial role in economic growth of farmers in general and for small and marginal farmers especially because this system provides farmers a platform to get income from many ventures at time, so income multiplication become possible by adopting agriculture with animal production as well simultaneously covering, dairy, poultry, goatry etc. The small enterprises also can be established with less investment. The Integrated Farming Systems /approach may be more suitable for small and marginal farmers for their economic upliftment.

Keywords : Animal production, Economic growth, Integrated Farming System, small and marginal farmers.

WATER FOOTPRINT FOR SUSTAINABLE AGRICULTURE

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Human activities consume and pollute a lot of water. At a global scale, most of the water use occurs in agricultural production, but there

are also substantial water volumes consumed and polluted in the industrial and domestic sectors. Water consumption and pollution can be associated with specific activities, such as irrigation, bathing, washing, cleaning, cooling and processing. Freshwater resources are becoming scarcer due to an increase in population and subsequent increase in water appropriation and deterioration of water quality. The impact of consumption of people on the global water resources can be mapped with the concept of the 'water footprint'. The water footprint of a nation has been defined as the total volume of freshwater that is used to produce the goods and services consumed by the inhabitants of the nation. It deviates from earlier indicators of water use in the fact that the water footprint shows water demand related to consumption within a nation, while the earlier indicators (e.g. total water withdrawal for the various sectors of economy) show water demand in relation to production within a nation. The water footprint is an indicator of freshwater use that looks not only at direct water use of a consumer or producer, but also at the indirect water use. The water footprint can be regarded as a comprehensive indicator of freshwater resources appropriation, next to the traditional and restricted measure of water withdrawal. The water footprint of a product is the volume of freshwater used to produce the product, measured over the full supply chain. It is a multidimensional indicator, showing water consumption volumes by source and polluted volumes by type of pollution; all components of a total water footprint are specified geographically and temporally. The water footprint thus offers a better and wider perspective on how a consumer or producer relates to the use of freshwater systems. It is a volumetric measure of water consumption and pollution. It is *not* a measure of the severity of the local environmental impact of water consumption and pollution. The local environmental impact of a certain amount of water consumption and pollution depends on the vulnerability of the local water system and the number of water consumers and polluters that make use of the same system. Water footprint accounts give spatiotemporally explicit information regarding how water is appropriated for various human purposes. They can feed the discussion about sustainable and equitable water use and allocation and also form a good basis for a local assessment of environmental, social and economic impacts.

PRODUCTION PERFORMANCE OF POULTRY GENOTYPES UNDER TRADITIONAL SYSTEM OF REARING IN KONKAN REGION OF MAHARASHTRA

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The present experiment was conducted at Poultry Unit, Department of Animal Husbandry and Dairy Science, Dr. B. S. Konkan Krishi Vidyapeeth Dapoli, Maharashtra to assess the comparative growth performance and feed efficiency of poultry genotypes. The experiment was carried out on four different types of poultry genotypes viz., - Kadaknath (T₁), Vanaraja (T₂), Giriraja (T₃) and Rhode Island Red (T₄). For this experiment, 200 one day old chicks were divided in five replications and each replicate have 10 birds. Results showed that Giriraja birds gain significantly higher daily body weight gain, weekly body weight gain and total body weight gain with superior feed conversion efficiency compared to Vanaraja, Kadaknath and Rhode Island Red. The benefit cost ratio (B: C ratio) higher achieved by Kadaknath birds. From the results of present investigation, it can be suggested that the rearing of Kadaknath as well as Giriraja poultry birds are more beneficial and efficient than Vanaraja and RIR in Konkan Agro-climatic condition of Maharashtra.

Key words: Feed efficiency, growth rate, poultry breeds, weight gain, net profit.

NOVEL FUNGICIDE AND THEIR MODE OF ACTION AGAINST THE PLANT DISEASES

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Fungicides continue to be essential for the effective control of plant diseases. New classes of fungicides with novel modes of action are being developed since 1990s. These include the strobilurins, phenylpyrroles, anilinopyrimidines, and compounds that trigger defense mechanisms in the plant. *In vivo* glasshouse screens and field trials are expected to remain the dominant methods for characterizing new compounds. Low toxicity to humans and wildlife, low environmental impact, low residues in food, and compatibility with integrated disease management (IDM) programs are increasingly important considerations in the selection of fungicides for development. Classification of Fungicides on the basis of mode of action, general uses, chemical composition and generation of fungicides like first generation of fungicides (1800-1940), Second generation of fungicides (1940 - 1967), third generation fungicides (1970- 1996) and fourth generation fungicides (1996 onwards). Fourth generation fungicides are referred as novel fungicides. On the basis of mode of action, fungicides are divided into Single-site Inhibition fungicides like which effects on specific single target site like inhibition of synthesis of lipids, sterol, and other membrane components, amino acids and protein synthesis, respiration, mitosis and cell division, nucleic acids biosynthesis and multi site inhibition fungicides, those fungicides acts on multi sites of Fungus. Study about the biochemical mode of action of fluopicolide, new fungicides like metrafenone, famoxadone, spiroxamine, reliant and strobilurin fungicides and their respective novel mode of actions, we will also be dealt with and elaborated in the changing scenario of agriculture,

these novel chemicals needs to be popularized at mass scale.

PROFITABILITY OF MUSTARD THROUGH FRONT LINE DEMONSTRATIONS

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Cluster front line demonstrations (14 at Balia khedi & 16 block Rampur Maniharan) on the farmers field were conducted on complete recommendation package of practices in comparison up to farmers practice during Rabi 2017 on Mustard Crop in two Block of Saharanpur District of Western Uttar Pradesh. On the basis of two blocks average result indicated that higher seed yield 26.8qtl/ha Net monetary return Rs.83360/ha & B.C. Ratio 4.5 of Mustard variety RH-749 was obtained under recommended package of practiced which was 37.36% higher seed yield as compare to farmers practices. Farmers practice obtain 18.2qtl/ha Mustard yield variety PM 26.0 Net monetary return Rs. 51500 & B.C. Ratio 3.2 of Mustard only.

REGULATORY ROLE OF MINERAL ELEMENTS

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Various mineral ions are recognized as vital plant nutrients that are directly incorporated into organic compounds synthesized by the plant. Out of these, potassium, phosphorus, calcium, magnesium and sodium are the most important quantitatively and are recommended for composition analysis (Anonymous 2004b). Minerals are inorganic nutrients, usually required in small amounts from less than 1 to 2500 mg per day. Vitamins and other essential food nutrients, mineral requirements varies with animal species. For example, humans and other vertebrates need large amounts of calcium for construction and maintenance of bone and normal functioning of nerves and muscles. Phosphorus is an important constituent of adenosine triphosphate (ATP) and nucleic acid and is also essential for acid-base balance, bone and tooth formation. Minerals have a diversified role in plant metabolism. Severity or scarcity of these causes miscellaneous effects in plant metabolism. Each and every aspect of plant biochemistry, physiology, anatomy, etc. is affected due to mineral nutrient composition of soils. The concentration of these minerals of both group i.e. activators or inhibitors present in the soil play a vital role in secondary plant metabolism. Minerals also play a major role in the reproduction in plants. Bioactive molecules of medical relevancy such as alkaloids, flavonoids, lignin's, lipids, carbohydrates, resins, glycosides, phenolic compounds, volatile oils, vitamins, tannins etc. produced through various biosynthetic pathways of plants are a boon to urban, hilly and remote population of each nation.

Keywords: Aadenosine triphosphate, Bioactive molecules, Biosynthetic pathways

THE ROLE OF INFORMATION TECHNOLOGY IN PRECISION FARMING

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Agriculture is the backbone of India having 2.4% of total geographical area and supports 17.5% of world population and over 30% of world small holder's farmers and 4% of world's water resources. India is second largest arable land after the USA. The arable land per capita availability is 0.12 ha. The land is decreasing day by day and population is increasing day by day. The total food grain production is 277.49 million tonnes (June, 2018). The food demand by 2050 is projected to almost double and realized in an environment-friendly sustainable manner from the shrinking land, water, and biodiversity resources. The sufficient availability of food is the biggest challenges of the country. The second green revolution or sustainable green revolution is possible through the use of e-Agriculture. "The e-Agriculture defined as the dissemination of agricultural technologies at the right time to the right people living in dispersed geographical area". The precision farming is the one of the most emerging concept in India. It has the huge potential in Indian agriculture to transforming from conventional farming to modern agriculture. The e-Agriculture is provides the appropriate information of farmer so that the farmer can understand use and the importance of e-Agriculture. It provides the better utilization of input such as land, Labours, capital, management and 5th is information technology. Information technology is the branch of engineering that deals with the use of computer and Tele-communication to retains, store and transmit information."

Key words- Information Technology, e-Agriculture, Precision farming and drone technology.

APPLICATION OF GENE TAGGING IN CROP IMPROVEMENT**SAURABH SINGH¹, KUMARI SHIKHA^{2*}, VAIBHAV SINGH³ AND PRIYANKA JAISWAL⁴**^{1,3} *Horticulture*; ^{2,4} *Genetics and Plant Breeding, Banaras Hindu University*

Over the past few decades, progress has been made in an understanding plant genome. Gene tagging is one of the advance molecular approaches which refers to the identification of existing DNA by marking or tagging interrupted genes with a unique DNA sequence through insertional mutagenesis. This DNA sequence subsequently can be utilized as a target for hybridization or as an annealing site for PCR primers, allowing flanking sequences to be isolated. It is useful in assigning functions to the large quantity of sequence information, gene cloning and marker-assisted selection. This gene tag can be either T-DNA, transposons, molecular marker, epitope etc. In this article, we attempt to review most of the gene tagging methodologies and its application in crop improvement. These days, it is the most commonly used approach for selection of biotic and abiotic stress-resistant plants. It is more studying the genomics, metabolomics, transcriptomics and proteomics.

Keywords: Gene Tagging, Genomics Metabolomics, Transcriptomics and Proteomics

IMPORTANCE OF VERMICOMPOST AS A SOURCE OF ORGANIC MANURE**SAWAN KUMAR^{1*}, JOGINDER KUMAR² AND PRIYANKA³**^{1,2,3} *Department of Soil Science, CCS Haryana Agricultural University, Hisar, India-125004*

Vermicompost is the product of the composting process using various species of worm, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. Vermicast (also called worm castings, worm humus, worm manure, or worm faeces) is the end-product of the breakdown of organic matter by earthworms. These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than the organic materials before vermicomposting. Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small scale sustainable, organic farming. Vermicompost play an important role in improving growth and yield of different crops like vegetables, fruits and flowers. After using compost in most of the crops, it has been found that germination percentage as well as produce quality is very high. Apart from supplying nutrient and growth hormones to plants, vermicompost improves the soil structure leading to an increase in water and nutrient holding capacities. The commercial production of vermicompost is increasing at tremendous rate because of low production cost and high returns. In India, it costs about 4-5 rupees per kilogram and can be sold about 10-12 rupees per kilogram in open market. Moreover, it can be used in all types of crops.

Keywords: Vermicompost, Earthworm, Casting, Nutrient, Organic Farming

INFLUENCE OF NITROGEN LEVELS ON PRODUCTIVITY AND PROFITABILITY OF FINGER MILLET GENOTYPES**SIMAKUMARI, RAJNISHANAND AND C.S. SINGH***Birsa Agricultural University, Ranchi, Jharkhand 834006*

The experiment was conducted at Birsa Agricultural University Farm Ranchi, during kharif (rainy) season of 2009. The experiment was conducted in Randomized Block Design with three replications and twenty treatment combinations consisting of four nitrogen levels (0, 20, 40 and 60 kg N/ha) and five medium duration finger millet genotypes (TNAU-1022, OEB-219, KMR-204, RAU-8 and BM-2). Finger millet genotypes respond positively to nitrogen levels and application of 40 kg N/ha manifested significantly higher grain yield (20.71 q/ha) and straw yield (54.12 q/ha) of finger millet also improved significantly only upto 40 kg N/ha resulting is significantly higher net return (Rs.7235/ha) and Benefit: cost ratio (1.24). Among genotypes, BM-2 was found superior to rest of the genotypes except RAU-8 which was comparable to BM-2. Genotype BM-2 has outstanding performance in respect grain yield (19.54 q/ha) and straw yield (52.44 q/ha). The economics of result also revealed that BM-2 genotypes gave significantly higher net return (Rs.6816/ha) and benefit: cost ratio (1.20) than other genotypes except RAU-8.

PROCESS OPTIMISATION FOR FORMULATION OF PROTEIN RICH RECONSTITUTED RICE: VALORISATION OF RICE BY-PRODUCT**'SHAGHAF KAU KAB, S. K. JHA AND ABHIJIT KAR***Division of Food Science & Postharvest Technology, ICAR-IARI, New Delhi, India* ²*Principal Scientist, Division of Food Science & Postharvest, Technology, ICAR-IARI, New Delhi, India*

Food and nutritional security necessitated development of alternatives to staple foods. Rice provides 30 to 70 % of the calorific need of the country men and its processing produces 16-20 % of broken that has the potential to feed 290 million people. Therefore, with the objective to valorise these processing by-products and complementing it with protein and micronutrients, formulation of reconstituted rice was carried out. Rice was reconstituted using flours of cheaper ingredients viz. broken rice and soya in the proportion of 3:1.

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Extrusion process was adapted for protein, micronutrients and fibre rich reconstituted rice as non-agronomic and non-genetic method. Formulating reconstituted rice was optimized using central composite design and data were analyzed through response surface methodology. Objective of optimisation was to maximise bulk density, water uptake ratio and minimise cooking time, cooking loss, b value of colour and chewiness (none) at varying range of temperature, moisture content and screw speed. Reconstituted rice with high nutritional and sensorial characteristics was obtained at 67 to 68 °C barrel temperature, 19 to 22% (wb) feed moisture content and 45 to 49 % rated screw speed of the extruder. Optimised reconstituted rice was further evaluated for its sensory and cooking quality by functionalising it with binders and whitening agents like soy isolate, starch, guar gum, sodium alginate and CaCO₃ and their combinations. Friedman's non parametric test results suggested 1% soya isolate with 3% CaCO₃ as the most effective in improving overall quality of the product. This study suggested that reconstituted rice has immense commercial potential in meeting the modern day requirements off working population of instant nutritive products Thus, the product obtained could be used as the nutrition rich instant replacement for natural rice.

NUTRACEAUTICS IN FINGER MILLET - A BOON FOR HILL AGRICULTURE

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Finger millet (*Eleusine coracana* L.) is considered as a major field crop in hilly regions of North Western Himalayan regions which predominantly is grown as rainfed crop. It is advantageous for hilly farmer as it requires less water and care. Apart from this finger millet is remarkable in nutraceutical properties. It is rich source of phytochemicals, dietary fibres, polyphenols, vitamins and minerals and offer several health benefits to its consumers. Germinated finger millet can be a good substrate for statins (anti-hypocholesterolemic metabolites) production. Various in vitro and in vivo studies demonstrated its blood glucose lowering, cholesterol lowering and wound healing properties. It can be used for the preparation of dietetic foods for anaemia patients and geriatric food formulation. Several work demonstrated the antioxidant properties of millet. Finger millet also possesses antimicrobial activities. Protein glycation, one of the complications of diabetes, was inhibited by methanolic extract of finger millet. Finger millet phenolics can inhibit aldose reductase and snake venom phospholipases too. Among the cereals and millets, finger millet is the richest source of calcium (344 mg %) and potassium (408 mg %). Specifically, it is the richest source of Calcium among cereals with up to 10-fold higher Calcium content than brown rice, wheat or maize and three times than that of milk. It is also rich in iron and fiber, making this crop more nutritive as compared to other most commonly used cereals. Finger millet is enriched in the essential amino acids like lysine and methionine which are important in human health and growth but remain absent from most other plant foods. In addition, it also contains useful amounts of the two polyunsaturated fatty acids- linoleic acid and α -linolenic acid metabolized products of which facilitate normal development of the central nervous system. It also contains both water soluble and liposoluble vitamins: thiamin, riboflavin, niacin, and tocopherols. As finger millet is often grown and consumed primarily in developing countries by small-hold farmers with limited agronomic resources, it is often referred to as a "crop for the poor" or a "famine food". Despite the well-documented health benefits of finger millet, only a limited progress has been made in context to its nutraceutical applications as functional food. Although, it may have remained underutilized by the general population due to either unawareness or apprehension, its immense potential for enhancing the nutritional and therapeutic attributes by acting as functional food cannot be ignored.

ICT IN AGRICULTURE: A ROAD TO DOUBLING THE FARMERS' INCOME

***SHAHAMIR**

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Information and communication technology in agriculture (ICT in agriculture), also known as e-agriculture, is developing and applying innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. ICT in agriculture offers a wide range of solutions to some agricultural challenges. It is seen as an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. E-agriculture continues to evolve in scope as new ICT applications continue to be harnessed in the agriculture sector. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture.

Keywords: e-agriculture, ICT, rural development, innovative and institutional capacity.

EFFECT OF BENZYLADENINE ON PHYSIOLOGICAL AND CHLOROPHYLL CHANGES OF ARTIFICIAL DROUGHT STRESS IN MAIZE SEEDLINGS.**SHAILESH AHIRE, PRANETI SONAWANE J. P. PATIL AND DR. PANKAJ SURYWANSHI***Department of Biochemistry and Molecular Biology, Anand Agricultural University, Anand-388110.*

Investigations were carried out at Department of Biochemistry, B. A. College of Agriculture, Anand Agricultural University, Anand to study the physiological and chlorophyll characterizations of two maize genotypes (resistant and susceptible) procured treatment given to seed followed by artificial drought (PEG) stress at 15 DAS. However, resistant genotype showed better performance in higher root-shoot length and weight than susceptible genotype under drought stress conditions, through treatment BA was higher root-shoot length and weight in resistant and susceptible genotypes. Biochemical analysis was carried out total chlorophyll content were increased in both the genotypes (resistant and susceptible) due to drought stress. Application of BA (25 ppm) could be increased in total Chlorophyll content and physiological parameters for improved biochemical content in both genotypes. Due to drought stress length and weight of root, shoot were decreased in maize seedlings of both the genotypes.

Key words: Physiological, Chlorophyll, PEG, Maize, *Zea mays L.*

NANOTECHNOLOGY IN SUSTAINABLE AGRICULTURE: AN INNOVATIVE APPROACH**SHAILJADHIMAN AND ARTI GOEL***Shailja Dhiman, Amity Institute of Microbial Biotechnology, Amity University, Noida, Uttar Pradesh, 201313, Amity Institute of Microbial Biotechnology, Amity University, Noida, Uttar Pradesh, 201313*

In the present scenario, among various technologies, nanotechnology has been considered as the most promising technology used in several sectors including agriculture. Agriculture is most important for providing food for humans and animals either directly or indirectly. As the world population is increasing day by day therefore, Agriculture, food, and natural resources are of main concern. Consequently, utilization of current technologies such as bio-nanotechnology is helpful for innovative future in the field of agriculture. The main motive behind using of biogenic nanoparticles as nanofertilizers in agriculture, is to lessen the use of harmful chemicals, minimize nutrient loss and increase yield through disease and nutrient management. Nanotechnology has the potential to improve the agriculture and food industry with novel nano tools for controlling disease caused by various pathogens and by providing nutrients to plants which are easy to absorb. The major interests of using nanotechnology in agriculture includes applications like bio-nano-fertilizers, nano-pesticides, nano-bactericides and nano-fungicides to increase the productivity without contamination of soils, water bodies and protection against several insect pests and microbial diseases. Hence, the present hypothesis will pave the way for the utilization of biogenic nanoparticles which are synthesized by microbes or plant extracts in enhancing agricultural yield because they have the potential to fertilize the soil by providing easily soluble nano nutrients as well as disease management by destroying the plant pathogens using nanoparticles in low doses without contaminating soil and water bodies with harmful chemicals.

STATUS AND CHALLENGES OF EXISTING TRANSFER OF TECHNOLOGY SYSTEM OF KRISHI VIGYAN KENDRA SHALINI PANDEY¹, NEHA GOSWAMI², RASHMI DURGAPAL³ AND DHRITI SOLANKI⁴*Department of Extension Education and Communication Management, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan.*

Krishi Vigyan Kendras (KVK) has been established by Indian Council of Agricultural Research (ICAR) as centre for transfer of technology at district level. In view of the changing scenario of agriculture, increasing urbanization, migration from rural to urban, declining involvement of youths in agriculture, inequality in distribution of incomes; there is a need to effective transfer of technologies from research system to grass root level. There is a dire need to ponder upon the existing transfer of technology model of KVK to address the newer challenges. Present review paper will put light on the status and methods used in transfer of agricultural technology by KVKs. The paper will also focus on the current challenges faced by KVKs network in transfer of technology. The paper will also highlight the possible course of action for strengthening the functioning of KVKs as per emerging needs.

Key words: Transfer of technology, KVK, extension system.

APPLICATION OF BIOINFORMATICS IN PLANT BREEDING**E. SHALINI PRIYA***S.V. Agricultural college, Tirupathi, ANGRAU*

The goal of plant genomics is to understand the genetic and molecular basis of all biological processes in plants that are relevant to the specie. This understanding is fundamental to allow efficient exploitation of plants as biological resources in the development of new cultivars with improved quality and reduced economic and environmental costs. This knowledge is also vital for the development of new plant diagnostic tools. Traits considered of primary interest are, pathogen and abiotic stress resistance, quality traits for plant, and

reproductive traits determining yield. A genome program can now be envisioned as a highly important tool for plant improvement. Such an approach to identify key genes and understand their function will result in a "quantum leap" in plant improvement. Additionally, the ability to examine gene expression will allow us to understand how plants respond to and interact with the physical environment and management practices. This information, in conjunction with appropriate technology, may provide predictive measures of plant health and quality and become part of future breeding decision management systems. Current genome programs generate a large amount of data that will require processing, storage and distribution to the multinational research community. The data include not only sequence information, but information on mutations, markers, maps, functional discoveries, etc. Key objectives for plant bioinformatics include: to encourage the submission of all sequence data into the public domain, through repositories, to provide rational annotation of genes, proteins and phenotypes, and to elaborate relationships both within the plants' data and between plants and other organisms.

THE 'FARMERS LAB', A TEMPLE OF LEARNING FOR THE FARMERS AND SUSTAINING SAFE AND COST EFFECTIVE REMEDIAL/ALTERNATIVE APPROACHES/STRATEGIES AGAINST CHEMICAL BASED FARMING

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'Farmers 'lab ' being the only source of knowledge bank for the helpless farmers as against the expensive and toxic farming, is expected to motivate the village farmers in gaining knowledge about the diagnostics of pests, diseases and other field related crop maladies faced by them and also their safe management by non-chemical and cost effective means. Training being imparted through illustrations, live materials and also microscopically including preparation of all the sustainable components of indigenous package and their sequential field application shall make them more confident in tackling their field problems. To maintain the sustainability of plant protection/production through latest technologies/packages and integrated farming among the motivated farmers who in turn inspire their fellow farmers Continuation of these indigenous, safe, cost effective packages for 3-4 cropping would lead towards complete organic farming thus improving the health of soil, crop and also the human beings. With the intension of sustaining the knowledge about the integrated farming and plant protection having been imparted to the growers/farmers through training and demonstrations at the hot spots in district Bulandshahar. It was felt desirable to establish the Farmers'lab a temple of learning for the farmers. This innovative idea came to the mind of proposers for the first time realizing the existence of such a unique platform under one umbrella of learning the basics of crop protection/production Science targeting mainly on safe and cost effective farming including their field application.

Key words: Farmers'lab , crop production, crop protection, integrated farming , IPM techno-packages

SCREENING OF RICE (*ORYZA SATIVA* L.) GENOTYPES FOR SUBMERGENCE TOLERANCE TRAITS AT SEEDLING STAGE

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A pot experiment was conducted with five rice genotypes Nagina 22, Swarna sub1, NDR 97, Susk Samrat and NDR 9830102 to evaluate submergence tolerance traits at vegetative stage. Thirty five days old seedling was exposed to 11 days complete submergence. At the end submergence, shoot elongation, catalase activity, chlorophyll content and total soluble sugar were measured against control. Less shoot elongation, high catalase activity and less percent reduction in chlorophyll content and total soluble sugar were recorded in Swarna sub 1 and NDR 9830102. Nagina 22 failed to survive after desubmergence. Survival percentage of Swarna sub1, NDR 9830102, NDR 97 and Susk Samrat was nearly 95, 75, 10 and 8 percent respectively. The days to 50% flowering and maturity were less effected in Swarna sub1 and NDR 9830102 and comparison to other genotypes. The high survival percentage in Swarna sub1 and NDR 9830102 was due to reserved carbohydrates, less shoot elongation and high activity of anti oxidant enzymes and consequently these two genotypes also showed less reduction in yield and yield components.

ADOPTION OF IMPROVED GUAVA (*PSIDIUM GUAJAV* L.) CULTIVATION PRACTICES AMONG ORCHARDISTS

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Guava (*Psidium guajava* L.) is the most important and commercially cultivated fruit crop belongs to the family Myrtaceae. The fruit is very delicate in the flavor and rich source of vitamin C, B2, B1, pectin and minerals like Calcium, Phosphorus and Iron. Hence known as 'Poor man's apple' and 'Apple of tropics'. The present study was undertaken in the Department of Agriculture Extension, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P). Adoption of improved practices for guava by the farmers and

constraints faced by them were studied in Baghara and Charthawal block of Muzaffarnagar district of Uttar Pradesh. The major constraints were broadly classified as economical, infrastructural, agro-climatic and technological aspects. About 50 to 80% of the farmers responded in adoption of recommended package of practices like selection of suitable cultivar, spacing and timely inter-cultivation, while the reverse is true in adoption of use of manures and recommended fertilizers, application of protective irrigation and timely need based plant protection measures. Lack of awareness, non-availability of genuine planting material, inputs like FYM, vermicompost, biofertilizers, micronutrients, non availability of labours at time, damage by pests like mealy bug, T-mosquito bug and fruit fly, diseases like dieback, fruit rot, fruit canker and leaf bronzing, marketing facility, and lack of awareness of bahar treatment were some of the other major constraints reported by the farmers.

INDIGENOUS TECHNICAL KNOWLEDGE (ITK) AND THEIR ROLE IN SUSTAINABLE GRASSROOTS INNOVATIONS: AN ILLUSTRATION IN INDIAN CONTEXT

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Indigenous Technical Knowledge (ITK) has immense potential for innovation, especially at the grassroots level. India is a country populated by a number of indigenous communities, most of which have their own set of unique traditional knowledge and technology base. Many of these knowledge and technologies are at par with the modern knowledge and technology system and have been provided the indigenous communities with comfort and self-sufficiency. These traditional knowledge and technologies have played a significant role in the overall socio-economic development of the communities. A study on some of the aboriginal knowledge and technologies, with special reference to the concept of Indigenous Technical Knowledge (ITK), prevalent among a number of indigenous communities was carried out and the significance of the same in innovation has been evaluated. The study was conducted within the framework of "sectoral system of innovation". A wide range of diverse sectors including agriculture, animal husbandry, fishing and textile were considered for the purpose of the study as all these sectors are imperative in Indian context. During the course of the study, it has been observed that there is an instant need to document and preserve the Indigenous Technical Knowledge (ITK) of different communities, many of which are at the brink of extinction. There is a lack of proper alliance between the practice of indigenous and modern knowledge. There are serious issues related to intellectual property rights. An appropriate association between the traditional and modern knowledge and technology systems has immense potential to benefit the society.

Keywords : Sectorial system, Innovation, Intellectual property rights

RECENT DEVELOPMENT IN BIOFERTILIZERS IN TEMPERATE FRUIT PRODUCTION

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India having 2.27 per cent of the total land area, feeds more than 16 per cent of world population. Such a huge population magnifies the demand for more food from shrinking cultivated area which requires huge amount of fertilizers and other inputs. The chemical fertilizers have played a very significant role in intensive food production, which has brought many fold increase in production, but large scale use of chemical fertilizers causes problem of ground water and environmental pollution through leaching, volatilization, denitrification and wastage of nutrients. Indiscriminate use of chemicals contributed in loss of soil biological dynamism and productivity along with addition of salts to the soil. Biofertilizers or microbial inoculants are carrier based ready to use live bacterial or fungal formulations, which on application to plants, soil or composting pits, help in mobilization of various nutrients by their biological activity and plays a very significant role in improving soil fertility by fixing atmospheric nitrogen both in association with plant roots and without it, producing numerous plant growth regulators, protecting plants from phytopathogens by controlling or inhibiting them, improving soil structure and bio remediating the polluted soils by sequestering toxic heavy metal species also, they are environmental friendly playing a significant role in crop production. Nitrogen fixing bacteria and phosphate solubilizer are the main biofertilizers for horticultural crops. Use of FYM + Bio + Mg increased the yield and fruit quality of pear. Conjoint use of biofertilizers with inorganic manure achieved the highest berry yield, improved the quality of strawberry and also sustains the fertility of soil. Beneficial effect of bioorganic nutrient sources on growth, fruit yield and biochemical attributes of kiwi fruit has been reported. Maximum fruit set, minimum fruit drop and highest fruit yield was recorded with the application of FYM 30kg + Vermicompost 10kg + poultry manure 2.5kg + neem cake 3kg/tree in peach. The integration of inorganic fertilizer with organic manures and biofertilizers can achieve the highest fruit yield with improved fruit quality and soil fertility status of apple.

Key words: Biofertilizers, phytopathogens, Nitrogen fixation, manure and soil fertility.

ROLE OF BIOLOGICAL CONTROL IN ORGANIC FARMING

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At the present time due to use of heavier doses of chemical fertilizers for crop nutrition and pesticides for pest management by farmers, there are many diseases e.g. cancer, allergic problems and respiratory dysfunctions in people due to pollutions and food contamination by different chemical application which is very harmful to animals and environment. Organic agriculture can be defined as farming systems where the use of pesticides, herbicides and chemical fertilizers is prohibited. These systems rely on crop rotations, natural nitrogen fixation, biologically active soil, recycled farm manure, crop residues and biological or mechanical weed and pest control. Major benefits to consumers of organic food are better health through increased nutritional quality and reduced pesticide exposure for all health harming chemicals such as pesticides, fungicides and herbicides. Due to less or no use of pesticides, the pest management is a big problem in organic farming system. For manage the pests in organic farming system IPM is applied as the potent disease management programme, IPM includes the different methods e.g. physical, mechanical, cultural, legal, biological, biotechnological and chemical methods for pest management. Biological control of pests is an ecofriendly method which uses natural or modified organisms, and genes or gene products of selected organisms to reduce inoculum density or disease producing activity of a pathogen or undesirable pests affecting crops. There are three basic types of biological pest control strategies: importation, augmentation and conservation. Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids and pathogens. Biological control agents of plant diseases are most often referred to as antagonists. Biological control agents of weeds include seed predators, herbivores and plant pathogens. Bio-pesticides are certain types of pesticides derived from natural material such as animals, plants, bacteria and certain minerals which are less toxic to human, biodiversity and pose a lower risk than conventional pesticides, great advantage of microbial pesticides is the specificity of their toxic action and their safety to nontarget organisms. These products cause minimal environmental disruption.

PERFORMANCE OF SUPER ABSORBENT POLYMER (HYDROGEL) ON WATER PRODUCTIVITY AND YIELD OF WINTER MAIZE (ZEA MAYS L.)**SHASHANK TYAGI, ROHIT KUMAR AND S.K. PATHAK***Department of Agronomy, Bihar Agricultural University, Sabour, Bhagalpur- 813210, India*

A field experiment was carried out during *rabi* 2011-12 at Bihar Agricultural College farm, Sabour to study the effect of hydrogels on yield attributes, yield of maize and water productivity. The design of the experiment was split plot design replicated thrice and the treatments comprised of main plot treatment having two sources of hydrogel i.e. Stockosorb and Pusa gel and six doses of hydrogel i.e. control, 50, 75, 100, 125 and 150% hydrogel dose were tested in sub-plots. Application of 150% gel dose recorded highest grain yield which was significantly higher over rest of the treatments. Highest grain yield (81.5 q ha⁻¹) was recorded under 150% dose of hydrogel which was 2.9% higher than those of 125% dose of hydrogel, respectively. However, application of 100 and 125% dose of hydrogel achieved similar grain yields. Recommended dose of hydrogel recorded 2.8, 11.1 and 19.1% higher yield over 75%, 50% gel dose and control. Highest yield attributes were in 150% gel dose being at par with 125 and 100% gel dose and significantly more over control, 50 and 75% dose. Recommended hydrogel dose improved water use efficiency over 50% gel dose and control. Hydrogel sources were non-significant for it; however, stockosorb was relatively much effective. Among hydrogel doses, 150% dose was registered for maximum water use efficiency being at par with 100 and 125% dose. It may be concluded that hydrogel sources did not have significant effect on maize yield, however, gel doses could make some significant impact on maize with increasing gel doses up to 150% in terms of enhancement in yield of maize and water use efficiency.

DOUBLING FARMERS INCOME THROUGH INNOVATIVE APPROACH**SHASHIKANT GOYAL, B. JIRLI, SHANI KUMAR SINGH***Department of Extension Education, I. Ag. Sc., BHU, Varanasi-221005*

India is a country where agriculture is the main occupation of the people According to 2011 Agricultural Census of India, an estimated 61.5% of the 1300 million Indian population is rural and dependent on agriculture. The base income of the farmers was Rs. 77,976 in 2012-13 as per the NSSO 70th Round data. The Effort of government is through increasing Minimum Support Price of cereals and Direct Benefit Transfer, Reduction in input cost. Policies reforms involved liberalization, Deregulation and removal of excessive control and restriction on private sector. Removal of licensing requirements and stock limits on foodstuff order. Ways for Doubling Farmers Income to improvement in productivity and resource use efficiency, increase in cropping intensity and diversification towards high value crop, shifting cultivators to non-farm and subsidiary activities. Strategies are to development of initiatives including infrastructure (schemes and programs), Technology and Institutional mechanism. Crop productivity requires growth for doubling income is 4.1% and livestock value added by 6.0% per year, it can enhance through technology generation and dissemination. Various initiative required to active and coordinated participation of various ministries of central government and states, While lead role played by ministry of agriculture co-

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operation and farmers welfare. The stakeholders including state and their various organization, International trade of agricultural commodity, food storage, quality and safety.

Key Words- Enhancing farmers income, DBT, Policy, agriculture and livestock production, stakeholders

TO STUDY ABOUT WAYS TO DOUBLE THE INCOME OF FARMERS OF INDIA

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Hypothesis: Farmers of India need to be educated to not throw away the agricultural wastes but to make money by recycling it into something valuable that holds the power to generate considerable income. Method: Herein this research, I have taken model based approach. I believe that India must incorporate little of each nation in order to achieve it's own agricultural success. Result: A lot can be done to educate the farmers of India and increase or double their income in upcoming years. They need to be educated and familiarized with the micro-irrigation techniques, tailor made for their region in joint collaboration with R&D departments of MNCs in the irrigation sector like Jains etc. The agricultural wastes which are usually burnt down can also be converted into useful resource which in turn leads to income generation for the farmer. In such cases, it will also lead to less environmental pollution as these "wastes" won't be burnt down anymore. The reduction of post-harvest food losses, which are particularly high in perishable crops in developing countries, is important not only from an obligation to avoid waste, but also because the cost of preventing food losses in general is considered to be less than producing a similar additional amount of food of the same quality. In perishable vegetatively propagated crops like the potato, appropriate post-harvest technology is not only required to reduce food losses, but also to maintain the perishable planting material from one growing season to the next.

EFFECT OF PLANT GROWTH REGULATORS TO ENHANCE QUALITY AND YIELD OF VEGETABLES

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The use of plant growth regulators (PGRs) in modern horticulture is well established. Indeed certain fields of horticulture such as asexual propagation are heavily dependent on the use of synthetic growth regulators. During recent years, the interest in vegetable production has increased rapidly because of good price value and place of vegetables in national food requirement. Besides, growth regulating chemicals are also becoming important in the field of horticulture for the modification of vegetative growth, flowering, fruiting and quality. Plant growth regulators in vegetables provides professionals and researchers with the information needed to effectively tap these versatile resources to enhance vegetables production. Plant growth regulators have found specific niches in the production of commercial vegetables but many opportunities continue to exist for improving quality, efficiency and coordination in commercial production. Auxin produced seedless fruits in cucumbers and watermelon, PCPA (50-100) ppm induced parthenocarp in tomato and brinjal. Naphthyl acetic acid (NAA) does not occur naturally. NAA (100 ppm) treatment induces parthenocarp of fruits in tomatoes, ladies finger and brinjal. Ethylene is the only gaseous hydrocarbon hormones which plays an important role in the ripening of fruits, inhibition of root growth, abscission and other growth processes. Ethrel treatment has been found to change sex expression in cucurbits. In cucurbits, GA₃ sprays have been made to induce staminate flowers in gynoeccious lines. Silver nitrate at 500 mg/L has been reported to be as effective as GA₃ in inducing male flowers on gynoeccious lines of cucumber. Maleic hydrazide (MH) functions as a growth regulator acting especially on root vegetables. Maleic hydrazide is applied as over-the-top foliar spray when the foliage is still in a good condition. Application of MH (2500 ppm) 15 days before harvesting prevents sprouting of onion in storage. Routinely, it is also used as a sprouting inhibitor during storage. These hormones are not known to be harmful to humans, but when applied outside of those guidelines, they can cause problems with excessively fast growth, including external fruit ripening prior to interior ripening, and residual PGRs remaining in plants and fruits after application.

Key words: Plant growth regulators, Ethrel, NAA, cucurbits. Tomamto, brinjal, onion.

APPLICATION OF SILICON ON CROP PRODUCTION

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Among the plants, silicon concentration is found to be higher in monocotyledons than in dicotyledons and its level increased from legumes < fruit crops < vegetables < grasses < grain crops. The role of silicon in plant biology is to reduce multiple stresses including biotic and abiotic stresses. It is also known to increase drought tolerance in plants by maintaining plant water balance, photosynthetic activity, erectness of leaves and structure of xylem vessels under high transpiration rates. Silicon application improved water economy and dry matter yield. It enhanced the leaf water potential under water stress conditions, reduced the incidence of micronutrient and metal toxicity. The presence of Silicon also been reported to affect the absorption and translocation of several macro and micronutrients. Si is

accumulated in plants to total concentrations in dry matter similar to those of essential macro-nutrients such as Potassium, Calcium, Magnesium, Sulphur and Phosphorous (Epstein, 1999). More recently, silicon amendments were shown to reduce the leaching of phosphate, nitrate and potassium.

GENETIC DIVERSITY OF INDIAN COMMON BEAN GERMPLASM COLLECTIONS BASED ON MICROSATELLITE MARKERS

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Common bean (*Phaseolus vulgaris* L.), locally known as rajmash, belongs to family *Leguminosae* and subfamily *Papilionaceae*. Success of crop breeding depends on the isolation of genetically superior genotypes based on the amount of variability present in the materials. Therefore, evaluation of the genetic diversity present in Indian accessions of common beans is essential for conservation, management and utilization of these genetic resources. Genetic diversity of one hundred sixty five common bean (*Phaseolus vulgaris* L.) accessions of north west Himalayan origin with 4 checks was studied using Simple Sequence Repeat (SSR) markers. 20 out of 55 primers screened showed polymorphism across present set of genotypes. A total of 124 amplicons were scored using these 20 primers indicating fair amount of variation at the DNA level among these accessions. Cluster analysis delineated the genotypes into four groups. The common bean seed size includes large, medium and small seeded out of which large seeded genotypes are mostly placed in Andean gene pool along with medium seed size, whereas Mesoamerican gene pool accommodates small seeded genotype.

Keywords: Common bean, Morphological diversity, SSR markers, Andean and Mesoamerican gene pools, Genetic divergence

HIGH TEMPERATURE STRESS ON CHICKPEA

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Chickpea play a significant role in food and nutritional security in cool regions. Heat or high temperature stress is common in major chickpea-growing areas in the world. Chickpea is sensitive to high temperatures, especially in the reproductive phase. Heat stress is the major (abiotic stress) environmental factors reducing productivity of food grain crop and pulses. The impact of heat stress on important pulse crops (cool season pulse chickpea) will be reviewed. The impact of heat stress of chickpea depends on duration time and intensity of stress. In general, heat stress has negative effects on production, especially during gamete development, podding and flowering. Yield reductions have been observed at a temperature of 30°C at 50% flowering and >30°C for 34 days at 100% flowering time that such conditions reduced the duration of flowering and pod filling, resulting in large yield losses. Heat caused withering, burning of lower leaves, desiccation of poorly developed plants, stunting flower and pod abortion, and reduced root nodulation, nitrogen (N) fixation and seed yield. The optimal temperature for germination of chickpea pollen is 25°C with drastic reductions at cooler and warmer temperatures. Flowers are the most sensitive organs to heat. There is a need to develop high throughput phenotyping techniques and/or physiological, biochemical or molecular markers that determines reproductive function. Future research should focus on screening germplasm collections to check genetic variability and identify the heat tolerant genotypes for use in breeding programs.

EFFECT OF PLANT GROWTH REGULATORS ON GROWTH PARAMETERS, BIOCHEMICAL STUDIES AND YIELD OF MUSTARD

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The Indian mustard (*Brassica juncea* L.) is an important oilseed crop, its botanical name is *Brassica juncea* L. (2n=18) and belongs to family Cruciferae. In India, it is the second most important edible oilseed crop after groundnut sharing 25-30%. The share of oilseeds is 14.1% out of the total cropped area, in India, rapeseed mustard accounts for 3% of it. Mustard seed is the second largest produced oilseed in the world. India contributes 28.3% and 19.8% in world acreage and production. GA₃ enhances growth activities to plant, stimulates stem elongation and increases dry weight and yield. Salicylic acid (SA) is a naturally occurring signalling molecule and growth regulator that enhances plant growth particularly in stress conditions. Abiotic stresses (such as metals/metalloids, salinity, extreme temperatures, and drought) are among the most challenging threats to agricultural system and economic yield of crop plants & they are controlled by Salicylic acid. Various concentrations of GA₃ (50ppm, 100ppm, & 150ppm) & Salicylic acid (100ppm, 200ppm, 300ppm) were taken along with untreated control. PGRs were applied on 30 DAS. Observations were recorded at 40, 60, 80 days & at maturity and growth parameters like plant height, number of primary & secondary branches plant⁻¹, total dry biomass plant⁻¹, biochemical parameters like chlorophyll content & catalase activities in green leaves. Foliar application of different concentrations of GA₃ and Salicylic Acid influenced on all characters of mustard crop.

VACUUM FRYING: A NEW TECHNOLOGY FOR HEALTHY FRIED PRODUCTS**SHIKHANGI SINGH¹, P.K. OMRE²***Department of Post-Harvest Process and Food Engineering, G.B. Pant University of Agriculture & Technology, Pantnagar 263145, India*

Vacuum frying is a novel technique which uses pressure below the atmospheric pressure (~8KPa) and temperature below 80°C, thereby preserving the natural quality attributes of fried products. Vacuum frying is the method of limiting the oil uptake in fried products, maintaining the natural color and flavor. The vacuum frying temperature is done much lower than boiling point of water i.e. 100°C. Hence, there is no burning of texture and the carcinogen acrylamide formation is reduced up to 97%. This technique is gaining more demand due to recent researches in the relationship between atmospheric fried food and their diverse effect on consumption on human health. Due to the high initial moisture content of the fruits, the frying process takes longer time. Therefore, before vacuum frying process pre-treatments are applied i.e. blanching, pre-drying, osmotic dehydration, freezing, hydrocolloids and anti-browning agent. Pre-treatments are necessary in moisture removal kinetics, product yield, and final product moisture content, oil uptake by the product and oil absorption rate in the final product. Centrifugation is done as a post treatment of vacuum frying process for removing the surface oil and can be part of the frying equipment. Centrifugation done at higher rpm and low pressure significantly decrease the amount of surface oil that can penetrate the porous products when breaking the vacuum and hence reduce the oil uptake up to 64%. In future, the vacuum fried products would be a suitable alternate for conventional fried products with better nutritional and sensorial properties.

PHENOLOGICAL EVALUATION OF TWELVE ELITE WALNUT (*JUGLANS REGIA* L.) GERMPLASM FROM SEEDLING ORIGIN.**SHILPA¹, GIRISH SHARMA²***1 Department of Fruit Science, PAU, Ludhiana, 2 Department of Fruit Science, YSPUHF, Solan, Nauni.*

Among the temperate fruits, nut fruit crops especially walnut finds a great scope as one of the diversifying fruit. Jammu and Kashmir ranked first in production of walnut followed by Uttaranchal, Himachal Pradesh and Arunachal Pradesh. Despite many constraints, the agro climatic conditions of Jammu and Kashmir are ideally suited for walnut growth and production. This study aimed to evaluate the twelve genotypes for various floral character viz. Time and duration of male and female flowering, time and duration of shedding of pollen grains, nature of dichogamy, number of male catkin per bud/catkins, length of male catkin, yield and yield efficiency. On the basis of study, the first male flower opened varied from 17 March ('Partap') to 14 April ('Meylannaise') with duration ranged from 14-20 days whereas the first female flower opened on 30 March ('Partap') to 5 May ('Meylannaise'). Pollen shedding period varied from 8 ('Gobind') to 15 ('Montignac', 'Kashmir selection' and 'Shimla Selection') days. Nature of dichogamy was protandrous among all the genotypes. The number of male catkin per bud varied from 4 to 6, while minimum (4) in cv. Partap, Perial-Lara and Shimla selection and the maximum (6) found in cvs. Hartley, Kullu Selection, Kashmir Selection and Kainthal Selection. Longest catkin length (16.83 cm) was recorded in Shimla Selection and shortest (5.80 cm) was noticed in cv. Meylannaise. The nut yield varied from 3.50 to 87.50 kg/tree, highest being in Kainthal Selection and lowest in 'Hartley'. The yield efficiency ranged from 0.061 to 0.006 Kg/cm², highest in 'Montignac' and minimum for 'Hartley'. All the genotypes were regular and terminal in bearing habit.

IN VITRO CALLUS INDUCTION AND PLANT REGENERATION IN BASMATI RICE (*ORYZA SATIVA* L.) VARIETIES.**SHILPY SINGH¹, ARUN KUMAR^{1*}, VIVEK RANA¹, ASHWINI KUMAR¹ AND V. RAKESH SHARMA²***¹Department of Agricultural Biotechnology, ²Department of Horticulture, S.V.P University of Agri. and Tech., Meerut-250110.*

Rice is the most important staple food for a large part of the world's population. To fulfill the global food demands, the production of grain needs to increase up to 50% more because it has been predicted that the world population will exceed 8 billion people by 2025. Biotechnology provides a novel approach for rice improvement through transformation technique. Studies related to In-vitro culture of plant require a basic protocol for callus induction and subsequent plant regeneration. Efficient callus induction and plant regeneration are pre-requisite for transformation. In the present study, an efficient callus induction and regeneration system was established for four basmati rice varieties viz. Basmati-370, Pusa Sugandha-4, Vallabh Basmati-22 and Taroari. A number of factors affects on callus formation and in vitro regeneration such as media composition, different concentrations and combinations of hormones were studied. MS media supplemented with 2.0 mg/l of 2, 4-D produced the most desired calli. The callus induction frequency was found to be highest for Pusa Sugandha-4 while Basmati-370 showed the highest regeneration frequency on MS medium supplemented with 2.0 mg/l BAP and 1mg/l of NAA.

Keywords: Rice, *Oryza sativa*, In vitro culture, Callus induction, Regeneration.

IMPACT OF SLOW RELEASE INORGANIC FERTILIZER UNDER WHEAT CULTIVATION (*TRITICUM AESTIVUM*) SHIPARANIDEY*, GEETA KANDPAL¹

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Wheat is one of the dominantly growing cereal crops throughout the world. It is Rabi seasonal crop and grown in a wide range of climatic zones. India being ecologically diverse country is one of the major producer and consumer of wheat. Neem coated urea (NCU) applied to wheat can result in high N use efficiency as it contains nitrification inhibition properties. The application of N through NCU and ordinary urea increased the wheat grain yield significantly with increasing levels of N at different condition. This experiment was carried out in Lovely Professional University, Phagwara at experimental field to check the impact of slow release inorganic fertilizer and nitrogen use efficiency in soils under wheat cultivation. Inorganic fertilizer like Neem coated urea and organic fertilizer like vermicompost were used for this trial with 7 treatments and 3 replications. Data was collected at 45, 60 and 90 days after sowing. There is a significant difference occurs in various agronomical parameters such as plant height, no of tillers, no of panicles, length of panicles etc. For Further research needs to consecutively understand about the inorganic fertilizer interaction with soil.

Key word- Crop, fertilizers, neem coated urea, parameter, recommended dose, wheat

MAGIC POPULATION : A NOBLE METHOD FOR CROP IMPROVEMENT SHIRSAT MAHESH SANTOSH* GIRISH TANTUWAY

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Breeding of the crop plants is the most promising method for getting a combination of novel and desirable characters all in a single plant. From the early stage of agriculture conventional breeding has played an important role to identify prominent varieties and germplasms with novel characters and develop high yielding varieties with better agronomic traits. But with time environment has also changed. Environmental stress due to its biotic and abiotic factors has become a major concern for today's breeders. Hence, to overcome such situations scientists have developed different molecular biology tool along with the concepts of conventional breeding to produce a diverse population like MAGIC population (Multi-parent Advanced Generation Intercrosses). MAGIC are a collection of RILs produced from a complex cross or outbred population involving several parental lines. Parental lines may be inbred lines, clones or individuals selected on the basis of their origin or use. Basically MAGIC populations are the extension of advanced inbred lines. MAGIC population provides novel opportunities and challenges in crop breeding due to their complex pedigree structure. They offer great potential both for dissecting genomic structure and for improving breeding populations. The genetic diversity of multiple parents, recombined over several generations, generates a genetic resource population with large phenotypic diversity suitable for high-resolution trait mapping. MAGIC lines have more genetic variation than bi-parental recombinant inbred lines. The MAGIC populations offer an alternative to traditional linkage or association mapping populations by increasing the precision of quantitative trait loci (QTL) mapping resolution and analysis of genotrait association by taking the advantages of both historical and synthetic recombination.

Keywords: MAGIC Population, Heterogeneous stock and QTL.

STUDY ON ECONOMICS OF COARSE RICE VIS-À-VIS FINE RICE PRODUCTION IN HARDOI DISTRICT OF UTTAR PRADESH SHITAL DEVI

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Paddy is most widely cultivated food crop over world and India . It is used as dominant food material in various forms by more than one thousand million people, composition of various industries material and other forms. Paddy was grown about 16300 millions hectare with an annual production of 741000 metric tonnes and productivity 45.46q/ha in the world (2016) . Basmati rice is distinguished by the characteristics of aroma, grain length and cooking qualities, the two most important features of basmati rice are that it is long grained and has a gentle aroma. Rice production has better scope for increasing income of farmers. The major portion of cost of cultivation will be accounted for human labour, tractor, labour, manure & fertilizer, irrigation charges and seed. The present study would carried out with the main objective of studying workout the various cost and income measure, input-output relationship and study resource use efficiency on different size group of farm. The purposive cum random sampling technique will be used for selection of district, block, villages and respondents. All paddy growers selected villages will be prepared along with their size of holding and will be grouped in two categories viz. marginal and small . Primary data will be collected through personal interview using with pre-structured schedule and secondary data will be taken from official records of district .

PRESENT STATUS AND FUTURE PROSPECTS OF MARKER ASSISTED SELECTION (MAS) IN CROP IMPROVEMENT**SHIV PRAKASH SHRIVASTAV¹, SURAJ KUMAR HITAISHI¹, AMIT KUMAR CHAUDHARY¹ AND ABHINAV KUMAR²***Department of Genetics and Plant Breeding¹, Department of Horticulture², Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad -224 229 (U.P.), India.*

Markers are used as signpost to find out the variation among the individuals. They are linked to the trait of interest and are co-inherited along with the trait. These can be divided into morphological markers (Qualitative traits), biochemical markers (Isozymes and proteins), molecular markers (DNA markers). Molecular markers/DNA markers/genetic markers are not the target genes but act as signs or flags, they are located close to gene of interest also called as "gene tags". DNA markers those are tightly-linked to target loci as a substitute for or to assist phenotypic screening. Ideal DNA marker must be polymorphic, co-dominant in nature, evenly & frequently distributed throughout the genome, high exchange of data between laboratories, absence of non-allelic interaction or epistasis, reproducible and it should be easy, fast and cheap to detect. The utility of a marker depends on how tightly it is linked to genes controlling important traits. The relative importance of those genes in determining the phenotype, the consistency of linkage disequilibrium between the marker and QTL, the frequency of the QTL (MAS will be more beneficial when the QTL is in low frequency). Marker Assisted Selection (MAS) is often used as a synonym of SMART breeding, which stands for selection with markers and advanced reproductive technology. It is Fast-tracking plant breeding. Selections can be made on the genotype rather than the phenotype, which may increase the speed and efficiency of selection. MAS was first proposed in 1980's Tanksley and Rick (1980) used isozyme marker to speed up introgression of a monogenic trait into adapted tomato cultivars. DNA-markers allow the breeder to introduce the gene(s) of interest into their cultivated species from a related species. While conventional breeding methods rely on the transfer of the whole genome (gene of interest along with the undesirable characters are also co-inherited and have to be eliminated through back crossing followed by selection). DNA-markers allow to eliminate 'undesired' genome regions in a few generations. Marker-Assisted Selection use in difficult traits (e.g., Biotic and abiotic stresses), traits with low heritability (Yield), pyramiding of resistance genes (recessive genes), selection at seedling stage and distinguish homo- & heterozygote. Molecular markers allow working with genotype information directly, analyze the effect of the genotype on the phenotype and provide the breeder a tool to look into the 'black box' of the genotype. Marker-Assisted Backcrossing (MAB) has several advantages over conventional backcrossing that is effective selection of target loci, minimize linkage drag and accelerated recovery of recurrent parent. Marker-Assisted Backcrossing (MAB) the 1st level of selection/foreground selection- (Tanksley, 1983) markers that are flanking the target gene in the donor genotype are used for the selection for target gene. MAB 2nd level of selection/recombinant selection purpose to reduce the size of the donor chromosome segment that is linked with the gene of interest. Linkage drag is minimized by using flanking markers (less than 5cM on either side) of target gene. Require large population sizes depends on distance of flanking markers from target locus. Concept of 'linkage drag' Large amounts of donor chromosome segments as large as 10cM remain even after many backcrosses. Undesirable due to other donor genes that negatively affect agronomic performance. MAB 3rd level of selection/background selection use unlinked markers to select against donor genome, accelerates the recovery of the recurrent parent genome. Savings of 2, 3 or even 4 backcross generations may be possible. It is the selection of backcross progeny with greatest proportion of recurrent parent. Marker-assisted pyramiding is the process of combining several genes together into a single genotype. Pyramiding may be possible through conventional breeding but it is usually not easy to identify the plants having more than one gene. (Multiple resistant genes show the same phenotype). Certain genes confer resistance in recessive condition, cannot be identified in heterozygous condition. Because of the availability of DNA markers derived from the resistance genes, it is now possible to pyramid several resistance genes into susceptible elite rice cultivars.

COMPOSTING ENHANCE THE SUSTAINABILITY IN AGRICULTURE**SHIVAKAR BHADARIA*, YOGESH KUMAR¹ AND SUSHANT KUMAR²***Deptt. of Soil Science and Agri. Chemistry, ²Deptt. of Entomology, SVP University of Ag. and Tech., Meerut*

Obtaining sustainability in waste management requires an option that employs environmental friendliness. Such a technique must be effective, efficient and less costly than many other. Solid waste management is an enormous task in developing nations all over the globe due to factors like poverty, population explosion, urbanization and lack of proper funding by the government. Disposal methods such as incinerator, landfill, pyrolysis and gasification are efficient but have negative impacts on the environment as well as threat to public health. Composting through developed many biofertilizer these are sustainable for environment, relatively low air and decreased water pollution, low operational cost and income generation. The use of composting for bioremediation of contaminated soil has gained much ground in many developed countries of the world. However, composting when improperly designed could lead to methane production, odour emission and heavy metals build-up in the final product. Therefore, this study reviewed sustainability of composting and its numerous advantages over other waste disposal options in developing countries. It is important to use renewable resources to maximize crop yields and minimize the environmental hazards associated with chemical residues. Composting is an age old practice for the biological conversion of organic waste to a humus-like substance which can enhance physical, chemical and biological soil properties.

EFFECT OF SILICON GROWTH AND YIELD ON PADDY UNDER RAINFED AREA**SHIVAM KUMAR VISHVAKARMA AND SATYBHAN SINGH***School of Agricultural Sciences and Engineering, IFTM University, Moradabad-244102*

The present study entitled Impact of Effect of Silicon levels on rice in north-western plain zone of India was carried out at School of Agricultural Sciences and Engineering, IFTM University, Moradabad in 2017-18. The effect silicon is the second most abundant element in the earth's crust after oxygen and accounts for about 28% of the soil weight, but it is not considered essential for growth of higher plants. Silicon in plant growth have concluded that reduced amount of silicon in plant develops necrosis, disturbance in leaf photosynthetic efficiency, growth retardation and reduces grain yield in cereals. Role of silicon in plant health and growth has been investigated in silicon accumulating crops and it seemed significantly effecting. The treatment T1 (100% RDF), T2 (100% RDF + One Si spray @ 3 ml/lit water (at 25 DAT), T3 (100% RDF + Two Si spray @ 3 ml/lit water (at 25 & 50 DAT), T4 (125% RDF), T5 (125% RDF + One Si spray @ 3 ml/lit water (at 25 DAT), T6 (125% RDF + Two Si spray @ 3 ml/lit water (at 25 & 50 DAT), T7 (150% RDF), T8 (150% RDF + One Si spray @ 3 ml/lit water (at 25 DAT), T9 (150% RDF + Two Si spray @ 3 ml/lit water (at 25 & 50 DAT) with three replication.

BREEDING FOR NUTRACEUTICALS IN CABBAGE**'SHIVANI CHAUHAN, 'HARNOOR KAUR DHILLON, 'SHUBHAM KUMAR, 'SUNIL KUMAR, 'PRIYANKA, 'ESHANEE AND 'BHALLAN SINGH SEKHON***CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.) - 176062*

Nutraceutical derived from the two words "nutrition" and "pharmaceuticals" and can be defined as food-derived products that may have health benefits. Recently the nutraceuticals have emerged as sustainable alternatives for the control and prevention of various diseases. Some popular nutraceuticals include lycopene from tomato, carotenoids from carrot, indole-3-carbinol (anti-cancerous) from cabbage etc. Cabbage is a cruciferous vegetable belongs to the genus *Brassica* of family *Brassicaceae*. It is a low calorie, fibre-rich, and modified leafy vegetable. Three major types of cabbage are white, red and savoy. It is a rich source of Vitamin A, B, and C. Cabbage is an excellent source of mineral such as calcium (39mg), iron (0.8mg), magnesium (10mg), sodium (14.1mg), potassium (114mg) and phosphorus (44mg). Major phytochemicals in cabbage are thiocyanates, indole-3-carbinol, sulforaphane and isothiocyanates. Red cabbage is a rich source of anthocyanin pigments. It has large amount of beta-carotene, ascorbic acid, riboflavin, niacin and thiamine. Fresh cabbage juice is said to have anti-bacterial activity and has been shown to inhibit the growth of various strains of lactic acid bacteria. It is also well known for its medicinal properties. In ayurvedic medicines, cabbage leaves are prescribed for cough, fever, skin diseases and peptic ulcers. With the people becoming aware about the health benefits of consuming colourful vegetables giving origin to the concept of rainbow cultivation it has become imperative that nutraceutical and edible colour rich varieties are bred. This can be accomplished by combining the conventional breeding methods with molecular biology. Identification of sources of variation for nutraceuticals content can be accomplished by screening germplasm collections, evaluating morphological characters and origin, evaluating mutations in key genes. Nutraceutical rich varieties can be developed by identifying important bio-active compounds present in cabbage, searching sources of variation with breeding potential and discussion of breeding strategies and developing suitable ideotype.

Keywords- breeding, cabbage, nutraceuticals, ideotype, phytochemicals.

ROLE OF TRANSGENESIS IN CROP IMPROVEMENT**'SHIVENDRA PRATAP SINGH, ²PRAKRITI TOMAR, ³AKASH SINGH AND ⁴VIKASH KUMAR SINGH**

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The most potent biotechnology approach is the transfer of specifically constructed gene assemblies through various transformation techniques; this constitutes genetic engineering. Genetic modification (GM) of crops involves the transfer of genes for specific traits between distantly related plant species using recombinant DNA technology known as transgenesis. Transgenesis has been highly utilized to incorporate desirable traits in plants like enhanced yield, nutritional value (high vitamin, healthy fatty acid/amino acid content, micronutrients), herbicide resistance, enhanced fruit shelf life, increased resistance to various biotic (bacterial, fungal, nematodes and other pathogens) and abiotic stresses (low and high temperature, salinity and drought). Several varieties of GM crops such as cotton, soya, maize, potato, sugar beet, alfalfa, and canola are grown throughout the world. The technology is also well-poised to enhance farm prosperity besides augmenting the cause of health, environment and livelihood of the people.

Keyword: Genetic engineering, Transgenesis and GM Crop increase biotic and abiotic stresses.

STUDIES ON THE PATTERN OF CHANGES IN PHYSICAL CHARACTERS OF DEVELOPING BER (*ZIZYPHUS MAURITIANA* LAMK.) FRUITS.

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The present investigation entitled "Studies on changes during growth and development of ber (*Zizyphus mauritiana* Lamk.) fruit cv. (Narendra Ber Selection-1)" was carried out during the year 2016-2017. The studies comprised experiments namely. Studies on the pattern of changes in physical characters of developing ber fruit. The study revealed that fruit length increased from days of fruit setting (0.49) cm to (4.51) cm at 168 days after fruit setting. Breadth of the ber fruit increased continuously from fruit set (0.38) cm to (4.66) cm at maturity. An increase in weight was observed during entire period of growth and development but marginal increase (37.24) g was at harvesting stage of fruit growth. The volume of fruits increased continuously during entire phase of growth (0.71) to 37.46 (cm³). The pulp weight is increased gradually from 91th days to maturity and the seed was traceable only from 91th days after fruit set and weight of seed was increase gradually till 168th days. Specific gravity, which first increased at mid of November then decreased when fruits proceeded toward at harvesting stage.

Key words: Physical characters, Growth and development, Harvesting, Maturity, Volume

APPROPRIATE CROPTECHNOLOGIES FOR SUSTAINABLE AGRICULTURE IN CHANGING CLIMATE SCENARIO : AN EXPERIENCE UNDER NICRA PROJECT

SHOBHARANI, JEETENDRA KUMAR & R.K. SOHANE

Agri production is highly vulnerable to climate change. Changing climatic scenario at the global level like rise in surface temperatures, changes in rainfall patterns, increases in evapo transpiration rates and degrading soil moisture conditions are increasingly one of the most serious national security threats, with significant impacts on agriculture, natural resources, ecosystem and biodiversity. At the same time, it is likely to trigger food insecurity and economic depression, thereby affecting national development being purely based on Agriculture. Recognizing the importance of science issues that need to be addressed to deal with climate change, new approaches crop interventions are desperately needed to enable and encourage smallholder farmers to adopt new technologies and practices under more uncertain and extreme climatic conditions for a resilient agricultural production system. Keeping these in view, various technologies related to agronomical intervention have been demonstrated by KVK, Jehanabad under NICRA project, which emerged into fruitful positive results in the adopted village Sakrorha at Modanganj block of Jehanabad district of Bihar. The village is facing with climatic vulnerability of drought and scarcity of irrigation water since last 4-5 years. The different crop production technologies demonstrated in the village include promotion of crop diversification along with low water requiring crops, intercropping, mixed cropping & community nursery.

INDUCTION OF DORMENCY IN RICE TO PREVENT PRE-HARVEST SPROUTING

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Rice is central to the lives of billions of people around the world. Possibly the oldest domesticated grain, Rice is the staple food for 2.5 billion people. Rice is the only cereal crop that can grow for long periods of time in standing water. 57% of rice is grown on irrigated land, 25% on rainfed lowland, 10% on the uplands, 6% in deepwater, and 2% in wetlands. Dormancy allows seeds to overcome periods that are unfavourable for seedling established and is therefore important for plant ecology and agriculture. Pre harvest sprouting is one of most serious and common problem in crops as these seeds can not be used as certified seeds because it is no longer viable. Pre harvest sprouting in rice frequently ranges from 0 to 25% mainly in non-dormant varieties exposed to prolonged rain and lodging during grain maturation. Sprouting may be reduced by incorporating various physical and chemical ways. Few chemicals should also be applied to prevent the crop loss and obtain better quality seeds. Growth inhibitors like Maleic Hydrazide can prove its excellence in increasing the dormancy by inhibiting or affecting GA synthesis in seeds. The non-dormant seeds when applied with ABA(Abscissic acid) can also prevent the crop from sprouting by minimizing the synthesis of GA. Application of ABA and Maleic Hydrazide at flowering stage may leads to the induction of dormancy genetically i.e. it will cause seed dormancy which will prolonged for longer time than the application of chemicals at maturity stage. Thus the foliar application at flowering time will be more effective. Seed dormancy prevents pre-harvest sprouting during rainy weather or when crop lodges with standing water. Its Disadvantages is also very clear that dormancy do not allows the use of seed from the crop to raise the succeeding crop without pre-treatment. The dormancy of dormant seeds can be broken by giving heat treatment for 45-50⁰ C for 3-4 days or with the oxidising agent to break dormancy.

EFFECT OF DIFFERENT APPROACHES OF FERTILIZER APPLICATION ON PRODUCTIVITY; NUTRIENTS UPTAKE AND ECONOMICS OF RICE UNDER SYSTEM OF RICE INTENSIFICATION**SHREYANSH MITTAL***Department of Soil Science, Punjab Agricultural University, Ludhiana, Punjab, India*

A field experiment was conducted during *kharif* 2015 at the Experimental Farm of Department of Soil Science, CSK HPKV, Palampur to study the effect of different approaches of fertilizer application on productivity; nutrients uptake and economics of rice under SRI. There were eight treatments (control, farmers' practice, general recommended dose, soil test based, yield targets 3.5, 4.0, 4.5 and 5.0 t ha⁻¹ replicated thrice in a randomized block design (RBD). The soil of experimental field was silty clay loam in texture, acidic (pH 5.5), high in OC (11.2 g kg⁻¹), medium in available N (320 kg ha⁻¹), high in available P (30 kg ha⁻¹), low in available K (112 kg ha⁻¹) and sufficient in micronutrients. Plant samples were collected at 50% flowering and harvest and analyzed for NPK contents whereas, micronutrients (Fe, Mn, Zn and Cu) concentration in grain and straw at harvest was also determined after harvesting. All levels for prescription based fertilizer application gave significantly higher grain and straw yield as compared to other fertilizer application approaches. Further, treatment for yield target of 5.0 t ha⁻¹ resulted in maximum grain (4.46 t ha⁻¹) and straw (10.03 t ha⁻¹) yield. Targeted yield treatments significantly increased the nutrients uptake over other approaches. The STCR based fertilizer application treatments excelled all other approaches of fertilizer application in terms of net returns and benefit cost ratio. However, STCR approach for transplanted rice worked satisfactorily up to yield target of 4.0 t ha⁻¹ beyond which deviation in yield from targeted yield was more than 10 per cent.

ROOFCULTURE**SHRISTI SINGH¹, KOTA CHAKRAPANI²***¹Department of Agronomy, Pacific College of Agriculture, Udaipur; ² Department of Plant Pathology, College of Agriculture, CAU, Imphal.*

Rooficulture is a new technique of raising plants on the metal sheets which are used as roofing structures. In this technique we use the roof metal covering sheets as a base for raising the plants in which furrow of the sheet is used for culturing. The sheets, i.e., the furrows of the metal sheets are filled with growing media and are arranged with the watering pipe inside the furrow of the sheet. Small plants like coriander, Methi, certain grasses and garlic leaves can be raised by using this technique. For developing this new technique an overall survey across the country is done along with the population density and the density of population using the sheets as the roof of their houses. This type of roofing structures is widely used in the northeast region of the country. By this environmental sustainability and proper utilization of natural resources like solar energy, rain water harvesting can be achieved. The technique of raising small plants in the furrows of the roofing sheets has many advantages despite of its disadvantages. By this technique, environmental sustainability, food security up to certain levels can be maintained, temperatures of the house during the summers can be reduced.

Keywords: Rooficulture, survey.

AGRICULTURE- GROWING THE FUTURE**SHRISTI SONAL***College Of Agriculture Sciences, Teerthanker Mahaveer University, Moradabad*

To truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy which is the profitable kind of energy. Agriculture including agricultural marketing is the backbone of Indian economy. Methods that prevailed in earlier decades for selling the produce have changed. Earlier Rural Primary Markets (RPMs) were set up whereas in contrast to this now- a-days, prices are set by the buyers and the commission agents. The perishable products get damage in the journey of transportation, which can be resolved by the provision of refrigerated trucks. An efficient marketing system can manage timely delivery of produce, reduce marketing costs and increased production and productivity thereby, making a healthy market. With the expansion in agricultural production and agro-industries, there has been an increase in the agricultural waste which gives birth to "Agricultural Pollution". Farmers aka Farmpreneurs don't realize that what they burn away, causing pollution, can be used to earn as much as Rs 1000 per ton. Experts believe that the agricultural sector is now all set for revolution where farmers need to shift their attention from primary to secondary agriculture, wherein they enhance the value of the produce and utilize all products and by-products of farms, poultry houses, slaughter houses, agro-industries etc. Biomass pellets and biogas generated from the agro-waste can be a big money spinner. To minimize the waste and enhance the income of the agriculturists, the best found solution is the use of 3R's viz Reuse, Recycle and Reduce. That is why, sustainable energy resources appear to be one of the most effective and efficient solutions. So just depending on the conventional energy sources will not solve the problem of energy crisis. In this paper efforts have been made to summarize the gradual shift towards exploring secondary agriculture and its future potential in India. This paper also assesses few policies for concentrating on the enhancement of renewable for the future. This paper is a piece of armed chair research and constitutes

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the knowledge from the secondary sources. The paper mainly focuses on what are the means of making money from agricultural waste and contribute to the entrepreneurship development.

Keywords: Renewable Energy, Secondary Agriculture, Waste-to-wealth, Agricultural marketing, Making money from agro-waste, Sustainable Energy, Energy Policies, Alternative Energy

MARKET INTEGRATION OF MAJOR VEGETABLES IN PUNJAB

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The present study was formulated to analyze the level of market integration in the major vegetable markets in Punjab. The study was undertaken on a macro framework based on data collected from secondary sources through employing Augmented Dickey-Fuller (ADF) unit root test, Johansen co-integration test, Granger causality test and Vector error correction method for the analysis of market price integration of selected vegetables viz. potato, tomato, cauliflower and peas. The investigations of integration between sample markets indicated that in case of all of the vegetables the state markets are found to be well integrated among each other and also with the national market (New Delhi) with an exception in case of tomato where it was seen that there was not any integration found between Ludhiana and Jalandhar market which was due to communication problems and lack of market intelligence between those markets. The policy intervention calls for strengthening market intelligence wing in all markets along with the establishing of online marketing system through computerization and networking. The market price information should be made available to the stakeholders through electronic and print media. Development/strengthening of market infrastructure including transportation and communication facilities are the need of time in order to fully integrate the market prices. Hence in order to continue the competitive condition of these markets there is need to strengthen the market intelligence and communication within markets so that a better platform could be placed for guiding the farmers in marketing their produce.

Key Words: Marketing, Co-integration and Trends.

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Key Words: Marketing, Co-integration and Trends.

IMPACT OF CONSERVATION AGRICULTURE ON CARBON SEQUESTRATION

SHUBHA TRIPATHI¹; RICHA TIWARI²; DIVYARAJPUT²; YAKSHI AGRAWAL¹ & B.P.DHYANI¹

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Agricultural activity contributes considerably to greenhouse gas emissions in the earth's atmosphere. Extensive deforestation and intensive agricultural management have led to an increasing transfer of carbon from soil organic matter to atmospheric CO₂. Global warming has already increased temperature and by the end of 21st century is likely to exceed 1.50 C due to anthropogenic emission of GHGs. The projected climate change may alter terrestrial carbon storage because of changes in temperature, precipitation & CO₂ concentration that could affect NPP, carbon input in soil & soil carbon decomposition rate. Carbon sequestration is an important practice

for the maintenance of optimum CO₂ level in the atmosphere, which in-turn results in reducing the recent increase in atmospheric CO₂. Agricultural soils can be a source or sink for atmospheric CO₂ depending upon the management practices and land use patterns. Carbon stored in soils is 2-4 times more as compared to that stored in the atmosphere and around 4 times that carbon stored in vegetation. The potential carbon sequestration in the world soil is 0.4-1.2 Gigatons carbon/year. There is an impact of conservation agriculture on carbon sequestration by synthesizing the knowledge of carbon and nitrogen cycle in agriculture, by changing conventional tillage to conservation tillage, use of legume based crop over grass based, residue management, crop rotation, organic agriculture, proper grazing management, biochar and land use management. To evaluate the carbon sequestration capacity of farming practices, their influence on emissions from farming activities should be considered together with their influence on soil carbon stocks. Removal of atmospheric CO₂ by terrestrial ecosystems via carbon sequestration and converting the sequestered carbon into the soil organic carbon has provided a great opportunity for shifting GHG emission to mitigate the climate change. It restores degraded soils, enhances the land productivity, improves the diversity, protects the environment and reduces the enrichment of atmospheric CO₂.

Key words: Global warming, Carbon sequestration, Conservation agriculture, Emission of gases.

IMPACT OF CONSERVATION AGRICULTURE ON CARBON SEQUESTRATION

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EVALUATION OF GENETIC VARIABILITY AND VIGOUR PARAMETER IN INDIAN MUSTARD (*BRASSICA JUNCEA* L.) GERMPLASM

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The present investigation entitled "Evaluation of genicatic variability and vigour parameter in Indian mustard (*Brassica juncea* L.) germplasm" was undertaken. The experiment was conducted at Genetic and Plant Breeding Research form of Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumargunj Faizabad (U.P) during Rabi season 2017-2018 in the present study 40 genotypes of Indian mustard where evaluated in Randomized Block Design with three replication. High estimates of PCV and GCV were found for seed yield per plant and biological yield per plant. The moderate and low estimates of PCV, GCV and ECV were recorded for 1000-seed weight, siliquae on main raceme, harvest index, low estimates whereas, of phenotypic and genotypic coefficient of variation were observed for day to 50 percent flowering, and day of maturity. Seed yield per plant (g) exhibited highly positive significant correlation with biological yield per plant, harvest index and number of seeds per siliquae; exhibited positive non-significant correlation with length on main raceme, 1000-seed weight and siliquae on main raceme. Path analysis identified biological yield per plant, harvest index, days to 50 percent flowering, 1000-seed weight, plant height and primary branches per plant are important direct components for seed yield per plant. The characters identified as important direct and indirect components merits due to consideration in the formulation of effective selection strategy in mustard for developing high yielding varieties.

KITCHEN WASTE COMPOSTING : A GREEN APPROACH IN WASTE MANAGEMENT FOR SUSTAINABLE

DEVELOPMENT**SHWETA CHAUDHARY* & SUNITA MISHRA*****Department of human development and family studies, School for home sciences, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Raibareli road, Lucknow-226025, Uttar Pradesh India*

India stands second in the production of fruits and vegetables in the world. It contributes about 10% as well as 14% of fruits and vegetables in the world production. Material waste is a by-product of almost all human activities and results in stress and pollution in the environment. Waste prevention is the primary goal of the waste management. Composting is a sustainable waste management technique in developing countries; an eco-friendly approach for bioconversion into value added product which may be utilized as plant nutrients. Compost acts as a fertilizer which substitutes chemical fertilizer, reduce the load of N:P:K use and associated environmental pollution. Manure and compost not only supply many nutrients for crop production, including micronutrients, but they are also valuable sources of organic matter. Increasing soil organic matter improves soil structure or tilth, increases the water-holding capacity of coarse-textured sandy soils, improves drainage in fine-textured clay soils, provides a source of slow release nutrients, reduces wind and water erosion, and promotes growth of earthworms and other beneficial soil organisms. Microbial inoculation in kitchen waste composting may yield attributes, yield and nutritional quality of crops under field conditions. This paper aims to delineate that composting is a natural way to promote green revolution in a healthy direction thereby achieving the target of waste management and sustainable development.

Key words:- Waste management, sustainable development, Microbial Inoculation, green revolution.

“STUDY ON EFFECT OF PLANT GROWTH REGULATORS AND BORON ON QUALITY ATTRIBUTES OF TOMATO (*SOLANUM LYCOPERSICUM* MILL.)”**SHWETA GUPTA¹, MADAN KUMAR JHA²**¹ *Dept. of Vegetable science, BTC CARS, Bilaspur (C.G.), 2. Dept. of Vegetable science, BTC CARS, Bilaspur (C.G.)*

The field experiment was conducted during *Rabi* season of 2017-18 at the Horticulture Research cum Instructional farm, BTC CARS, Bilaspur (C.G.). The experiment was laid out in Randomized Block Design (RBD) replicated thrice including ten treatments viz., treatments T₁ (control), T₂ (GA₃ @ 50 ppm), T₃ (GA₃ @ 75 ppm), T₄ (NAA @ 75 ppm), T₅ (NAA @ 100 ppm), T₆ (Boron @ 75 ppm), T₇ (GA₃ @ 50 ppm + Boron @ 75 ppm), T₈ (GA₃ @ 75 ppm + Boron @ 75 ppm), T₉ (NAA @ 75 ppm + Boron @ 75 ppm) and T₁₀ (NAA @ 100 ppm + Boron @ 75 ppm). The significantly Maximum total soluble solid (5.06 %) was recorded in (T₁₀), while, the minimum total soluble solid (3.53 %) was observed in (T₁). The highest ascorbic acid recorded (30.00 mg/100 g) in (T₈), whereas, lowest ascorbic acid observed by (T₁). And Lowest percentage of acidity (0.45 %) was recorded in (T₁₀) and highest percentage of acidity (0.60 %) was observed in (T₁).

Keywords: GA₃, NAA, Boron, and Tomato.

EFFECT OF ELECTROMAGNETIC RADIATIONS ON THE FORAGING ACTIVITY OF *APIS MELLIFERA* L.**SHWETA PATEL*, PRAMOD MALL AND RENU PANDEY***Department of Entomology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar - 263 145, U.S. Nagar, Uttarakhand, India*

Honeybees are essential partners for the success of agriculture. A third of all our food depends on their pollination. However, in recent years, honey bee colony declines have reached 10-30 per cent in Europe, 30 per cent in the United States and up to 85 per cent in Middle East, but such declines are not apparent in South America, Africa, Asia and Australia. Recently, a new phenomenon of sudden disappearance of bees with little sign of disease or infection has been reported from the world over. Bees simply leave the hives and fail to return. The syndrome behind honey bee population decline has been designated in the western world as Colony Collapse Disorder (CCD). Colonies with CCD would appear healthy just weeks prior to collapse. However, the adult bees soon 'disappear' (hence its historic nickname 'disappearing disease') from the colonies, leaving behind the hive full of honey, pollen, capped brood, a queen, and may be a few worker bees. Bee colony collapse was previously attributed to viruses, parasitic mites, pesticides, genetically modified crop use and climate change. Recent efforts have been made to study another potential cause responsible for bee losses influences on honeybee behaviour, man-made electromagnetic. The experiment was conducted in order to study the effect of electromagnetic radiation on the foraging activity of *Apis mellifera* L. at G. B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand). Total six hives were kept below the mobile tower and fifteen forager bees were selected from two bee hives every day and marked with white colour for collection of data to calculate number of foragers returned. All bee hives were kept under the influence of tower radiation. For measuring radiations, Radio-frequency meter (R. F. meter) was used. The activity of outgoing bees was not affected by the cell phone tower at Pantnagar. During the experiment, there is no impact of mobile tower radiation on the foraging activity of *A. mellifera* L. None of the apiculturist in India reported the term “CCD” and none of the bee hives facing this phenomenon. In India, bee colonies decline only under floral dearth if not migrated to bee floral areas.

ECONOMIC ASSESSMENT OF HYBRID PADDY PRODUCERS IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND**SHWETA CHAUDHARY¹, SHIVAMARORA², ASHUTOSH SINGH³, KIRAN RANA⁴, AJAY KUMAR TRIPATHI⁵.***Department of Agricultural Economics, College of Agriculture, Department of Agricultural Communication, College of Agriculture, College of Agri. Business Management, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar*

A study was conducted to evaluate hybrid paddy cultivation in Udham Singh Nagar district of Uttarakhand. A three stage sampling technique was employed for constructing sampling plan of the study. Probability Proportion to size method technique was followed to select respondent which make a sample size of 60 farmers comprising of 28 small, 17 medium and 15 large farmers selected from 4 villages. CACP concept was applied to work out cost of cultivation and returns of hybrid paddy of sample farms. The net returns were estimated Rs. 26420.00/ha, Rs. 26775.00/ha, Rs. 32133.00/ha for small, medium and large farm size groups, respectively in the study area. However major production constraints faced by sample farmers were high incidence of pest and diseases, low output price during harvesting, high output price fluctuation, inadequate availability of fertilizer. The nature and dimension of these problems were found varying across different size group of farms. High cost of hybrid seeds was restricting farmers from adopting hybrid rice technologies. Thus the subsidy should be provisioned on seeds of hybrid rice for its popularization among the rice growers. There is a need to follow a strong extension program in the area regarding improved cultivation practices of hybrid rice. Production constraints are discouraging the growers to augment the production of hybrid rice. Efforts should be made for vital inputs particularly seeds, fertilizers and pesticides at reasonable prices and in adequate quantities to the farmers at required time. In this context, strengthening of input delivery system in the area is urgently required. Also, less expensive and effective measures for the control of serious insect-pests and diseases should be undertaken.

UTILIZATION OF SUGAR INDUSTRY WASTES IN AGRICULTURE**SHYAM C.S. MOHAMMAD HASANAIN, V.K.SINGH, S.S. RATHORE, KAPILAS. RATHORE***ICAR-Indian Agriculture Research Institute, New Delhi, 110012*

Sugar industry is the second largest agro-based industry in India after textile industry. During the manufacturing of white sugar, processing of sugarcane generates huge solid wastes (i.e. pressmud, bagasse, bagasse ash) (Bhat et al., 2016). In India, on an average, processing of 100 tons of sugarcane in a factory yields 10 tons of sugar, 30-34 tons of bagasse (of which 22-24 tons is used in processing and 8-10 tons is saved), 4.45 tons of molasses, 3 tons of filter mud, i.e. press mud (Solomon, 2011). Proper disposal of these wastes is a big problem and concern. Open dumping of these wastes often cause environmental contamination and several health problems in humans. There is vast scope to use these sugar industry wastes in agriculture for enhancing crop productivity and enriching soil fertility. Among the different organic manures used, application of bio-compost prepared from press mud and distillery spent wash @3 t/ha gives the highest rice yield (5.15 t/ha) over control (3.7 t/ha) with improved soil microbial activity (Khushnakumar et al., 2005). The application of bagasse ash @2% for wheat has been found most suitable for improving the yield and physico-chemical properties of calcareous soil (Jamil et al., 2004). The sugar industry wastes have wide application in fisheries also. The application of 10 t/ha of pressmud significantly increases the survival rate and production of common carp (Keshavanath et al., 2006). Also soil contamination of heavy metals like cadmium can be minimised with the application of diluted molasses on to the top of the soil surface @ 2000 kg/ha at heading or one week after heading in the rice grains (Toshimitsu et al., 2012). The increase in sugarcane production implies a proportional increase in sugar industry wastes also. As a consequence sugar industries can assist in reversing the trend of soil degradation and can help in safe disposal of sugar wastes through proper waste management, which are otherwise causing severe environmental problems (Bhatnagar et al., 2016). Out of the various by-products, if the entire amount of press mud alone is recycled in agriculture; about 32,464; 28,077; 14,038; 3434; 393; 1030, and 240 tonnes of N, P, K, Fe, Zn, Mn, and Cu, respectively, can be made available resulting in saving of costly chemical fertilizers (Dotaniya et al., 2016). Therefore, concerted efforts are required to use sugarcane wastes/by-products as nutrient source and soil amendment for overall improvement of soil health and for ensuring high productivity, profitability and long term sustainability in agriculture.

MODERN APPROACHES OF PEST MANAGEMENT FOR SUSTAINABLE AGRICULTURE**SHYAM SUNDAR DEHUR & RAM KEVAL***Department of Entomology & Agricultural Zoology, Institute of Agricultural Science B.H.U., Varanasi, Uttar Pradesh-221005*

Modern approaches of pest management are pest control methods using organic or synthetic derivatives of organic contents which alter behaviour of insects. Chemicals triggering social responses, behavioural changes and chemical changes are Pheromones, Sex pheromones like Litlure for *Spodoptera litura*, Loophure for *Trichoplusia ni* are lured for pest control. These are widely used for monitoring, mass trapping and mating disruption to reduce insect population by using false trails and attraction-annihilation. Synthetic

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analogues of hormones ecdysoids, juvenoids, anti JH, Chitin synthetic inhibitors are insect growth regulators(IGR) used successfully for controlling field insects. Chemosterilants, anti feedant like Azadiractin for locusts, attractants like Sinigrin for cabbage butterfly, repellents are effective against particular pest. Sterile insect release method called as sterile insect technique(SIT) gaining popularity against insect like *Cochliomyia hominivorax*. These chemical products do not disrupt food chain and ecosystem and species specific. So such non pollutant, non hazardous and ecologically acceptable approach of insect control helps to retain a sustainable future.

Keywords : Pheromones, Attraction-Annihilation, Insect Growth Regulators(IGR), Chemosterilants, Anti Feedant, Attractants, Repellents, SIT

QUALITY OF FINGER MILLET AS INFLUENCED BY NITROGEN LEVELS AND GENOTYPES.

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The experiment was conducted at Birsa Agricultural University Farm Ranchi, during kharif (rainy) season of 2009. The experiment was conducted in Randomized Block Design with three replications and twenty treatment combinations consisting of four nitrogen levels (0, 20, 40 and 60 kg N/ha) and five medium duration finger millet genotypes (TNAU-1022, OEB-219, KMR-204, RAU-8 and BM-2). Finger millet genotypes respond positively to nitrogen levels and application of 40 kg N/ha manifested significantly higher grain yield (20.71 q/ha) and straw yield (54.12 q/ha) of finger millet also improved significantly only upto 60 kg N/ha resulting is significantly higher protein content and nutrient uptake. Among genotypes, BM-2 was found superior to rest of the genotypes except RAU-8 which was comparable to BM-2. Genotype BM-2 has outstanding performance in respect grain yield (19.54 q/ha) and straw yield (52.44 q/ha).

CONJUNCTIVE USE OF POOR QUALITY IRRIGATION WATER FOR CROP PRODUCTION

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Fresh water resources are becoming limited in many regions that require irrigation for crop production. The demand for irrigation water to secure food for ever growing population with present resources suggests the alternative ways of using poor quality water for irrigation. Brackish water adversely affects crop quality and yield and deteriorates soil properties. The amount of soluble salts present in irrigation water causes salt accumulation in the rhizosphere which affects plant water uptake thus nutrients dissolved in water. In arid-zone agriculture where available water is saline, mixing is becoming an attractive method for increasing yields and reducing negative environment consequences. With this objective, we compared the chemical composition of canal water, saline water and mixed water (canal water and saline water in equal ratio) at monthly intervals. Chemical composition of mixed water was found to be significantly different as compared to saline water. Salinity in mixed water was measured by its electrical conductivity (EC) which was recorded to be significantly lower than saline water. Both canal and mixed water had lower pH values that were initially higher for saline water. Mixing also brought Cl^- and Na^+ ion concentration in water to satisfactory levels as compared to higher composition of these in saline water. Comparison of chemical composition of mixed water with canal water showed that mixing of poor and good quality water may be used as an alternative to saline water for irrigation by reducing the salt load in the groundwater. Mixing could be a novel option for irrigating crops with an acceptable yield loss in scarce availability of good quality canal water.

Keywords: Poor quality water, saline water, salt accumulation, electrical conductivity, soil properties,

EFFECT OF DIFFERENT CONCENTRATIONS OF ROSELLE ON PHYSICO-CHEMICAL CHANGES IN POMEGRANATE WINE

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Pomegranate (*Punica granatum* L.) which has been extensively used as a source of traditional remedy for diarrhea, dysentery and intestinal parasites is a rich source of polyphenols (especially ellagic acid and punicalagins) which acts as antioxidants. It contains high sugar levels and thus, pomegranate juice can act as a good fermentation medium for making wine with good color. In present study pomegranate fruits which were unmarketable were used for the preparation of wine and red roselle which is also known as guinea or Indian sorrel is used to enhance the quality and color of wine. The calyx of roselle has been reported to be rich in antioxidants and it contains a mixture of organic acids such as citric, malic and tartaric acids. In present investigation, the effect of different concentrations of roselle on various physico-chemical properties of pomegranate wine was investigated. The wine prepared from pomegranate arils with 32 °B sugar syrup, 2.5 per cent rind powder and 0.4 % roselle was found best as compared to other treatments with higher TSS (11.45 °B), ascorbic acid (81.55 mg/100 ml), antioxidants (342.43 mg AAE/100 ml), phenols (384.07 mg GAE/100ml), alcohol (10.69) during primary fermentation and at storage of 30, 60 and 90 days were found desirable with physico-chemical properties.

Key words: Pomegranate, Roselle, fermentation, TSS, alcohol, antioxidant

INTEGRATED PEST MANAGEMENT: A WAY TOWARDS FOOD SECURITY AND SUSTAINABILITY

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Closing gaps in crop yield, while enhancing sustainability is among the greatest challenges for achieving food security. It is beyond doubt that Integrated Pest Management (IPM) is the powerful tool for the sustainable agriculture. In one hand, it has played a crucial role in enhancing the yield potential in the sustainable way to meet out the burgeoning population demand and on the other to keep the natural resources and environment safe for the future farming generations to come. Chemical pesticides have been set as the last resort in IPM practices, but farmers still applying the pesticides as the first resort for getting quick results in developing countries. At the same time, pesticides proved to be more dangerous due to their indiscriminate and excessive use, contaminating food (milk, honey, cereals, vegetables, and fruits) and the environment (ground water, soil, etc.), resulting in pest resistance, pest resurgence, loss of beneficial fauna, pesticide poisoning and pest outbreaks. We have travelled a long way of five decades since the inception of economic threshold level by Stern et al. in 1959 and at this juncture we have to redefine and analyze the challenges and strategies of IPM particularly in developing countries to boost the safe and sustainable food production. Growing population pressure has hastened environmental degradation and depletion of essential natural resources. Available estimates reveal that global pesticide use has increased 50-fold since 1950, and 2.5 million tonnes of agricultural pesticides are now used each year worldwide. No doubt, pesticides are credited to have saved millions of lives by controlling diseases, such as malaria and yellow fever which are insect borne; however, their use causes a variety of adverse health effects and environmental pollution, along with the bad impacts on crops. So another better option is to reduce the use of pesticides and promoting the other activities like improved cultural practices, physical control of pests, mechanical control and biocontrol etc.

Keywords: Crop yield, sustainability, food security and pesticides

QUINOA: NUTRITIONAL ASPECTS OF A WONDER CROP

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Quinoa is Known as a pseudo cereals crop, having broad leaf with starchy dicotyledonous seed and therefore not a cereal. Quinoa is used like the cereal foods; it is also an important ingredient source for the food industry. Quinoa can survive and adapts in different agro-ecological zones. It adapts to very hot climate to cold climate. It can be grown in hot desert as well as dry climates. It can survive in temperature ranges from -4° C to 38° C. The relative humidity for Quinoa cultivation ranges from 40 percent to 88 percent. It is a highly water efficient plant. It is tolerant and resistant to lack of soil moisture. The Average rainfall required for considerable yield is 100 - 200 mm. Quinoa having such a remarkable properties can be used as raw material to derive so many products like Puffs, Flour, Pastas, Flakes, Energy bars etc. However it is also being used in producing the products like extraction of quinoa oil, starch, saponin, protein concentrates, etc.. Quinoa is an appealing, sans gluten elective accessible to celiac patients, and incorporating quinoa in the eating regimen may turn out to be a decent methodology for devouring high organic esteem proteins and additionally all bio-available basic amino acids, something that different grains once in a while offer. Quinoa additionally contains unsaturated lipids, fiber, Complex sugars and other gainful mixes, for example, betaine, and might be utilized to enhance the metabolic hazard factor profile and help control compose Type-2 diabetes.

Keywords: Quinoa, Nutritional food, benefits, Saponin.

ICT: AN EFFECTIVE TOOL IN TRANSFER OF TECHNOLOGY

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ICT (information and communications technology - or technologies) is an umbrella term that includes any communication device or application, encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. The Information needs of the farming community have been addressed by the public extension system through a two pronged strategy one is mass media and another one is training. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries. ICT in agriculture is an emerging field focusing on the enhancement of agricultural and rural development in India. It involves application of innovative ways to use ICT in the rural domain. It can provide with accurate information necessary for the farmers which facilitates better

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agricultural output. Information is one of the key inputs in agriculture and information deficits constrain agricultural productivity in India. Application of ICT in agriculture is increasingly becoming steady in developing countries and this could facilitate self-reliance for national growth. Hence, the use of Information and Communication Technologies (ICTs) for agricultural extension is one way of addressing the information needs of farmers.

Keywords: ICT, information and communication.

INTEGRATED DISEASE MANAGEMENT

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Plant diseases are considered an important biotic constraint, which leads to significant crop losses worldwide. Integrated plant disease management can be defined as a decision-based process involving coordinated use of multiple tactics for optimizing the control of pathogen in an ecologically and economically. It combines various components which can be divided into strategic preventative measures, tactical preventative measures and control measures. For each crop-pathogen relationship and cropping system such components will contribute to different extent to disease management. The development of integrated disease management systems depends on thorough knowledge of the cropping systems as well as of the pathogen and can only be achieved by interdisciplinary research. In addition to these traditional measures, monitoring environmental factors (temperature, moisture, soil pH, nutrients, etc.), disease forecasting, and establishing economic thresholds are important to the management scheme. Therefore, IDM turned out to be the only economic way of crop production in modern agriculture due to increase of agricultural running costs, especially fertilizers and pesticides.

Keywords: IDM, plant disease and pathogen.

DOUBLING FARMERS' INCOME : WAY FORWARD

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The will of the present Government to double the incomes of farmers by 2022 as announced by the Honourable Finance Minister during his Budget Speech on 29 February 2016 has been greeted with less of optimism and more of scepticism by economists and other columnists. The reaction on the proposal brings to bear certain questions: What should be the metric for measuring the progress and which is the baseline data for comparison? Should not the comparison be in real terms as the announcement did not specify? Do we have evidence of income growth in past decades and if so what does it tell us about the possibility of doubling incomes? Is the 7-pronged strategy to achieve the doubling as announced by the Honourable Prime Minister enough? If not, what other initiatives are needed? This issue of Rural Pulse discusses some of these questions.

Key word: innovation tech., rural development, innovation achievement,

INFLUENCE OF ETHYLENE ABSORBENTS ON SHELF LIFE AND POSTHARVEST QUALITY OF NECTARINE

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Nectarine is an important stone fruit after plum and peach. The area under peach cultivation is now getting replaced by nectarine due to its fuzless nature. In India its cultivation is confined to Himachal Pradesh and some North Eastern states. But being a new crop, postharvest treatments to enhance its marketability is lacking. To tackle this problem, we conducted a study to enhance the marketability and shelf life of fruits by packing it with various ethylene absorbents. For execution of the study, we procured fruits from RHRS, Bajaura. After harvesting fruits of 'Silver Queen' variety at climacteric stage of maturity, were packed with different ethylene absorbents such as KMnO₄, Bioconservation, Al₂O₃, silica gel and KMnO₄ + silica gel, making sachets and placing them at bottom, middle and on the top of the packing box and transported to IARI, New Delhi. To observe the effect of different ethylene absorbents on nectarines, fruits were stored at super market conditions (20° C) and evaluated various physical parameters and biochemical parameters. Observations were recorded at fixed interval of 4 days. This study revealed that among the various ethylene absorbents KMnO₄ sachets was found to be better in reducing ethylene evolution rate and respiration. It extended the shelf life up to 8 days at super market condition by maintaining better firmness (3.77N), low PLW (9.302%) higher phenolics (16.06 mg GAE/100g⁻¹) and antioxidant activity (19.09 μmoles TEg⁻¹ FW) and other quality parameters like ascorbic acid (10.61 mg/100g⁻¹), anthocyanin content etc.

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GENOME EDITING IN PLANTS

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One of emerging field which brings real revolution in genetic engineering and biotechnology by having the potential to change the genomic architecture of an organism at precise locations, with desired accuracy is genome manipulation/ editing technology. This has paved the path to address a wide range of goals not only to improve quality and productivity of crops along with biotic abiotic stress resistance but also provided efficient tools to analyse the fundamentals of biological systems. Due to complexity in genomic architecture, it is challenging to edit all of the genes/genomes using a particular genome editing tool. Hence, numerous novel genome editing systems have been introduced during the past few years; comprise of Homologous recombination (HR), zinc finger nucleases (ZFNs), transcription activator-like effector nucleases (TALENs), and clustered regularly interspaced short palindromic repeats/Cas9 (CRISPR/Cas9), RNA interference (RNAi), Cisgenesis and intragenesis. In addition to these, site-directed sequence editing and oligonucleotide-directed mutagenesis have the potential to edit the genome at the single-nucleotide level. Recently, adenine base editors (ABEs) have been developed to mutate A-T base pairs to G-C base pairs. Genome editing technique is consistent for improving average yield by generating elite cultivars of crop plants with enhanced and durable climate resilience to achieve the growing demands of the world's existing food famine and to launch a feasible and environmentally safe agriculture scheme, to more specific, productive, cost-effective and eco-friendly approach.

RECENT TRENDS IN AGRICULTURE SCIENCE AND TECHNOLOGY: PRECISION FARMING

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Precision Agriculture (PA) is a relatively new farm management strategy that allows agriculturists to quantify and manage the spatial variability in farm fields. Precision Farming or Precision Agriculture is generally defined as information and technology based farm management system to identify, analyse and manage spatial and temporal variability within fields for optimum productivity and profitability, sustainability and protection of the land resource by minimizing the production costs. Increasing environmental consciousness of the general public is necessitating us to modify agricultural management practices for sustainable conservation of natural resources such as water, air and soil quality, while staying economically profitable. The use of inputs (i.e. chemical fertilizers and pesticides) based on the right quantity, at the right time, and in the right place. This type of management is commonly known as "Site-Specific Management". The productivity gain in global food supply have increasingly relied on expansion of irrigation schemes over recent decades, with more than a third of the world's food now requiring irrigation for production. Many significant developments in the machinery used for precision agriculture have occurred during the last few years. Precision farming becomes more and more an accepted way of crop production and helps to achieve a sustainable environmental friendly agriculture. Furthermore, growing interest in automated data acquisition and information processing is going to form another milestone towards improved farm management and an overall trace ability in agricultural food production. The benefit and effectiveness of using precision farming techniques is highly dependent on the capabilities of the utilized technology. Precision farming provides a new solution using a systems approach for today's agricultural issues, namely the need to balance productivity with environmental concerns. Precision farming aims at increased economic returns, as well as reducing the energy input and the environmental impact of agriculture. The potential of this technology has already been demonstrated, but in practice, meaningful delivery is difficult as it needs large scale commercial application to realize the benefits. PA is facilitating the prospects and scope for switching over to modern agriculture leaving the traditional one by utilizing right resources in right time and management, which results an environment friendly sustainable agriculture.

Keywords: Precision agriculture (PA), precision farming (PF), spatial variability, site specific management.

INTEGRATED FARMING SYSTEM (IFS) FOR SUSTAINABLE FARMING

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There are many operations holding in the country and many are marginal and small farmers. To fulfill the basic needs household including food, feed, fodder and fiber etc. warrant an attention about Integrated Farming System. It is a characteristic or a state whereby the needs of the present and local population can be met without compromising ability of future generation or population in other location to meet the needs. An Integrated Farming System consist of range of resources saving practices that aim to achieve acceptable profits and high and sustained production levels, while minimizing the negative effects of intensive farming and preserving the environment. The Agronomic approaches to increase the overall productivity and sustainability of IFS is by adoption of improved cropping systems according to the rainfall and soil moisture availability, selection of suitable grain crop species, tree species that supply pods or leaves throughout the year, the surplus fodder leaves, crop residues etc. during the rainy season should be preserved as silage or hay for lean

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season (summer). Within this IFS framework, an integrated crop livestock farming system represent a key solution for enhancing the livestock production and safeguarding the environment through prudent and efficient resource use. IFS is also an eco friendly approach in which waste of one enterprise become inputs of another thus making efficient use of resources. It takes care of the wealth, food and nutritional security of the farming family.

Key words: Intensive farming, integrated crop livestock farming system

ORGANIC FARMING IN HORTICULTURE

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Organic farming is a type of farming which avoids or largely excludes the use of synthetic fertilizers, pesticides, growth regulators, livestock feed additives, and use of genetically modified crops mainly use of animal manures, green manures, organic wastes, crop residues, crop diversification methods and biological pest control to maintain soil productivity. Modern agriculture largely depends on the use of fossil fuels based inputs such as chemical fertilizers, pesticides, herbicides and labour saving but energy intensive farm machinery while, application of such high input technologies has undoubtedly increased production and labour efficiency, there is a growing concern about the adverse effects on soil productivity and environmental quality. The generally accepted organic rules prohibit the use of synthetic fertilizers, pesticides, growth regulators, livestock feed additives and stress on long term soil management. Use local resources for nutrient supply and control of pests and diseases restricting external inputs to the bare minimum. It is soil-building mechanisms to keep soil alive. Components of organic farming are:-Organic manures, Farm Yard Manure, Compost, Green manuring, Vermicompost, Bio fertilizers. Organic horticulture involves natural processes, often taking place over extended periods of time, and a sustainable, holistic approach - while chemical-based horticulture focuses on immediate, isolated effects and reductionist strategies. Organic farming system is the only option for sustainability of soil health improvement in quality and shelf life of produce, reduced environmental hazards, increase farm income and also for rural employment generation and ultimately maintains the health of human and animals. It helps in rejuvenating the degraded soil and ensure sustainability of crop production .Hence it's to be promoted.

SEED PRODUCTION SYSTEM IN INDIA

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The Indian seed programme largely adheres to the limited generations' system for seed multiplication in a phased manner. The system recognizes three generations namely breeder, foundation and certified seeds and provides adequate safeguards for quality assurance in the seed multiplication chain to maintain the purity of the variety. **Breeder Seed:** Breeder seed is the progeny of nucleus seed of a variety and is produced by the originating breeder or by a sponsored breeder. Breeder seed production is the mandate of the Indian Council of Agricultural Research (ICAR). On receipt of information from ICAR, the available breeder seed is allocated to all the indenters in an equitable manner. In the case of varieties which are relevant only to a particular State, the indents for breeder seed are placed by the concerned Director of Agriculture with the SAUs/ICAR institutions located in the State. **Foundation Seed:** Foundation seed is the progeny of breeder seed and is required to be produced from breeder seed or from foundation seed which can be clearly traced to breeder seed. The responsibility for production of foundation seed has been entrusted to the NSC, SFCI, State Seeds Corporation, State Departments of Agriculture and private seed producers, who have the necessary infrastructure facilities. **Certified Seed:** Certified seed is the progeny of foundation seed and must meet the standards of seed certification prescribed in the Indian. The availability of seed is ascertained by the State Departments of Agriculture on the basis of the production of seed in government farms and production of seeds by State Seeds Corporations and other agencies. NSC, SFCI, States Seeds Corporations and other seed producing agencies are continuously and gradually expanding all its activities especially in terms of its product range, volume and value of seed handled, level of seed distribution to the un-reached areas, etc.

Keyword: Breeder seed production, limited generations, adequate safeguards etc

EFFECT OF CLIMATIC CHANGE ON ANIMAL DISEASES

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Climatic factors can have a major effect on the rate of transmission of many infectious diseases. Microbial agents and their vector organisms are sensitive to factors such as temperature, humidity, precipitation, surface water, wind and changes in vegetation. This applies particularly to vector-borne diseases (VBDs) such as RVE, transmitted by mosquitoes, African horse sickness (AHS) and BT, both transmitted by biting midges (*Culicoides spp*), ASF, East Coast fever, anaplasmosis, babesiosis and Nairobi sheep disease, both transmitted by ticks, and trypanosomosis, transmitted by tsetse flies. Lumpy skin disease has long been suspected of being transmitted by

arthropod vectors. In general, increased temperature and moisture will enhance transmission. It is projected, therefore, that climate changes and altered weather patterns will affect the range, intensity, and seasonality of vector-borne and other infectious diseases. Considerable progress has been made in investigating and defining the climatic and environmental factors that influence vector biology. The data has generally been obtained by a combination of field and laboratory studies. These approaches, combined with satellite remote sensing, geographical information systems and biomathematical modelling, could be used to develop models to predict when and where disease outbreaks are likely to occur and how the situation might alter with climate change. Armed with this information, control strategies, such as the use of prophylactic vaccination and vector control, could be used to protect animals in advance of the spread of a disease and thereby reduce its impact.

INVESTIGATION ON LEVEL OF INFESTATION AND MANAGEMENT OF CUCURBIT FRUIT FLY, *BACTROCERACUCURBITAE* (COQUILLETT) IN DIFFERENT CUCURBIT CROPS

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Among four selected cucurbitaceous bitter gourd crop was found most infested host for cucurbit fruit flies whereas, bottle gourd was found least infested host for cucurbit fruit flies. Based on the observations on the numbers of fruit infestation, bitter gourd and ridge gourd was found most likely host among four cucurbitaceous vegetables for cucurbit fruit flies. For management of cucurbit fruit flies among four cucurbits crops Cue lure traps was found most effective in bitter gourd, ridge gourd, and pumpkin and bottle gourd crops them Methyl eugenol. Among four installed Methyl eugenol traps (treated) cucurbits field trials higher yield 10.00, 17.75, 7.7 and 19.6 t/ha were obtained in bitter gourd, bottle gourd, ridge gourd and pumpkin respectively but uninstalled Methyl eugenol traps (untreated) cucurbits field trials 8.00, 14.00, 5.50 and 16.00 tonnes/hectare yield were obtained in bitter gourd, bottle gourd, ridge gourd and pumpkin respectively at Meerut. While among four cucurbits fields installed methyl eugenol traps (treated) cucurbits fields higher yield 11.50, 15.50, 8.00 and 17.50 were obtained (tonnes/hectare) in bitter gourd, bottle gourd, ridge gourd and pumpkin but uninstalled Methyl eugenol traps (untreated) cucurbits fields 8.50, 12.20, 6.65 and 13.50 tonnes/hectare yield were obtained in bitter gourd, bottle gourd ridge gourd and pumpkin respectively.

Key words: methyl eugenol traps; cue lure traps; cucurbit; *Bactroceracucurbitae*

CONSERVATION AGRICULTURE IN INDIA: RETROSPECT & PROSPECT

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Sustaining agricultural systems under the current scenario of depleting natural resources, negative impacts of climatic variability, spiraling cost of inputs and volatile food prices are the major impediments to attain food security for a growing population and alleviating poverty before most of the Asian countries including India. In addition to these challenges, the principal indicators of non-sustainability of agricultural systems includes: soil erosion, soil organic matter decline and salinization. These are caused mainly by intensive tillage, insufficient return of organic material and monocropping. Therefore, a paradigm shift in farming practices through eliminating unsustainable parts of conventional agriculture is crucial for future productivity gains while sustaining the natural resources. Conservation agriculture (CA), a concept evolved as a response to concerns of sustainability of agriculture globally, which involve minimum soil disturbance, permanent soil cover through crop residues or cover crops, and crop rotations for achieving higher productivity and profitability. Globally, CA systems are being adopted on 156.99 M ha (FAO, 2014). In India, CA adoption is still in the initial phases. Over the past few years, adoption of zero tillage and CA has expanded to cover about 1.5 million hectares (FAO, 2014). Though major CA-based technologies being adopted is zero-till (ZT) wheat in the rice-wheat (RW) system of the Indo-Gangetic plains (IGP) other CA-based RCT are being adopted in India are diversified crop rotation, bed planting, direct seeding, laser land leveling, brown manuring etc. In cotton-wheat cropping system permanent bed with residue addition increase mean cotton-wheat system productivity by 3.1 tonnes wheat equivalent yield /ha/year (Das *et al.*, 2013). In a six year experiment on pigeonpea indicated that zero till- raised bed with mulch retention recorded higher yield followed by zero till- flatbed with mulch retention, zero till-flatbed without mulch retention. The annual rate of increase in SOC content over initial condition under zero-tillage bed planting and zero-tillage flatbed plots were 0.64 and 0.62 tonnes C/ha/yr, respectively in 0-30 cm soil layer (Sharma *et al.*, 2013). The soil organic Carbon (SOC) and the effective cation exchange capacity (CEC) were significantly higher at the end of two year ZT-maize than CT-maize (Busari and Salako, 2013). In a study Bhatt and Khera (2006) reported that minimum tillage with fully covered plots was the most effective and conventionally tillage with no residue was least effective in reducing the soil erosion. In maize-wheat cultivation system the permanent raised bed planting system was superior to other tillage method with respect to yield, water productivity, profitability and soil physical condition (Jat *et al.*, 2013). In wheat crop water-use efficiency under FIRB and BBF was 8.322.8 and 4.924.8% higher respectively, over the FB with flooding (Behera and Sharma, 2014). The adoption of laser land leveling technology resulted into water saving of 28 and 12

per cent in paddy and wheat respectively thus the yield of paddy and wheat was enhanced by 4.24 and 8.08 per cent, respectively with the use of technology (Singh and Kaur, 2014). However, there are still main constraints for promotion of CA technologies, such as lack of appropriate seeders especially for small and medium scale farmers, competition of crop residues between CA use and livestock feeding, burning of crop residues, availability of skilled and scientific manpower and overcoming the bias or mindset about tillage (Bhan and Behera, 2014). Developing and promoting CA systems will be highly demanding in terms of the knowledge base. This will call for greatly enhanced capacity of scientists to address problems from a systems perspective; be able to work in close partnerships with farmers and other stakeholders and strengthened knowledge and information-sharing mechanisms. "Conserving resources enhancing productivity" has to be the new mission.

INTEGRATED DISEASE MANAGEMENT: GREEN ALTERNATIVE TO CONVENTIONAL USE OF CHEMICALS

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Integrated Disease Management is decision based process which count in consummate combination of all the available methods of disease management against pathogen causing disease such that their infesting population is decreased to economically insignificant level with minimum intrusion on the activity of natural beneficial organism. Unfettered use of fungicides for control of diseases has resulted in pest resistance to fungicides, pest resurgence and environmental degradation fashioning IPM as potent disease managing approach. Pesticide if applied shall be as specific as possible those have non-toxic effect on non-target organisms and shall have the least side effects on human health and environment. Host resistance, Biological control, cultural practices and chemical control are united with main objective to keep disease incidence below economic threshold level. Current theoretical approaches need to be supplemented with inclusion of more complex processes, such as the effect of fitness modifiers in pathogen populations and the influence of quantitative adaption of pathogen to their host. Epidemiological impacts of integrating host resistance, fungicides, host density and host diversification should be taken into account to increase the durability of resistance in the overall host plant population. Such integrated approaches will maintain yield potential and bestow green alternative to conventional use of chemicals It has the potential to be remunerative method combining all possible disease management measures.

Key words: IDM, Economic Threshold level, Host Resistance, Remunerative.

OVERVIEW OF THE EFFICACY OF PLANT EXTRACTS AGAINST *FUSARIUM OXYSPORUM* CAUSING A WIDE RANGE OF DISEASES

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Concern over the use of chemical to manage the pathogen raising the risk of food toxicity as well as the development of new races of the pathogen. Also, as both public demands for organic produce and the profile of organic farming have increased in recent years. *Fusarium oxysporum* causes a wide range of diseases in different crops like banana, tomato, muskmelon, chick pea and also post-harvest diseases e.g. ginger dry rot. So today we need an option which controls the diseases without any side effects in the environment as well as human health. There are many botanicals which were tested by the various workers against *Fusarium oxysporum*. To prepare Aqueous extract of plant part, botanicals are wash thoroughly with running tap water then dried with blotting paper and grinding using pestle mortar by adding sterile water (w/v). Finally it is filter through two layers of muslin cloth and then centrifuge at 10,000 rpm for 20 min. and supernatant used as a 100 percent solution. Aqueous extracts of different botanicals shows range of inhibition over *Fusarium oxysporum* which depend on their concentration and antimicrobial compound presence. Mixture of garlic (*Allium sativum*) and onion (*Allium cepa*) extract at 50% conc. shows 100% inhibition. At 10% aqueous extract of *Psidium guajava* show 83% inhibition and also 10% *Azadirachta indica* shows 65% inhibition. There are many other botanicals viz. Dhatura (*Dhatura stramonium*) and Turmeric (*Curcuma longa*) which shows considerable inhibition over *Fusarium oxysporum*.

IMPLEMENTATION OF NANOTECHNOLOGY IN AGRICULTURE

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World population is increasing and to meet the growing demand it is necessary to use the modern technology. In addition climate change is posing additional challenge to cope with growing needs. Therefore in such changing environmental scenario there is a constant need to identify the new area of research to overcome the technological challenges in addressing the yield barrier, resource use efficiency and

development of environmentally accepted technology. Nanotechnology is one such branch of science. It is an emerging multi-disciplinary area that involves technology of diverse fields at nano level i.e. biological sciences, chemical sciences, physics, material science etc. In the recent years nanobiotechnology is gaining momentum to be occupying the promising position to mitigate the constraints in order to obtain a sustainable and secure future of agriculture worldwide. It has many applications in all stages of production, processing, storing, packaging, and transport of agricultural products. This technology has capability to revolutionize agriculture by innovation of new techniques such as: precision farming techniques, enhancing the ability of plants to absorb nutrients, more efficient and targeted use of inputs, disease detection and control diseases. Novel nanomaterials have been developed for increasing the productivity using substances like inorganic, lipid and polymeric nanoparticles. The utilization of nanosensors along with GPS-enabled smart devices will help farmers to gain accurate information thereby assisting in making correct decisions regarding plant growth and soil suitability. The use of carbon nanotubes and nanoparticles of silver, zinc oxide, silicon etc. can be really helpful in remediating the plant growth in stress conditions and ensure that nutrients are utilized optimally by plants. However, before actual implementation at full fledged scale the cost, risk and benefits have to be evaluated. The focus should also on need of designing processes which are easily up-scalable at the industrial level.

DISEASE CONTROL THROUGH PLANT QUARANTINE

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Plant Quarantine Unit is to prevent the introduction of destructive plant pests, soil and diseases of plants from other countries. Plant Quarantine regulations are promulgated by the national and the state governments to prevent the introduction and spread of harmful pests and pathogens. The introduction of several plant pests into Europe in the 19th century with disastrous consequences called for the development of plant quarantine measures to prevent the spread and introduction of pests of plants and plant products. In India 35 Plant Quarantine stations, Airport 11 Sea Port 11 Land Frontier 13. With the purpose of harmonizing these measures, and promoting measures for pest control, the International Plant Protection Convention (IPPC) was developed to address organisms that are both directly and indirectly injurious to plants. It supplies a framework for measures against invasive alien species according to the Convention on Biological Diversity, as far as they are plant pests. In its 1997 revision, the IPPC provides for the establishment of International Standards for Phytosanitary Measures, being acknowledged by the Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization. These measures may include prescribed product standards, labeling and packaging requirements, quarantine treatment, processing and production standards, and testing, inspection, certification and approval procedures. Pest Risk Analysis Standards most important for invasive alien species are those, on requirements for the establishment of pest-free areas, on surveillance, on pest eradication programs, and on the import and release of exotic biological agents.

Keywords: Plant Quarantine, Phytosanitary, Pest Risk Analysis, surveillance, prevent, and eradication

EGG DUMPING IN INSECTS

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In egg laying arthropods, host availability and host quality may vary both in space and time and may set boundaries for female decision making on when, where and how many eggs to lay. Among herbivorous and parasitic insects, females often display considerable plasticity in their ovarian development or oviposition behavior in response to variation in host availability. In some species, females may respond to prolonged host deprivation by "dumping" eggs on unsuitable substrates, even though this behavior can lead to complete larval mortality. Females that place eggs under the care of conspecifics have been labeled as egg dumpers. The patterns of egg dumping as affected by host availability and feeding treatments in Mexican fruit fly, *Anastrepha ludens* Loew and reported that females continuously exposed to hosts and food exhibited some degree of egg dumping which suggest that the costs of egg production in this species are likely to be low. The egg dumping behavior in seed beetle, *Callosobruchus maculatus* by comparing two populations of the same species and reported that females from an African population are much more prone to dump eggs than Asian females. It reveals the genetic variation in egg dumping between the populations of a species. When there is male biased sex ratio within a population of coreid bug, *Phyllomorpha laciniata*, eighty five per cent of the females laid eggs on the backs of their partners and only fifteen per cent of the females dumped their eggs.

USES OF BIO-PESTICIDES AGAINST RICE (*ORYZA SATIVA* L.) SEED-BORNE DISEASES

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¹Rajiv Gandhi South Campus, I. Ag. Sc. B. H. U., Barkachha, Mirzapur (U.P.) 231001, Rice (*Oryza sativa* spp. L., 2n=24) grown in India and South east Asia is a plant of Asian origin.

Global demand for food is rising because of population growth, increasing affluence and changing dietary habits. Rice is the most

important cereal food crop of India, which occupies about 24 per cent of gross cropped area of the country. It contributes 42 per cent of total food grain production and 45 per cent of total cereal production of the country. The average productivity of rice in India, at present, is 2.2 tons/ha, which is far below the global average of 2.7 tons/ha. India is expected to surpass its demand by the year 2030, if the rice production grows at 1.34% per annum. But it will remain in deficit of around 2.5 million tons, if the present growth rate of 1.14% continues up to the year 2030. It is estimated that India would require 5.3 MT more rice (as demand is 106.8MT and production is 101.5 MT) according to data CRRI 2015. Rice is known to be attacked by 56 fungal pathogens, of which 41 are reported to be seed-borne. Disease spectrum varies in different agro-climatic zones. In developing countries with poor farming practices seed-borne diseases are among the major problems. Losses due to seed borne diseases, Rice blast 75%, bacterial blight 6-60%, brown spot 50-90%, sheath rot 50%. Seed-borne pathogen may result in (i) loss in germination, (ii) discoloration and shrivelling, (iii) development of plant diseases, (iv) distribution of pathogen to new areas, (v) introduction of new strains or physiological races of pathogens along with germplasm from other countries, (vi) toxin production in infected sheets. Methods of detection of seed borne pathogen* visual examination*water agar method*standard blotter method*Examination of seed soaked in water*Examination of seed washing*Embryo count method*Rolled paper towel method*Examination of dried seed*growing on tests *Phage plaque method*PCR*ELISA*Electron microscopy Seed treatments for diseases management*physical seed treatment*chemical treatments*biological seed treatments Ideal characteristics of biocontrol agents* (not to be pathogenic) plant, animals, humans and other beneficial microorganism*should be broad spectrum*fast growth and sporulation* withstand adverse environment conditions*can be cultured under artificial media Recommendations of biocontrol agent as seed treatment in rice blast disease, other insects/pests, bacterial sheath blight *Trichoderma harzianum*, *T. viride*@ 5-10g/kg seed (before transplanting), *Bacillus subtilis*, *Pseudomonas fluorescence* 0.5 W.P. 10g/kg.

ORGANIC FARMING IS A WAY OF PROTECTING HUMAN LIFE FROM DANGEROUS CHEMICAL

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Sustainable agriculture is one of the most important farming at present time where societies are facing several kind of illnesses and coming risk in their life with the use of dangerous pesticides and fertilizers in farming. We should know that organic farming is a technique to liberate ourselves from these life aggressive chemicals. Organic farming is not an innovative concept, it is being practice from primitive times. The goals of organic farming to cultivating the land and growing crops in such a way that the soil is saved alive and in worthy condition by use of organic wastes such as crop, animal farm house litters, marine wastes and other organic constituents. The aims of organic farming to produce crop with a high nutritional value. There are various methods by which organic farming is practiced are such as crop diversity, Soil Management, Weed Management, Controlling other organisms and Livestock. Without sustainable farming we cannot grip our natural resources for future generation. Plant deposits nutrients, created on the farm are reprocessed back to the soil. Cover crops and composted manures are used to sustain soil organic matter and fertility. Sustainable agriculture provide food fiber, protect environment quality, enhance the quality of human life and use nonrenewable resources at most efficient way Through sustainable farming Indian farmer can increase productivity our resources as well as increase life of resources.

Key word: sustainable agriculture, organic farming, crop diversity, pesticide, environment

TIKHUR POWDER PREPARATION BY SEDIMENTATION AND THEIR EFFECTS IN ITS ATTRIBUTES

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The present study was designed to investigate effects on number of sedimentation on various attributes of *tikhur* powder. This powder was obtained after sedimentation process in traditional processing. During *tikhur* powder extraction process the sedimentation of *tikhur* paste was observed to be a critical component in the *tikhur* processing. After decantation of water *tikhur* powder attribute like starch, fat, protein, fiber, and ash content were recorded. Acidity of powder was decrease with increasing no. of sedimentation-decantation. Some physical properties like bulk density and angle of repose significantly deviated during the experiments. Also attempts were made to data analyzed by statistical methods.

Key words: *Tikhur*, *Curcuma angustifolia*, Properties, Sedimentation and attributes of *tikhur* powder.

TERRITORIAL STRATEGIES IN INSECTS

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Territory is a sociographical area that an organism of a particular species consistently defends against conspecifics (or, occasionally, organisms of other species). Organisms that defend territories in this way are referred to as territorial. Territorial behaviour in insects

being reported in many orders, particularly among the Odonata, Orthoptera, Hemiptera, Coleoptera, Hymenoptera, Lepidoptera and Diptera. Although territoriality has been recognized among immature stages as well as in both sexes of adult insects, most of the published reports deal with the reproductive consequences of aggressive interactions among territorial males. In all the species studied, territorial behaviour spreads males through a habitat, minimizing intruder interference with courtship and mating, and increasing the probability that females will be mated. There is still a widespread impression that the spectacular battles through which ants, bees and termites defend their broods and nests (Baronui-Rbanic, 1979; Wilson, 1971; Wynne-Edwards, 1962) provide the best examples of insect territoriality. Other kinds of territorial behaviour by subsocial or solitary insects have not been so widely published. Territorial organisms may use several strategies to defend their territories. Some organisms use a strategy termed the *dear enemy effect* in which two neighbouring territorial animals become less aggressive toward one another. The converse of this is the *nasty neighbour effect* in which a territory-holder shows more aggression towards neighbouring territory-holders but unaffected aggression to unfamiliar animals or distant territory-holders. These contrasting strategies depend on varied kind of purposes.

Key words: Territory, Dear enemy effect and Nasty neighbour

RELATIVE EFFICACY OF SELECTED INSECTICIDES BASED ON LT_{50} AGAINST *APHIS CRACCIVORA* (KOCH)

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Cowpea [*Vigna unguiculata* (L) Walp.] is a warm season annual leguminous fodder crop mainly grown in Northern and Central India. It has a great potential for sustainable agriculture in marginal lands and semi arid regions of the country and is now rapidly spreading to the entire country. The green cowpea fodder is rich in protein and forms an excellent mixture with maize, jowar, bajra and teosinte etc. and considered as balanced diet for animals for higher milk and meat production. Cowpea is attacked by many insect-pests which are the principal limiting factor for its productivity throughout the country. The losses in green fodder yield are estimated to a tune of 30%. Aphids are economically important insects causing severe damage to the crop. Both nymphs and adults suck plant sap and cause serious damage right from the seedling to pod bearing stage. The cowpea aphid, *A. craccivora* is widely distributed and prevalent throughout India. It is easily distinguished from other aphids because of its black colour and relatively small size (less than 2 mm). Apterous and winged adults are usually shiny black while the smaller nymphs may appear to be a dull gray to black. Laboratory and pot studies revealed few effective chemicals for management of the aphid. LT_{50} values ranged between 0.925 to 7.618 days (24 hours after treatment) and 3.098 to 15.560 days (48 hours after treatment). The highest LT_{50} value of 7.618 and 15.560 days against cowpea aphid was obtained with imidacloprid followed by dimethoate (5.765 and 10.542 days), acetamiprid (4.893 and 8.719 days) and thiamethoxam (2.867 and 6.015 days), at 24 and 48 hours after exposure, respectively. Whereas diafenthiuron, spiromesifen and chlorfenapyr showed the LT_{50} values of 1.540 and 3.454 days, 1.022 and 5.159 days and 0.925 and 3.098 days, respectively.

Keywords: LT_{50} , Relative efficacy and Insecticides.

IMPROVING SOCIOECONOMIC STATUS OF RURAL WOMEN THROUGH MUSHROOM CULTIVATION

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Women constitute almost fifty percent of the entire population. Rural women are invisible in statistics while women are extensively involved in agricultural activities. Rural women play a crucial role in agricultural development and allied fields. For the improvement of socio economic status of rural women mushroom cultivation plays an important role. Mushroom cultivation is a women friendly profession. Mushroom growing is one agricultural activity in which rural farm women can play a pivotal role without sacrificing their household responsibilities. Mushroom cultivation is simple, low cost, and suitable for rural areas, is less labor intensive and can provide employment in both the semi-urban and rural areas. Mushroom cultivation will improve the socio-economic condition of farmers, families and solve employment problems of both literate and illiterate, especially rural women. Mushroom cultivation is environment friendly and they biosynthesize their food from agricultural crop residues, which is readily available in rural areas. Mushroom have prized as the food of God on an account of their nutritive value, special flavor and medicinal property which can fight against malnutrition and helps to maintain nutritional security in rural areas. Mushroom is an indoor crop, grown independent of sunlight and do not require fertile land. Hence, rural women can adopt mushroom cultivation on individual or group level and raise their income and employment opportunities which make them economically and socially empowered.

Keywords: Rural women, Mushroom cultivation and malnutrition.

APPLICATION OF GREEN MANURE ENHANCE THE SOIL PROPERTIES AND YIELD IN AGRICULTURE**SOUMYA SUNHERIKABHOI¹ AND DEBASHIS NAYAK²***1: Gandhi Institute of Biological sciences, Berhampur University, Gunupur, Rayagada, Odisha, 2: Dept. of Agronomy, Krishi Vigyan Kendra Mayurbhanj-I, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha*

Green manure crops have been used in traditional agriculture (before 1960s) for thousands of years but conventional (chemical) farming systems largely rejected them as the use of fertilizers and pesticides became more common. Although they have many roles they are still often under utilised by today's organic farmers. The green manure basically comprises of green rotten crops or plants. It is created by leaving uprooted or sown crop parts to wither on a field so that they serve as a mulch and soil amendment. The plants used for green manure are often cover crops grown primarily for this purpose. Green manuring helps in, structural improvement of soil and its tilth, fertility improvement of soil, Amelioration of soil problems, improvement of crop yield and quality, pest control and population of soil micro flora (Bacteria, Fungi and Actinomycetes) and enzymatic activity (dehydrogenase and phosphatase) were found. Plant growth promotion will be observed due to increased microbial activities leads to production of enzymes, hormones and metabolites, biocontrol of plant insect pests, pathogens, enhancing metabolic activity in plant, production of plant alkaloids and natural metabolites. Green manuring has been scientifically proven to increase soil fertility due its ability to enhance soil organic matter content, available nitrogen, concentration of nutrients near the soil surface in available form, and reduce the N losses through leaching and soil erosion.

Keywords: Green manure, mulch and soil fertility.

INTROGRESSION OF TOLCV DISEASE RESISTANCE GENE (TY-2) INTO TOMATO CULTIVAR BY MARKER ASSISTED BACKCROSS BREEDING**SOWJANYA B.A.¹ AND O. SRIDEVI²***Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad - 58005*

The present research was undertaken to develop fresh market tomato lines resistant to begomoviruses causing *tomato leaf curl (ToLCV)* disease. *ToLCV* disease resistance gene (*Ty-2*) was transferred by marker assisted backcross breeding from donor parent CLN2777H into the susceptible but agronomically superior tomato cultivar DMT-02 (recurrent parent) by marker assisted selection. DMT-02 is released for Northern Karnataka, India for fresh market with superior yield and which is highly susceptible to leaf curl, a major disease of the region. A *ToLCV* resistance gene associated Co-dominant SCAR marker P1-16 which is tightly linked to the gene *Ty-2* was used to discriminate between homozygotes and heterozygotes at the seedling stage prior to reproductive stage, which enabled the rejection of non target backcross progenies of the cross DMT-02XCLN2777H. F_1 hybrid population were developed by crossing DMT-02 with CLN2777H and genotyping of F_1 was carried out, plants carrying *Ty-2* gene resistant to *ToLCV* backcrossed for two more generation to recurrent parent to get BC_2F_1 . Genotyping of BC_2F_1 plants was done to conform the presence of *Ty-2* gene, conformed plants was selfed to get BC_2F_2 population. BC_2F_2 plants were genotyped to get the homozygous resistant plant for *Ty-2* gene. BC_2F_2 plants which were phenotypically similar to recurrent parent DMT-02 along with *Ty-2* gene were selfed to get BC_2F_3 population. Plants of BC_2F_3 generation containing *Ty-2* gene were phenotypically screened for *ToLCV*, and these plants exhibited resistance to *Tomato leaf curl* disease. Further comparisons indicated that the improved lines were similar to recurrent parent in multiple agronomic traits including plant height, fruit shape, fruit yield.

Key words: Tomato, *ToLCV*, marker assisted selection, SCAR, genotyping.

UTILIZATION OF AGRO WASTE: NEW ECO- FRIENDLY ENERGY RESOURCE**SREENIVAS REDDY. K¹, UDAYBHASKAR. M² AND PULLARAO. CH³***Acharya N.G.Ranga Agricultural University, Agril.college, Bapatla*

Agricultural residues generally considered as agro-wastes are produced in huge quantities every year in Indian farm fields. This waste can be used for energy production in rural areas of the surrounding region. According to survey by GOI, every year about 500 Metric ton of crop residue is generated. If all these agro wastes were collected and used for power generation it could generate over 50,000 MW of power and also providing extra income to farmers. Use of agro waste for the power generation is the new eco-friendly resource. Agricultural waste management (AWM) for ecological agriculture and sustainable development consist of six basic functions, these are production, collection, storage, treatment, transfer, and utilization. Many studies reported the feasibility of utilizing the different wastes, like coffee waste is used in the production of bricks, waste of sawdust for the removal of basic dye 'methylene blue', wheat bran agricultural waste to produce Bio-alcohol and Physical and chemical properties of coconut shell in asphalt mixture its application in road construction. . More conversion of the waste requires more research and renovation in the existing technologies. Our country should focus towards clean and secure energy sources for the growth of a green nation.

Key words: Agro waste, eco-friendly

MANAGEMENT OF SILICON IN SUSTAINABLE RICE PRODUCTION**SRINIVASA, D. K¹. CHIKKARAMAPPA, T². MALLESH, K. U³ AND JAISON, M⁴.**

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Rice is heavy feeder of silicon, its content as well as Si: Ca ratio is higher than 1 percent and therefore, it requires high amounts of silicon for sustained productivity. Although agricultural soils are largely composed of silicate minerals, many soils contain an inadequate supply or are naturally low in plant available silicon. Most likely, silicon content in some regions might be limiting to sustainable rice production. In addition, silicon depletion can occur in traditional rice soils from the continuous monoculture of high yielding cultivars with intensive cultivation practices especially if farmers are not applying the silicon removed by rice. The form of silicon absorbed by plant roots is silicic acid which is transported to the shoot. It is concentrated due to loss of water and is polymerized to colloidal silicic acid and finally to silica gel with increasing silicic acid concentration. Rice is known as silicon accumulator and plant benefits much from silicon nutrition. Silica is required for healthy and productive development of the rice plant. This element is absorbed by rice from the soil in large amounts that is several fold greater than those of other macro- nutrients. On an average, it is estimated that a rice crop producing a total grain yield of about 5 tonnes ha⁻¹ will normally remove 230 to 470 Si kg ha⁻¹ (500-1000 SiO₂ kg ha⁻¹) from soil. Silicon interacts with other native or applied nutrients and has the potential to induce resistance or tolerance in the rice plant to biotic (insects, pests and diseases) and abiotic stresses like Al, Fe and Mn toxicity, salt injury and lodging. From this, it's clearly shows that silicon is a quasi-essential element for rice plant.

Key words: Silicon, Rice and salicylic acid

AGRONOMIC BIOFORTIFICATION OF WHEAT TO ACHIEVE NUTRITIONAL SECURITY**SUBHASHISA PRAHARAJ* & ROHITASHAV SINGH**

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Wheat is the second most important cereal of India next to Rice. Thus its nutritional significance holds great value as it constitutes a major portion of Indian diet. Though wheat is a rich source of carbohydrate and protein, still it is comparatively lower in terms of micronutrient content. Micronutrient deficiency is a major problem in India. Intensive agriculture, lower addition of organic matter to soil, use of high analysis fertilizers etc. has posed serious concern of micronutrient deficiency in Indian agriculture. More than 50 % of the areas have been reported to be deficient in zinc. There is growing interest in the role of micronutrients (essential trace elements and vitamins) in optimizing health, and in prevention or treatment of disease. For these reasons, understanding micronutrients is critical for anyone seeking to maintain or improve the nutritional security which in turn ensures health security. Zinc deficiency often limits crop productivity of cereals, though the response to the nutrient varies with crop and even with variety. Thus, biofortification of wheat with micronutrient like zinc can be of great use in reducing Zinc deficiency related hidden hunger. Application of Zinc containing fertilizer to wheat has been found to improve the zinc content of Wheat, however the efficiency of zinc fertilizer varies with application methods. Foliar application of Zinc to wheat has been found to improve zinc content to a higher content as compared to soil application methods.

PROSPECTS OF BIO-RATIONAL APPROACHES IN PEST MANAGEMENT**SUDHANSHU BALANAYAK AND SANKARARAO K**

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Biorational pesticides are derived from natural materials such as animals, plants, bacteria and certain minerals, it may be synthetic or natural compound of microbial, plant protectant and biochemical (pheromones, hormones, natural growth regulators and enzymes) origins. The examples of biorational pesticides are the microbial pesticides *Bacillus thuringiensis*, neonicotinoids, avermectins, phenylpyrazoles, spinosyns, pyrroles, oxadiazines and insect growth regulators (IGR). Some of them results in knock-down, rapid intoxication, lack of coordination, paralysis and death, and have higher affinity to insect receptors than to mammalian. The others affect specific systems such as the molting processes, metamorphosis and insect endocrinology system. The efficacy of two insect growth regulators (IGR) like buprofezin and lufenuron evaluated against *Bemisia tabaci* and *Helicoverpa armigera*. Both IGR found effective against *B. tabaci*, while buprofezin was not effective against *H. armigera*, both IGRs appeared safe to predator populations. Insect growth regulator buprofezin was found effective against the papaya mealybug, *Paracoccus marginatus* under field condition. Biorational pesticides are known as third generation pesticides, and these are preferable because of their specificity to target pests, effectiveness at low rates, selectivity to beneficial insects and their non-persistent characteristics in the environment. Hence it can play an important role in integrated pest management (IPM) strategies.

IN VITRO MULTIPLICATION OF BANANA CV. KECHULEPA USING GROWTH HORMONES SUGANDH SUMAN* AND HARSH KUMAR

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Kechulepa, is one of the most important local cultivar of banana grown in north-eastern India. It is suitable for the fresh leaf market and it produces a robust bunch with good quality and dual-purpose fruits having high TSS. The aim of this study was to investigate the effect of growth hormones on *in vitro* multiplication of banana. Shoot tips were cultured on MS medium supplemented with different concentrations of IAA (5.71, 11.42 and 22.83 μ M), BAP (4.43, .87, 17.74 and 26.61 μ M) and combination of IAA (0.57, 5.71 and 11.42 μ M) and BAP (8.87, 13.30 and 17.74 μ M). The culture of shoot tips taken from suckers on Murashige and Skoog (MS) medium supplemented with different concentrations and combinations of Indole acetic acid (IAA) and Benzyl amino purine (BAP) resulted in differentiation of adventitious shoots. The maximum differentiation of shoots (62.50 %) was observed on MS medium with 0.57 μ M IAA and 17.74 M BAP. The number of shoots per culture was 7.25. The subculture of differentiated shoots on MS medium resulted in further differentiation of shoots. The *in vitro* developed shoots showed 100% rooting on MS medium supplemented with 4.92 μ M Indole butyric acid (IBA). The plantlets were acclimatized and field transferred. A suitable and efficient protocol for micropropagation of Kechulepa cultivar of banana was developed.

INDUCTION OF DEFENSE ENZYMES AND SCANNING ELECTRON MICROSCOPY STUDY OF COW URINE AGAINST *DICKEYA DADANTII* ASSOCIATED WITH STALK ROT OF SORGHUM.

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Sweet sorghum (*Sorghum bicolor* (L)), has an important role as a source of carbohydrates. Soil borne *Dickeya dadantii* (Stalk rot) significantly affects sorghum production. Although studies delineating antimicrobial activity of Cow urine (CU) against bacterial pathogens are documented, there is need for divulging to get the best dosage of cow urine on growth, production and induction of defense related enzymes of Sorghum. Therefore, investigations pertaining to induction of such systemic resistance and associated biochemical responses is essential to understand the mechanism of bio-growth promoter control by cow urine. In this regard, current study was designed to understand the role of cow urine in antibacterial activity and inducing defense related enzymes (Peroxidase (PO), Polyphenol Oxidase (PPO) and Phenyl Alanine ammonia Lyase (PAL)) at different four concentration (5, 10, and 15, 20 %) against *D. dadantii* under *in vitro* and glass house conditions and it exhibited a equal degree of antimicrobial activity in comparison to antibiotics. And among these different concentrations of cow urine at 20 % conc. was found most effective against *D. dadantii*. We also evaluated effect of cow urine at these different concentration on exomorphological parameters (of plant height, root shoot length, leaf length and leaf width) of Sorghum. Application of cow urine in sorghum significantly induced production of defense related enzymes such as PO, PPO and PAL that could have enhanced the incidence systemic resistance in sorghum plant, which in turn would have reduced the disease incidence. We have also done to know the minimum inhibitory concentration (MIC) against *D. dadantii* of CU by using U.V. Spectrophotometer and as well as observed the morphology changes in bacterial cell size at 20% conc. with scanning microscope (SEM). These results indicate that the cow urine at 20% has significant antimicrobial activities and induced the higher level defense enzymes to reduce the disease level against *D. dadantii*, which supports the claim of traditional practitioner. Outcomes of the study will be useful in formulating cow urine accurate concentration and time of application to control stalk rot of sorghum.

EFFECT OF IRON ON GROWTH, YIELD AND NODULATION OF BLACK GRAM (*VIGNA MUNGOL*). SUJEET RAM AND VIRENDRA SINGH

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The present study entitled Impact of Effect of Iron on growth, yield and nodulation of black gram was carried out at School of Agricultural Sciences and Engineering, IFTM University, Moradabad in 2017-18. The effect iron Blackgram is the third important pulse crop in India. In blackgram (*Vigna mungo* (L.) Hepper) popularly known as "urdban" is one of the important grain legumes and is an excellent source of easily digestible good quality protein. It belongs to the family Leguminosae under the genus *Vigna*. It is widely cultivated in Indian subcontinent and to a lesser extent in Thailand, Australia and other Asian and South Pacific countries (Poehlman, 1991). Black gram (*Vigna mungo* L.) belongs to family *Fabaceae* sub family *papilionaceae*, is being grown as one of the principle pulse crops. Madhya Pradesh is occupying an area of 0.64 m ha with the production and productivity of 0.26 MT and 413 kg/ha, respectively. In India, black gram is grown in 3.11 M ha area with total production of 1.90 MT and average productivity is 642 kg/ha (Anonymous, 2013). Treatment Detail T1- Control (RDF), T2-30kg P₂O₅ +Iron-Seed treatment, T3 -30kg P₂O₅ +Iron-Seed treatment + One Spray (15

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DAS), T4 -30kg P₂O₅ + Iron-Seed treatment + Two Spray (15&30 DAS), T5-45kg P₂O₅ + Iron-Seed, treatment, T6-45kg P₂O₅ + Iron-Seed treatment + One Spray (15 DAS), T7-45kg P₂O₅ + Iron-Seed treatment + Two Spray (15 & 30 DAS), T8-60kg P₂O₅ + Iron-Seed treatment, T9-60kg P₂O₅ + Iron-Seed treatment + One Spray (15 DAS), T10-60kg P₂O₅ + Iron-Seed + Two Spray (15 & 30 DAS). with ten treatment and three replication.

EFFECT OF DIFFERENT NUTRIENT SOURCES ON SOIL PROPERTIES AND YIELD OF WHEAT UNDER POPLAR BASED AGROFORESTRY SYSTEM

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The field experiment was carried out in Agroforestry Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand during the *rabi* season of 2017-2018 to study the effect of different nutrient sources on the performance of wheat under poplar based agroforestry system. Nine nutrient sources and their combinations (Control, NPK, FYM, VC, NPK+FYM, NPK+VC, FYM+VC, NPK+FYM+VC and open control) were tested in randomized block design with three replications. Among different nutrient sources under poplar based agroforestry NPK+FYM+VC reported maximum plant height (92.8 cm), spike length (8.7 cm), 1000 grain weight (34.17 g), grain yield (35.1 q/ha), straw yield (68.7 q/ha) and biological yield (103.8 q/ha). However open farming system had more grain yield than beneath tree canopy. Soil physico-chemical and biological properties improved under organic nutrient sources and their combinations as compared to control and open control. Bulk density was lower under tree based treatments compared to open control. Also the CO₂ evolution and carbon fractions were recorded higher under tree based system compared to open control and were considerably influenced by the nutrient sources. Therefore, it is concluded from the study that the effect of nutrient sources showed considerable improvement on the soil properties as well as yield of wheat.

Keywords: Agroforestry, poplar-wheat, nutrient sources, yield

MICROCLIMATIC STUDIES IN RICE CROP UNDER DIFFERENT PLANTING METHODS

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Rice is the predominant cereal crop in north-west India including Punjab. Rice ranks second after wheat in terms of area, production and productivity in Punjab. It occupies an area of 28.45 lakh hectare with production of 113.7 lakh tons and an average yield of 39.98 q/ha (Anonymous 2014). Punjab is currently facing problem of declining water table in some parts, increased energy cost of pumping and deterioration of ground water quality etc. There are indications that the water availability would emerge soon as a limiting factor in Punjab. Keeping this in view, the field experiment was carried out at the Research Farm, School of Climate Change and Agricultural Meteorology, Punjab Agricultural University, Ludhiana during *khari* 2015 to study the performance of rice crop under different planting methods. The experiment comprises of two dates of sowing (15th May and 30th May), two rice varieties (PR 122 and PR 124) and two methods of planting (conventional and direct seeded). The micrometeorological data on photosynthetically active radiation (PAR), relative humidity and canopy temperature were recorded within the crop canopy. The phenological stages were recorded visually. The yield and yield contributing characteristics viz. number of tillers, number of effective tillers, number of grains per panicle, 1000-grain weight, total grain and straw yield were recorded at the time of harvesting. The result showed that, PAR interception was recorded two per cent higher under direct seeded as compared to conventional method. Canopy temperature was also higher (0.5- 1°C) in direct seeded method as compared to conventional method. Relative humidity was higher in conventional method as compared to direct seeded method. The yield and yield contributing attributes viz. plant height, number of grains per panicle, panicle length, number of effective tillers and 1000-grain weight were higher in 15th May sown crop as compared to 30th May, variety PR 122 as compared to variety PR 124 and conventional method as compared to direct seeded method. The grain yield was higher 70.32 q/ha in early sowing (15th May) as compared to 64.07 q/ha in late sowing (30th May). Grain yield was recorded significantly higher in variety PR 122 (68.31 q/ha) as compared to PR 124 (66.07 q/ha) and significantly higher in conventional method (68.54 q/ha) as compared to direct seeded method (65.84 q/ha).

Keywords: Rice, conventional method, direct seeded method, photosynthetically active radiation and canopy temperature

DETERMINATION OF THE MOST SENSITIVE SPECTRAL BANDS FOR ASSESSING SOIL FERTILITY STATUS OF A POTATO FIELD

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Potato is the predominant vegetable crop of India (Third advanced Estimates, Govt. of India, 2017). As per a survey conducted by

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Sekhon et al. (2015, personal communication), potato growers use on an average 241 kg N ha^{-1} , $183 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$, and $101 \text{ kg K}_2\text{O ha}^{-1}$ (as against the general recommendation of $\text{N } 190 \text{ kg ha}^{-1}$, fertilizer $\text{P } 60 \text{ kg ha}^{-1}$, and fertilizer $\text{K } 60 \text{ kg ha}^{-1}$). Soil test based fertilizer use holds a huge promise in curtailing irrational fertilizer use in this crop and thus can benefit financially both the farmers and the government. However, timely availability of soil test results and comprehensive sampling are two important prerequisites for successful adoption of soil test based fertilizer recommendations. Conventional chemical-based soil test methods may not match up to these prerequisites. Diffuse reflectance based spectroscopic methods can, however, help meet these prerequisites. With this objective, a potato field in Mohie village of Ludhiana district was sampled (0-15cm) at 70 nodes in $10\text{m} \times 20\text{m}$ grid pattern. The samples were divided into two parts and prepared for both chemical and spectral analyses. Reflectance of soil samples was recorded in dark chamber by using ASD FieldSpec Pro[®] spectroradiometer (350-2500nm reflectance spectra collected at every 1nm width and then resampled after every 10nm). The raw spectra were transformed into absorbance and then further to first derivative, to eliminate noise. Partial least squares regression (PLSR) procedure was used to develop models for predicting soil fertility variables by using absorbance values by employing SAS 9.3 statistical package. Weighted regression coefficients were developed to identify spectral bands that correlate well with a given soil fertility variable. Results showed that the band around 1000-1050nm was most relevant to pH and EC prediction and for soil organic carbon it was around 2200-2250nm. Olsen-P measurements correlated well with band around 2150-2200nm. However, Mehlich-3P predictions were related with 1800-1850nm band. Available K predictions were weighed heavily on band around 1860-1910nm. Thus, soil reflectance properties due to their rapid assessment hold good promise in providing timely soil test results and can ensure wider coverage of acreage to override spatial variability.

Keywords: Potato, Reflectance, Sensitive Spectral Bands, Weighted Regression coefficient

INTERACTION EFFECT OF NITROGEN AND SULPHUR ON THE YIELD, OIL AND PROTEIN CONTENT OF MUSTARD (*BRASSICA JUNCEAL.*)

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The present investigation conducted through a pot experiment followed by laboratory analysis of the soil and plant samples in the Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP). This experiment consists of four Nitrogen level treatments i.e. 0, 50, 100 and 150 kg N ha^{-1} designated as N_1 , N_2 , N_3 and N_4 , respectively and three levels of sulphur 0, 25, and 50 kg S ha^{-1} indicated as S_1 , S_2 , and S_3 respectively. The experiment was analysed using Factorial CRD with three replications. The yield and total biomass production increases upto treatment ($100 \text{ kg N}^{-1} + 25 \text{ kg S}^{-1}$) oil content was also increases with increasing N level up to 150 kg N ha^{-1} , and with sulphur level upto 50 kg S ha^{-1} . But when both the nutrients were provided together maximum yield, oil and protein content was observed with ($100 \text{ kg N}^{-1} + 25 \text{ kg S}^{-1}$). Further increasing N level i.e. 150 kg N ha^{-1} along with Sulphur doses have negative effect on seed yield, oil and protein content and other growth factors. On the other hand, with increase in sulphur levels plant height increases upto highest i.e., 50 kg S ha^{-1} whereas silique per plant, 1000 seed weight, branches per plant and seed and stover yield increases significantly up to 25 kg S ha^{-1} . Considering the combined effect of N and S, the treatment combination N_2S_3 produced the maximum seed yield.

Keywords: Fertilizer, Treatment level, Seed and Stover yield, Silique

IMPORTANCE OF PLANT GENETIC RESOURCES IN AGRICULTURE

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Plants are the main source of food, fodder and shelter for all the living organisms. Human have always tried to select best plant for its use. But this selection is possible only when genotypic variability exist in a species. So to continue this selection it is necessary that we should save sum total of all variability existing in a particular species. These variations which include all alleles from cultivated and wild relatives are called germplasm. Germplasm is the pre-requisite of all plant breeding programmes. The relative and wild forms of a species always harbor many important genes providing resistance to abiotic and biotic stresses. But in last few decades, there is continuous losses of germplasm from nature. Recent modernization activities which led to deforestation are main cause of these losses. If we will ignore these activities, we can loss sources of many useful genes. So to control these losses there is a need of conservation of these resources. There are different methods and techniques to conserve them. Seed and field gene bank are the most commonly used methods for field and plantation crops. Now a day, biotechnological techniques like cryopreservation, DNA bank and slow growth culture are also in use for germplasm protection.

Keywords: Germplasm, Plant Genetic Resources, Plant Breeding

EFFECTIVE SOIL MANAGEMENT PRACTICES IN SUSTAINABLE AGRICULTURE**SUMAN DHAYAL***Agronomy at Agriculture university, Kota, Rajasthan*

Managing soil organic carbon is a common point in soil for best growth of crops and has good soil condition. This condition will be completed by best soil management practices, whereby increases soil organic matter, the soil sustain most living organism, being the ultimate source of their mineral nutrients. Compost and manures also contain appreciable quantities of other essential mineral elements. The cultivation of grasslands causes a rapid loss of carbon and nitrogen from the soil, which results in both a decline in soil quality and an increase in the emission of green house gasses. Soil erosion can be reduced by conservation tillage systems that maintain crop residues on the soil surface. Physical properties (soil structure, soil consistency, soil temperature and moisture etc.), Biological properties (microorganisms, organic matter etc.) and chemical properties (soil reaction, CEC, nutrient content etc.) also increases by good soil management practices i.e. tillage, mulching, high amount of FYM and low amount of external fertilizers, timely and right amount of irrigation etc. Decreasing soil erosion is essential, both to maintain soil resource and minimize downstream damage for ex. Sedimentation of rivers with adverse impacts on fishes. Soil erosion management practices followed by:-cover crop growing ex. Cow pea, groundnut; Mulching practices; Erosion resistance crop growing

Key words: 1. Soil organic carbon 2. Tillage operation 3. Soil properties 4. Soil erosion

FOOD PROCESSING AND VALUE ADDITION OF AGRI-PRODUCTS: IMPORTANCE AND CHALLENGES**RAJASTHAN AGRICULTURE RESEARCH INSTITUTE, DURGAPURA, JAIPUR*****SUMAN KUMARI YADAV AND *SURESH KUMAR CHOUDHARY****Department of Horticulture, RARI, Durgapura, Jaipur*

India rank first in cereals and milk production and second in fruit and vegetable production but post harvest processing and value addition is about 1.5 percent in India as against 30 percent in developed countries. Value addition is the process of changing or transforming a product from its original state to more valuable state. Food processing and value addition are key steps in the food value chain. Processed and value added products fetch a higher price, can be stored for a longer time and need less space. Developing food processing technologies that are environmentally friendly and efficient can substantially contribute to the food value chain. Some methods of food processing have been challenged in the recent years but food processing cannot be circumvented entirely because of the ever-growing human population that has to be nourished. The increase in global population during the past two centuries has made food processing one of the most deliberated subjects in the food value chain. The need for processed food is expected to increase even further when the global population increases further. Inadequate infrastructure facilities, absence of comprehensive national level policy on food processing sector, food Safety Laws & Inconsistency in State and Central policies, Lack of adequate trained manpower, high requirement of working capital, low availability of new reliable and better accuracy instruments and equipments these are the major challenges for poor post harvest processing and value addition in India.

Key words: Value addition, food, processing and products.

EFFECT OF SULPHUR AND ZINC ON GROWTH AND YIELD OF YELLOW MUSTARD (*BRASSICA CAMPESTRIS* L.) IN WESTERN U.P.**SUMIT KUMAR, VIRENDRA SINGH, SATYBHAN SINGH AND PRADEEP KUMAR****School of Agricultural Sciences & Engineering, IFTM University, Moradabad-244 102*

A field experiment was conducted during Rabi 2016-17 at the research farm of IFTM University, Lodhipur Rajput, Moradabad (U.P.). The experiment consisted of twelve treatment combinations viz. T₁- Control, T₂- Zinc 5 kg/ha, T₃- Zinc 10 kg/ha, T₄- Sulphur 15 kg/ha, T₅- Sulphur 15 kg/ha + Zinc 5 kg/ha, T₆- Sulphur 15 kg/ha + Zinc 10 kg/ha, T₇- Sulphur 30 kg/ha, T₈- Sulphur 30 kg/ha + Zinc 5 kg/ha, T₉- Sulphur 30 kg/ha + Zinc 10 kg/ha, T₁₀- Sulphur 45 kg/ha, T₁₁- Sulphur 45 kg/ha + Zinc 5 kg/ha and T₁₂- Sulphur 45 kg/ha + Zinc 10 kg/ha, which were tested in randomized block design and replicated three times. The recommended dose of NPK were applied @ 60: 60: 40 kg ha⁻¹ and standard package of practices followed during crop growth. The result revealed that the application of Sulphur @ 45 kg/ha + Zinc 10 kg/ha significantly influenced the plant height (46.66, 85.66 and 128 cm), fresh weight (37.00, 66.66 and 173 g), dry weight (4.36, 8.26 and 26.83 g) at 30, 60 and 90 days after sowing, test weight (5.02 g), grain yield (17.38 q/ha), cost of cultivation (35,586 Rs/ha), gross return (86,904 Rs/ha), net return (51,318), respectively. Number of primary branches (10) at 30 DAS, number of siliqua/plant (173.33) at harvesting time were also superior over the control. While, number of secondary branches (5.33) at 30 DAS were found significantly superior with the treatment (Sulphur 45 kg/ha + Zinc 5 kg/ha) and number of plant/m² (19.67) at 30 DAS, stover yield (59.87 q/ha), benefit cost ratio (1.48) were found significantly superior with the treatment (Sulphur 45 kg/ha).

INTEGRATED DISEASE MANAGEMENT OF LATE BLIGHT OF POTATO**SUMIT KUMAR¹, PUSHPENDRA KUMAR DHAKAD¹, SHYAM KISHOR PATEL¹***Department of Mycology and Plant Pathology, IAS, BHU, Varanasi*

Late blight of potato caused by *Phytophthora infestans* (Mont.) de Bary is one of the most serious diseases of potato. Several management practices have been adopted so far to minimize the disease. But in present investigation based on laboratory and glass house condition revealed that soil application and tuber seed dressing with bio formulation provided good protection against late blight and also stimulate the germination. The efficacy of fungicide revealed that minimum radial growth with 0.50 mm in diameter was recorded at 300 ppm concentration which was followed by 200 ppm, 100 ppm and 50 ppm. However, no mycelial growth recorded at 400 ppm. As per concern of per cent inhibition the highest with 100% inhibition was recorded from 400 ppm concentration of Metalaxyl. The data showed that the plant height of potato was maximum in treatment T₁ (Soil application of FYM @ 125gm/pot + mushroom waste with *T. harzianum* @ 5gm/kg + tuber treatment with *Azotobacter* @ 5% + foliar spray with Ridomil @ 0.25%) with the value of 44.5 cm at 30 day age of plant. Tuber treatment with bio agents stimulated the germination per cent of the tuber. The maximum germination per cent was noted in case of T₁ (Soil application of FYM @ 125gm/pot + mushroom waste with *T. harzianum* @ 5gm/kg + tuber treatment with *Azotobacter* @ 5% + foliar spray with Ridomil @ 0.25%).

EFFECT OF SULPHUR AND ZINC ON GROWTH AND YIELD OF YELLOW MUSTARD (*BRASSICA CAMPESTRIS* L.) IN WESTERN U.P.**SUMIT KUMAR, VIRENDRA SINGH, SATYBHAN SINGH AND PRADEEP KUMAR****School of Agricultural Sciences & Engineering, IFTM University, Moradabad-244 102*

A field experiment was conducted during Rabi 2016-17 at the research farm of IFTM University, Lodhipur Rajput, Moradabad (U.P.). The experiment consisted of twelve treatment combinations viz. T₁- Control, T₂- Zinc 5 kg/ha, T₃- Zinc 10 kg/ha, T₄- Sulphur 15 kg/ha, T₅- Sulphur 15 kg/ha + Zinc 5 kg/ha, T₆- Sulphur 15 kg/ha + Zinc 10 kg/ha, T₇- Sulphur 30 kg/ha, T₈- Sulphur 30 kg/ha + Zinc 5 kg/ha, T₉- Sulphur 30 kg/ha + Zinc 10 kg/ha, T₁₀- Sulphur 45 kg/ha, T₁₁- Sulphur 45 kg/ha + Zinc 5 kg/ha and T₁₂- Sulphur 45 kg/ha + Zinc 10 kg/ha, which were tested in randomized block design and replicated three times. The recommended dose of NPK were applied @ 60: 60: 40 kg ha⁻¹ and standard package of practices followed during crop growth. The result revealed that the application of Sulphur @ 45 kg/ha + Zinc 10 kg/ha significantly influenced the plant height (46.66, 85.66 and 128 cm), fresh weight (37.00, 66.66 and 173 g), dry weight (4.36, 8.26 and 26.83 g) at 30, 60 and 90 days after sowing, test weight (5.02 g), grain yield (17.38 q/ha), cost of cultivation (35,586 Rs/ha), gross return (86,904 Rs/ha), net return (51,318), respectively. Number of primary branches (10) at 30 DAS, number of silique/plant (173.33) at harvesting time were also superior over the control. While, number of secondary branches (5.33) at 30 DAS were found significantly superior with the treatment (Sulphur 45 kg/ha + Zinc 5 kg/ha) and number of plant/m² (19.67) at 30 DAS, stover yield (59.87 q/ha), benefit cost ratio (1.48) were found significantly superior with the treatment (Sulphur 45 kg/ha).

DOUBLING THE FARMERS INCOME THROUGH MANAGING THE INPUT RESOURCES**SUNDARANCHRA¹ DR. R. C. BAIRWA² MAHENDRA KUMAR ROJH³ ANKUR BHAKAR⁴***Agronomy, ^{1,2,3}SKRAU Bikaner; ⁴NDRI Karnal (Haryana)*

If a large number of agricultural households are connected to mass consumption markets both domestic and global the objective of doubling farm income doesn't seem daunting. The focus must shift from increasing per acre productivity to gainfully employing farm households in other farm-related activities. According to economic survey around 50 percent of the Indian population depends on Agriculture and its allied activities for their living which contributes 17.4% of Gross Domestic Product (GDP). The real growth of an economy lies in enhancing the lives of the part population struggling in agriculture. The NITI Ayog's road map presents a quantitative framework for doubling farmer's income which has identified seven sources of growth. These includes 1) increase in productivity of crops, 2) increase in production of livestock, 3) improvement in efficiency of input use, 4) increase in crop intensity, 5) diversification towards high value crops, 6) improved price realization by farmers and 7) shift of cultivator to non-farm jobs. Apart from this, the ministry has also constituted an inter-ministerial committee for recommending a suitable strategy for doubling farmers' income by 2022. Meanwhile, the Centre is realigning its interventions to move from "production-centric" to "farmers' income centric" platform. "Agrarian distress as manifest from a large number of farmers living below the poverty line and unfortunate incidents of suicides can be addressed by enabling farmers to increase their income," the Minister of State for Agriculture Parshottam Rupala said. The schemes to promote soil health card, neem-coated urea, crop insurance, e-market and interest subvention are aimed at increasing farmers income.

BLACK RICE: A NEW EMERGING SUPER FOOD IN NUTRITION SCIENCE**SUNIDHI MISHRA¹, SARLA LAKHAWAT² AND HIMANSHU PANDEY³***Department of food science and nutrition, Maharana Pratap University of agriculture and technology, Udaipur, Rajasthan., Department of FSN, MPUAT, Udaipur, Raj.**Department of biotechnology, Dr. Y.S. Parmar University of horticulture and forestry, Solan, Himachal Pradesh*

Rice is a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. Black rice is the one of variety of the rice and it is also known as forbidden rice is packed with high level of nutrients and antioxidants. Black rice is black due to anthocyanin content in the outer layer of its kernel. Black rice is a rich source of iron, **vitamin E**, and antioxidants. It also contains dietary fiber, anti-inflammatory properties and has the ability to help and stop the development of diabetes, cancer, heart disease and even weight gain. It is also naturally gluten free grain. Hence, black rice is super food loaded with lots of nutrients, which helps to maintain the health and prevent the diseases.

EFFECT OF MULTINUTRIENT BRIQUETTES ON MOVEMENT OF NITROGEN, PHOSPHORUS, POTASSIUM AND ZINC IN SOIL AND ITS INFLUENCE ON YIELD OF Bt COTTON**SUNIL B. H.*, V. D. PATIL **, PUSHPALATHAM.******Department of Soil Science and Agriculture Chemistry, Parbhani., Department of Soil Science and Agriculture Chemistry, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani 431402 (M.S.) India*

A field experiment was conducted to study the effect of multinutrient briquettes on the movement of Nitrogen (N), Phosphorus (P), Potassium (K) and Zinc (Zn) in soil and its influence on yield of Bt cotton. The experiment was laid out in a Randomised Block Design with five treatments and four replications, conducted at the College of Agriculture Parbhani during the Kharif season of 2015-2016. Treatments detail are as follows: T₁: Absolute Control (No fertilizer application), T₂: Soil application of 120:60:60 by N, P₂O₅, K₂O kg ha⁻¹ and drip irrigation, T₃: RDF through fertigation (soluble fertilizer: 80:40:40 NPK kg ha⁻¹), T₄: 120: 60: 60 kg NPK kg ha⁻¹ through briquettes with drip irrigation, T₅: Application of NPK + micronutrient briquettes (120:60: 60 NPK kg ha⁻¹ + 20kg ha⁻¹) ZnSO₄. The results of the investigation revealed that height of Bt cotton plant at square formation, flowering, boll bursting and harvest was continuously increasing in all the treatments. Maximum increase in height of plant, number of leaves and dry matter yield and also number of boll was observed with the treatment receiving RDF through a fertigation in six splits followed by multi nutrient NPK+ Zn briquette application. The movement of nutrient N was maximum in treatment receiving recommended dose of fertilizer through fertigation at all depths followed by the application of briquette in root rhizosphere. The movement of nutrient P was observed at a lower magnitude, however, the P movement was maximum in soluble fertilizers and briquettes. The mobility rate of K, was reduced due to the synergetic effect of the slow release of N and Zn. The Zn content was more at 15 and 30 cm depth as compared to 30 cm distance from the plant. The movement of Zn was found to be the highest in the treatment which received soluble fertilizer.

EFFECTIVE TOOL OF INCREASING FARMERS INCOME: INCREASING SEED REPLACEMENT RATE**SUNIL KUMAR***Department of Seed Science and Technology, College of Agriculture, CCSHAU, Hisar-125004, Haryana, India*

Seed is the critical determinant of agricultural production on which the performance and efficacy of other inputs depend. Quality seeds appropriate to different agro-climatic conditions and in sufficient quantity at affordable prices are required to raise productivity. Availability and use of quality seeds is not a one time affair. Sustained increase in agriculture production and productivity necessarily requires continuous development of new and improved varieties of crops and efficient system of production and supply of seeds to farmers. Ideally seed should be replaced every year for hybrids and every three to four years for non-hybrids. However, in practice seed is replaced less often especially in case of open pollinated crops. As a consequence, seed replacement rates are lower than recommended for different crop varieties. As adequate information is not available on replacement schedules followed by farmers. One simple method is to take the ratio of quality seed of a crop produced during the year to the total seed needed to cover the entire area under the crop. As is well known, seed replacement rate has a strong positive correlation with the productivity and production of crops. The problem of low seed replacement rate is reduced by timely availability of quality seed, review on the ongoing policies, awareness programmes, control on black marketing and subsidies should be given in advance to enhance the farmers' income.

Key words: Quality seed, seed replacement rate, farmers, income

COMPUTATIONAL MODELING FOR YIELD PREDICTION IN SUGARCANE USING IFSS VER. 1.1 MODEL**SUNIL KUMAR, P.C. GHASAL, A.L. MEENA, L.K. MEENA, JAIRAM CHOUDHARY AND PREM SINGH***ICAR- Indian Institute of Farming Systems Research Modipuram-250110, Meerut, India*

An investigation was carried out at research farm of ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut during

2013-2014 and 2014-2015 with the objective to develop and validate the computational modeling of Integrated Farming Systems. Crop growth simulation models are useful tools for considering the complex interactions between a range of factors that affect crop performance, weather, soil properties and management. In the present investigation, IFSSIMULATOR Ver.1.1 model was used to develop algorithm and validate it under climate conditions by conducting a field experiment on silty loam soils during two consecutive *rabi* and *kharif* seasons of 2013-2014 and 2014-2015. The study was carried out for purposes of simulation of phenology, yield and yield attribute of crop of sugarcane validation of commercial yield of the crop were done using the data of 2013-14 and 2014-15. The highest cane yield of sugarcane was recorded in T2 during 2013. The cane yield was basically determined ($R^2=0.959$) by days to start of tillering, days to maximum tillering, days to vegetative growth, days to grand growth and days taken to physiological maturity was contributed significantly. Using algorithm developed for estimation of yield (kg/ha.) computational model (IFSSIMULATOR Ver.1.1) was developed using yield attributing parameters of components of IFS of models. Three years data of IFS component was used for development of the IFS Simulator Ver.1.1. However, 2013-2014 and 2014-2015 data were used for validation of the model algorithms were developed using the regression model fitted into PHP programming. Farmers were benefitted by the use of such model on their fields, use of models in farming was carried out to increase productivity and in turn livelihoods. Modeling technology like IFSS (Integrated Farming System Simulator Ver.1.1) was developed for sugarcane crop computational modeling for yield predictions in integrated farming system, which benefitted the entire farmer community in western Uttar Pradesh and also became popular in other regions of India.

IMPORTANCE OF VERMICOMPOST IN SUSTAINABLE AGRICULTURE

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Vermicompost returned to the soil can maintain, enhance soil quality, fertility and productivity through favourable effect on soil properties and other processes. It serves as an important component of integrated plant nutrient supply system for balanced fertilization along with maintaining health to sustain the productivity of soils. In present day alarming situation of soil degradation and declining crop yields, sustainability in agriculture with respect to maintenance of soil fertility and stabilized crop production year after year is the main concern. In fact there must be a balance between soil degradative and restorative processes that determine sustainability. Using this concept, sustainable agriculture practices are those in which benefits of soil restorative measures are equal to or greater than the overall negative effects of soil degradative processes. An important soil restorative management practice is the use of organic manure for crop production. Organic farming is a production system which avoids, or largely excludes, the use of synthetic fertilizers, pesticides, growth regulators, and livestock feed additives. The objectives of environmental, social, and economic sustainability are the basics of organic farming. The key characteristics include protecting the long-term fertility of soils by maintaining organic matter levels, fostering soil biological activity, careful mechanical intervention, nitrogen self-sufficiency through the use of legumes and biological nitrogen fixation, effective recycling of organic materials including crop residues and livestock wastes and weed, and diseases and pest control relying primarily on crop rotations, natural predators, diversity, organic manuring, and resistant varieties. A great emphasis is placed to maintain the soil fertility by returning all the wastes to it chiefly through compost to minimize the gap between NPK addition and removal from the soil.

Key word- Vermicompost, Soil Fertility, Sustainable Agriculture.

PRECISION AGRICULTURE ON ARABLE LAND

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The use Precision agriculture of techniques on arable land is the most widely used and most advanced amongst farmers. Controlled traffic Farming is a whole farm approach that aims at avoiding unnecessary crop damage and soil compaction by heavy machinery, reducing costs imposed by standard methods. Controlled traffic methods involve confining all field vehicles to the minimal area of permanent traffic lanes with the aid of GNSS technology and decision support systems. Another important application of precision agriculture in arable land is to optimize the use of fertilizers, starting with the three main nutrients Nitrogen, Phosphorus and Potassium. In conventional farming these fertilizers are applied uniformly over fields at certain times during the year. This leads to over application in some places and under-application in others. The environmental cost is directly related to over-application which allows nitrogen and phosphorus leaching from the field into ground- and surface waters or to other areas of the field where they are not desired. With the use of precision agriculture methods, fertilizers can be applied in more precise amounts, with a spatial and temporal component to optimize the application. The technology that allows the farmer to control the amount of inputs in arable lands is the Variable Rate Application (VRA), which combines a variable-rate (VR) control system with application equipment to apply inputs at a precise time or location to

achieve site specific application rates of inputs. VRS are decided on the basis of prior measurement, e.g. from remote sensing or machine mounted sensors.

Key words - Crop management, hi-tech agriculture, variable rate technology, precision farming.

COMPUTATIONAL MODELING AND ANALYSIS OF VARIETAL EFFECTS ON GROWTH AND YIELD OF PIGEONPEA USING IFSS VER. 1.1 MODEL

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The field experiment was carried out during the *Rabi* and *kharif* seasons of 2013 and 2014 in order to determine various characters pertaining to growth, development and yield of pigeonpea cultivars. The objectives of the field experiment were to simulate the various parameters of growth and grain yield of crop to find out best cultivar that resulted highest yield on the basis of validation of the model performance and also to calibrate the genetic coefficients of various cultivars of pigeonpea for IFSS Ver.1.1 model. The highest grain yield (770 kg/ha) was recorded in crop grown in field treated with pond soil in the *kharif* 2014. The mean grain yield of rice during 2013 & 2014 was found to be higher in T₂ (Pond Soil) followed by T₁ (Control) and T₃ (RDF - Recommended doses of fertilizer). In general higher grain yield of pigeonpea was observed in *kharif* 2014 over the *kharif* 2013. The test weight of rice was recorded higher in treatment T₂ in both the year 2013-2014. Result of phenological observations showed that the highest days taken to flowering (94 days), days to pod formation (112 days) and days taken to achieve the dough stage (138 days) were recorded highest in treatment T₂ followed by T₁ and T₃. The similar trend was also observed in case of crop season *kharif* 2014. Mean days taken to attain the grain filling stage by the crop were 123 days in T₂, 118 days in T₃ and 120 days in T₁. The highest days taken to grain filling stages were found similar in year *kharif* 2013 and 2014. Out of 6 parameters related to grain yield of pigeonpea viz, biomass yield, flowering, Pod formation, dough stage and physiological maturity significantly contribute in the determination of grain yield of pigeonpea, the coefficient of determination R²=0.912 was calculated following the stepwise regression analysis. The regression equation {(Grain Yield (kg/ha) = 769.914*(Biomass)-0.1948*(Physiological maturity)+2.68*(Pod formation)-1.741)} was fitted in the model for development of the software (IFSS ver. 1.1) for decision support systems as a pigeonpea component/module.

Keywords: Coefficient of determination, phenological, pigeonpea, regression equation and yield

POMATO A HORTICULTURAL WONDER PLANT

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Climate change and ever increasing population are the burning issues in 21st century. Scientist's particularly dealing with agriculture has to focus on strategies to increase the production per unit area. Further, developing plants with durable resistance is the need of the hour in the era of climate change. In order to counter above issues, plant breeders started using conventional breeding techniques which were time consuming and also the resistance incorporated through these methods may break under climate change. Next option is the development of genetically modified crops (GM) but it is not possible to exploit this technique where GM crops are not generally accepted. Grafting could act as suitable alternative to these strategies. Developing wonder plants like Pomato not only provide two crops per unit area but also provide resistant plants. Pomato has properties of two plants i.e. tomato and potato that are grafted together. Tongue or cleft grafting is done between tomato as a scion and potato as a rootstock which produces tomatoes on the top and potatoes underground. Both crops grow symbiotically and independently without affecting the production as well as quality of either crop. Potato rootstock is grown for its healthy tubers and tomato scion contributes via its fruits. It can also withstand both cold and heat, just like the potato and tomato respectively. This plant has great impact on developing countries where farmers can save their time, space and labour. It can be grown indoor as well as outdoor in the field. Thus, this horticultural wonder plant can create more opportunity for undeveloped growers to change their economic status.

Keywords: cleft grafting, pomato, potato, tomato, tongue grafting,

PRECISION FARMING: KEY TECHNOLOGIES & CONCEPTS

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Precision Farming is an approach to farm management that uses information technology to ensure that the crops and soil receive exactly what they need for optimum health and productivity. The goal of precision farming is to ensure profitability, sustainability and protection of the environment. They include laser planning of land; chiseling; minimum tillage; complete analysis of soil samples for 12 or more

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essential plant nutrients; fertilizer placement in the root zone; mechanical and chemical control of weeds; integrated pest management; siphon irrigation; drip and micro-sprinkler irrigation; and ploughing back crop residues in the soil. It is strictly based on the Global Positioning System (GPS). The unique character of GPS is precision in time and space. Some of the areas in agriculture where precision farming is taking hold with implications for the economics of farming are: - 1. Soil Fertility Management a) This involves dividing a field into several small and equal divisions using the sub-inch accuracy of GPS. To do this, the tractor is fitted with a dish antenna to receive signals from satellites, which are recorded on a tractor-mounted computer. Soil samples are mechanically taken from each sub-division and this process is technically known as "Grid Sampling." 2. Other applications of the GPS-generated grid method: a) Planting variable rates of seed to maximize crop yields from the specific fertility of each grid section. b) The GPS-guided grid system helps to apply variable rates of herbicides and pesticides to achieve maximum control of weeds and pests. This not only reduces the cost of chemicals used, but also improves efficiency of pest control and protects environment. c) This enables the farmer to side dress application of fertilizers at variable rates to meet the specific requirement of each grid section, thus improving fertilizer use efficiency.

Keywords: laser planning, minimum tillage, Soil Fertility, Grid Sampling.

EFFECT OF BIO-ORGANICS ON YIELD OF COWPEA [*VIGNA UNGUICULATA* (L.) WALP]"

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A field experiment was conducted to find out the "Effect of bio-organics on yield of cowpea [*Vigna unguiculata* (L.) Walp]". The experiment was laid out in Factorial Randomized Block Design with three replications. The experiment comprised four bio-organic levels (control, FYM @ 10 t ha⁻¹, FYM @ 5 t ha⁻¹ + humic acid @ 20 Kg. ha⁻¹ and FYM @ 5 t ha⁻¹ + humic acid @ 20 Kg. ha⁻¹ + *Rhizobium* + PSB) were applied to the cowpea var. RC-19. The RDF was 20 kg N₂ and 40 kg P₂O₅ per hectare. The application of bio-organics gave significant increase in the yield attributes and yield but the application of FYM @ 5 t ha⁻¹ + humic acid @ 20 kg ha⁻¹ + *Rhizobium* + PSB was found to be significant superior with respect to number of pods plant⁻¹, number of seeds pod⁻¹, seed, straw and biological yield over control and other bio-organics application. However, test weight and harvest index was found to be non-significant.

Keywords: Bio-organics; *Vigna unguiculata*; *Rhizobium*; Humic acid; Yield

BREEDING FOR DISEASES RESISTANCE IN FIELD CROPS

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In nature organisms are classified as producers, green plants, consumers organisms exploiting other organisms), and decomposers (organisms using dead organisms). Green plants, including our crops, are used by a multitude of consumers of almost every kind, from various types of herbivores (mammals, snails, insects) to typical parasites (insects, mites, fungi, bacteria). In order to survive green plants developed a broad range of defence mechanisms to ward off most of these consumers. These defence mechanisms are principally based on avoidance, resistance or tolerance. Selection for resistance implies measurements of plant resistance. Ideally one should measure the amount of pathogen present at a given moment compared with the amount present on or in a extremely susceptible cultivar. True disease symptoms are observed with several pathogens such as wilting caused by vascular pathogens, and leaf rolling, mottling, stunting, etc., caused by viruses. These symptoms tend to be rather unreliable for assessing resistance, since the relationship between the amount of pathogen present and the severity of symptoms is often poor. In other cases the pathogen itself is observed, making assessment much easier and far more reliable.

Keywords: plant resistance, green plants developed, defence mechanisms etc.

MUSHROOM CULTIVATION: A STEP TOWARDS SUSTAINABLE AND ORGANIC FARMING

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Mushrooms are the members of higher fungi, belonging to the class Ascomycetes (*Morchella*, *Tuber* etc.) and Basidiomycetes (*Agaricus*, *Auricularia*, *Tremella*, etc.) They occur naturally on decaying litter. They are rich in protein (33-44%), fat content (1-20%), carbohydrates (3-28%), good source of fatty acids and vitamins. They are among the most appetizing of the table delicacies and aid greatly to palatability of many foods when cooked with them, for example *Morchella esculenta*, *Agaricus bisporus*, *Tuber sp.* etc. Use of mushrooms can contribute positively in facing the challenge of world-wide food shortage, targeting the goal of doubling farmers income and offcourse fulfills the need of promotion of sustainable, zero input and organic farming. First time an attempt was made for artificial

cultivation of *A. bisporus* at Solan (Himachal Pradesh) where synthetic compost preparation technology was developed by using horse dung and wheat straw. The major steps of mushroom cultivation are: (i) obtaining pure culture of a suitable mushroom by tissue or spore culture method on the specific culture media; (ii) preparation of spawns, for example, grain or straw spawn; (iii) preparation of substrate i.e. compositing, and (iv) spawning, spawn running and cropping. Since mushrooms have a very short life, it should reach to consumers within a short time or immediately canned. This will lead to proper marketing of mushrooms. The technology for cultivation and processing of mushroom has been developed at CFTRI (Hyderabad), RRL (Jammu) and NBRI (Lucknow). RRL and NBRI are distributing mushroom spawns in rural areas for mass cultivation. CFTRI has developed technique for processing and drying of mushrooms.

Keywords: spawning, casting, composting, spore culture

CROP IMPROVEMENT THROUGH BIOTECHNOLOGICAL APPROACH AND ITS IMPACT ON INSECT RESISTANCE SURENDRA SINGH BHADU, DEVENDRA KUMAR, ADITI CHARAK

Department of Entomology

The application of transgenic technology has resulted in useful GM insect-resistant varieties by genetic engineering (GE). Crops expressing Cry toxins derived from *Bacillus thuringiensis* (Bt) have been planted globally, and are a vital tool for pest control. Genetically modified (GM) plants are grown on more than 67 million hectares in 18 countries worldwide. A major trait used in GM crops is plant resistance to insects; this trait is based on one of several Bt proteins. Stress resistance and fiber improvements are the next targets for biotechnology. These events, although long overdue, mark a turning point in the cotton industry. The benefits accruing to farmers growing Bt crops are substantial across a number of geographies and economic strata, especially in developing countries. These benefits include increased crop yields, reduced pesticide use, less environmental damage, less fungal contamination, and reduced labor. The use of notable Bt crops, such as Bt-maize and Bt-cotton, have resulted in significant reductions of insecticide use and clear benefits on the environment and farmer health. Consequently, Bt-crops can be a useful component of integrated pest management (IPM) systems to protect the crop from targeted pests. Genetic engineering to confer useful agronomic and fiber traits is likely to lower the cost of production, improve yield and quality, and promote environmentally friendly farm practices. New genes for insect and herbicide resistance are being sought. A strategy to modify fiber using metabolic pathway engineering to produce aliphatic polyester compounds is under development. New genes for insect and herbicide resistance are being sought. A strategy to modify fiber using metabolic pathway engineering to produce aliphatic polyester compounds is under development.

CONJOINT APPLICATION OF SEWAGE SLUDGE AND INORGANIC FERTILIZER ON CROP PRODUCTIVITY AND SOIL HEALTH UNDER RICE WHEAT CROPPING SYSTEM IN INDO - GANGETIC PLAN.

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Sewage sludge have multi-element material can be used as substitute for commercial fertilizers and organic matter if applied in the proper amounts to soil. It also help for restores barren lands. Because an increase in beneficial microorganism in soil thus, improving the physical and biological properties of soil. Application of sewage sludge is considered to be advantageous for plant growth and yield attribute. Yamur et al. (2005) showed that when lentil was grown on soil with different doses of sewage sludge that found the plant seed yield increased significantly. Some important plant parameter such as plant height, first pod height, number of pod per plant, number of seed per plant, seed weight per plant, and 1000-seed weight and one of the yield characters showed an increase in the amended soils. Spinach accumulated more Zn than carrots. Carrots and spinach grown on this sludge amended soils had the highest mean concentration of Zn with values of 131.6 and 86.3 mg kg⁻¹ respectively. Khan et al. (2007) showed the variations in wheat yield with different doses of sewage sludge @ 10, 20, 40 and 80 t ha⁻¹, keeping 120:60:60 NPK as a standard application rate (control). The results indicated that the sewage sludge @ 80 t ha⁻¹ recorded significantly higher yield when compared with control. Sewage sludge increased the levels of Zn and Cd, within the permissible limits, in wheat grain; whereas no significant increase was observed in Cu and Pb. The recommendable rate of 40 t sewage sludge ha⁻¹ was found to be better than 80 t ha⁻¹ though the yield was to some extent low. At higher doses sludge application, there are chances of risk of metal contamination while the possible risks of heavy metal uptake and accumulation in the soil are very less with lower dose of sewage sludge.

Key word. Swage sludge, heavy metal, soil properties

EFFECT OF HOST PLANTS ON LIFE TABLE PARAMETERS OF *SPODOPTERA LITURA***SURENDRASINGH SHEKHAWAT, M. SHAFIQ ANSARI AND RABIYA BASRI***Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University Aligarh- 202002.*

Life table parameters of *Spodoptera litura* (Fabricius) was studied on castor, cabbage and cauliflower. Hatchability of eggs was recorded 100 % on all host plants. Survivorship was 35 days on castor and 38 days on cabbage and cauliflower. Highest mortality occurred in the pupal stage (46.11, 43.87 and 38.72 %) on castor, cabbage, and cauliflower, respectively. The net reproductive rate was found highest on castor 476.92 (females/female/generation) while on cauliflower 340.61. The highest intrinsic rate of increase was 0.2069 female/female/day on castor compared to 0.1836 on cauliflower. Finite rate of increase was 1.23, 1.21, 1.20 females/female/day for castor, cabbage, and cauliflower, respectively. Mean length of the generation was significantly higher on cauliflower (31.94 days) castor. The population of *S. litura* will become double in a short period (3.35 days) on castor compared to cabbage (3.71) and cauliflower (3.78), respectively. It can be inferred from the above parameters that castor is a suitable host for *S. litura* and it may also be used as trap crop to prevent the attack of economically important crops.

DEVELOPMENT AND QUALITY EVALUATION OF FRUIT JELLY OF GUAVA AND CARROT**SURESH CHANDRA* AND SAM SHER***Department of Agric. Engg., SVP UAT, Meerut (UP) India*

Experiments were conducted to develop the mixed fruit jelly using various level of guava extract and carrot juice content i.e. 75:25, 50:50 and 25:75. The desired amount of sugar was added and blended with guava extract and carrot juice in the ratio of 75:25, 50:50 and 25:75. The fruit jelly jars were labeled and stored at room temperature up to 90 days to assess the physico-chemical, microbial (TPC) and sensory quality attributes of mixed fruit jelly. These qualities were evaluated for fresh as well as stored samples at the interval of 15, 30, 45, 60, 75 and 90 days of storage under room temperature. The moisture content, acidity and ascorbic acid decreased with increase the storage periods at room temperature. The TSS, pH, optical density and microbial growth increased with increased the storage periods at room temperature. The maximum overall acceptability score for the fresh samples prepared with the amount of guava extract and carrot juice level 75:25 were awarded as 7.8 (like moderately). However, the minimum overall acceptability score of 5.3 (neither like nor dislike) was obtained to that sample which had guava extract and carrot juice ratio of 25:75 after 90 days of storage at room temperature. The overall acceptability of mixed fruit jelly decreased with storage periods irrespective of storage condition. It was concluded that mixed fruit jelly prepared with guava extract and carrot juice ratio of 75:25 were found to be superior to those prepared with other ratios.

HORTICULTURAL INNOVATIONS, FOOD PROCESSING AND VALUE ADDITION***SURESH KUMAR MEENA,** SURESH KUMAR SABAL,***DEVENDRA CHANDEL****Department of Horticulture, ** Department of Entomology, ***Department of Plant Breeding, College of Agriculture, S.K.R.A.U, Bikaner Rajasthan 334006 (India)*

Scientists with the Horticulture Innovation Lab are testing and adapting a range of technologies aimed at significantly improving the profitability of fruit and vegetable production throughout the world. Given the complexity of horticulture, technologies such as these can reduce constraints that limit the ability of smallholder farmers to achieve maximum profitability with high-value horticultural products. Our goal is to develop and test technologies that can overcome common limitations in land, labor, capital and infrastructure. When conditions are not suitable for storage or immediate marketing of fresh produce, many horticultural crops can be processed using simple technologies. There are some processing methods that can be used by small-scale handlers, including drying, fermenting, canning, freezing, preserving and juicing. Fruits, vegetables and flowers can all be dried and stored for use or sale in the future. On the Other hand, Value Addition in Horticulture is the process in which a high price is realized for the same volume of a primary product, by means of processing, packing, upgrading the quality or other such methods. For example: Making Jam of Pomegranate and Strawberry.

Keywords- Innovation, Profitability, Technologies, Constraints, Upgrading, Processing, Packing.

GREEN SEEKER : A TOOL FOR REAL TIME 'N' MANAGEMENT IN RICE**SURESH KUMAR. B¹, SANJANA. G² AND SALOMI GRACE. M³***Acharya N.G. Ranga Agricultural University, Agricultural College, Naira 532 185, Srikakulam (Dist.)*

Blanket fertilizer nitrogen (N) recommendations for large irrigated rice tracts lead to low N use-efficiency (NUE) due to field-to-field variability in soil N supply and seasonal variability in yield. To achieve high NUE, fertilizer N management research has developed new dimension of synchronizing N use with plant N demand through real time N management techniques which include green seeker based nitrogen application that not only improves N use efficiency but also leads to higher grain yield levels. SPAD&LCC have helped in developing real-time N management strategies for rice (Ladha *et al.*, 2005) but these do not take into account photosynthetic rates or the biomass production and expected yields for working out fertilizer N requirements. Application of green seeker in agriculture is

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increasingly through measurement of visible and near-infrared (NIR) spectral response from plant canopies to detect N stress (Peuelas *et al.*, 1994; Ma *et al.*, 1996; Raun *et al.*, 2001). Chlorophyll contained in the palisade layer of the leaf controls much of the visible light (400-720 nm) reflectance as it absorbs between 70 and 90 percent of all incident light in the red wavelength bands. Several researchers have assessed N status and other physiological parameters of rice using green seeker and reported that using specific reflectance ratios could improve precision and accuracy in predicting leaf N concentration in rice and thereby improved NUE, WUE and grain yield and is thus a superior method than the other two real time N management techniques viz., leaf color chart (LCC) and chlorophyll meter (SPAD).

Key words: NUE, Green seeker, SPAD and LCC

IMPORTANCE OF MICROPROPAGATION IN SUGARCANE TISSUE CULTURE: A VITAL APPROACH

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Sugarcane (*Saccharum officinarum* L., 2n=8x=80) is an important commercial crop in tropical and subtropical region of the world and is the major source of sugar with respect to export product in many developing countries. It is the only member of the family poaceae belongs to genus *Saccharum* in which *in vitro* propagation is standardized and commercially viable. (Wrigley, 1982). Micropropagated plantlets offer high planting ratio (1:60) when compared to the conventional methods having low planting ratio (1:10). In addition, micropropagation ensures genetic purity, uniformity, high germination percentage (~95%), early germination (2-3 weeks), free from diseases and pests, faster spread and increased yields (20-25%). There is a greater scope for practical application of tissue culture by utilizing the technique of micropropagation in commercial crops like sugarcane. Plant tissue culture is nowadays the most viable and successful technique that offers the best methodology through micropropagation to ensure high quantity and quality of sugarcane planting material within a short period of time and space. It has become a solely alternative to conventional propagation method. In contrast to conventional methods where one bud produces 4-5 shoots, tissue culture can produce around 260,000 healthier and identical plants from a single shoot tip in 3-4 months (Hendre *et al.*, 1983). Among different components of culture medium, plant growth regulators (PGRs) are the essentially required substances, which have profound effect on shoot and root regeneration. Auxins and cytokinins are the major PGRs that play role in differentiation in plants. A high auxin to cytokinin ratio leads to production of callus while a low ratio leads to organogenesis and shoot induction.

Keywords: micropropagation, PGR's, shoot and root regeneration.

ASSESSMENT OF IMPACT AND EFFICACY OF EXTENSION TECHNIQUES IN DOUBLING THE FARMER'S INCOME: AN ANALYTICAL APPROACH

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The lead policy makers should undertake extension investments as major public responsibility with focus on the performance of extension systems. Social Impact Assessment (SIA) could aid in the planning and decision making process of farmers by identifying the likely positive and negative impacts of policy actions, likely trade-offs and synergies, and thus facilitate informed decision-making. Accordingly, the paper outlines farmers' demand for information, the welfare economic characterizations of extension services, and the impact of organizational and political attributes that govern the performance of extension systems. The several extension modalities could be analysed for actual effectiveness through its impact study. The paper also provides a discussion of methodological issues pertaining to the assessment of extension outcomes, and a review of the empirical literature on extension impact. Thus, it can be ensured that the potential problems should be foreseen and addressed at an early stage in the projects planning and policy formulation. Indicators especially for technical, institutional, socio-cultural, commercial, economic and environmental aspects should be objective, so that it is amenable for precise quantification. Both quantitative and qualitative methods imply the core part of review paper which depends on impact level, availability of time, data and human resources which will come up with effective assessment report for the farmer's welfare.

Key words: - Extension system, farmers, modalities, Quantitative methods, organization, social impact assessment and welfare.

VARIETAL STUDIES IN COWPEA (*VIGNA SINENSIS* L.)

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The present investigation entitled "Varietal studies in cowpea (*Vigna sinensis* L.)" was conducted at the Instructional- Cum- Research Farm, Department of Horticulture, College of Agriculture, Latur during *kharif* season 2013. The experiment was laid out in Randomized Block Design with ten treatments and three replication. For the investigation six improved and four local varieties of cowpea were used.

In all ten cowpea varieties namely Pusa Phalguni, Pusa Phalguni Selection-21, Pusa Komal, Falguni Gold, Cowpea Selection-7, Hirwi Selection-5, Ahmedpur Local, Partur Local, Parbhani Local and Ahmednagar Local were tested. The variety Parbhani Local had significantly maximum plant height (46.27 cm) as compared to other varieties, whereas, Partur Local had the lowest (27.27 cm). Maximum number of leaves per plant was observed in variety Ahmedpur Local (48.40), whereas, minimum Partur Local (17.33) was observed in cowpea varieties. Maximum number of branches (8.40) were recorded in variety Pusa Komal, whereas, it was minimum (6.73) in variety Parbhani Local. As regards to reproductive attributes, the variety Hirwi Selection-5 (41.33 days) showed early flower initiation and maximum (56.67 days) in variety Ahmedpur Local. The minimum number of days required for 50 per cent flowering was recorded in variety Hirwi Selection-5 (47.67 days) as compared to other varieties. Significantly maximum number of cluster per plant was recorded in variety Ahmedpur Local (55.60), over rest of the varieties and minimum recorded in variety Pusa Komal (24.93). Minimum days required for first picking of green pods were recorded in variety Hirwi Selection-5 (56.00 days) and more number of days required first picking in variety Ahmedpur Local (69.33 days) as compared to other varieties. Highest numbers of pickings were recorded in variety Ahmedpur Local (6.00) and the lowest in variety Falguni Gold (3.67) and Ahmednagar Local (3.67). Significantly maximum crop duration was recorded in variety Ahmedpur Local (125.00 days) and minimum in variety Parbhani Local (91.00 days). Maximum numbers of pods in a cluster were recorded in variety Ahmedpur Local (4.64) and the minimum numbers of pods in a cluster were recorded in variety Pusa Phalguni Selection-21 (2.13). Significantly maximum length of pod was recorded in variety Cowpea Selection-7 (23.49 cm) and the minimum in variety Ahmednagar Local (11.35 cm). The variety Parbhani Local (14.99) recorded significantly highest number of seeds per pod and the lowest in variety Ahmednagar Local (11.92). The variety Pusa Phalguni Selection-21, showed significantly superior performance and produced maximum green pods yield per plant (86.00 g), yield per plot (6.02 kg) and yield per hectare (47.15 q).

SIGNIFICANT ROLE OF FLORICULTURE AND LANDSCAPING IN AGRO-TOURISM

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Agro- tourism is a new concept in tourism industry, which is growing rapidly all over the world. It involves tourists taking part in farm and village activities. It usually occurs on farm and is a key element of sustainable development and rural transformation mainly in developing countries. Floriculture and landscaping which is an aesthetic branch of Horticulture (Agriculture), that deals with growing of flower and ornamental crop plants and also deals with gardening activities, play vital role in development of agro-tourism by modifying landscape and creating more scenic views. These plants have different colours, shape and form which create contrast making surrounding landscape more beautiful. Aromatic compounds are present in several flower crops and once emitted in nature these compound give pleasant fragrance and also purify air. Besides, these plants attract birds, butterflies and insects which create mobility in nature. Thus, flowering plants grown in house compounds, public places in village and near on farm areas enhances beauty of the place. Flowers play significant role in our life right from birth to death. Flowers are used to convey our feelings to other people, used for worshipping God and for decoration purpose. Flowers bring feeling of happiness in our life and also boost our confidence and sagging spirit. Almost all people associate themselves with flowers. Hence, floriculture play important role in attracting more people towards agro-tourism. Floricultural plants used in agro-tourism sector have more positive impact on psychology as well as on health of people, which attract people to visit the place frequently. Hence, floricultural plants utilized in proper and effective manner in agro-tourism lead towards upliftment of farmers, which is one of the major objective of agro-tourism.

PLANT QUARANTINE: A STRATEGY OF PEST MANAGEMENT

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Plant Quarantine Unit is to prevent the introduction of destructive plant pests, soil and diseases of plants from other countries.). Plant Quarantine regulations are promulgated by the national and the state governments to prevent the introduction and spread of harmful pests and pathogens. Cottony cushion scale, woolly aphid, San Jose scale, golden cyst nematode of potatoes, the giant African snail are some exotic pest introduced into our country and cause extensive damage. So to prevent the introduction of exotic pests, diseases and weeds from foreign countries or within country, legal restrictions are enforced commonly known as Quarantine. Plant Quarantine regulatory measures are taken at the national level (Domestic Quarantine) as well as international level (Foreign Quarantine There is considerable cooperation between various countries, so that exporting country may furnish a certificate to the importing country which clears products or the importing country may maintain inspectors to examine the product before it leaves the country of its origin. The enforcement of the quarantine measures is supported by legal enactments, called quarantine laws. It acts as an important tool in excluding pests from the crop. Effective implementation of quarantine is highly emphasized for manage of pests, which in turn helps in maintaining the productivity of crops. The quarantine measures are of almost relevance to a country like India whose economy is largely Agriculture based.

EFFECT OF NITROGEN FERTILIZER ON THE BROWN PLANTHOPPER (*NILAPARVATA LUGENS* STAL) IN RICE FIELD**SUSHANT KUMAR, VIPAN KUMAR***Deptt. of Entomology, Sardar Vallabhbhai Patel university of Agri. & Tech., Meerut, U.P.*

In many of the scientific literature, the relationship between the insect pest population and fertilizer application has been deeply described in which mostly are related to the rice based cropping system. There is a considerable body of research highlighting the indirect effects of fertilizer applications on crop susceptibility to pests. Among these fertilizers, nitrogenous fertilizer is one of the main factor which induced to the pest population. For growth and reproduction in both plants and insect pest, the nitrogen is an essential element. Nitrogen fertilizer had the strongest effect on the fitness traits of BPH. The excess amount of Nitrogen fertilizer Attract to the insect pest for the feeding and their survival, growth, reproduction on the plant. For the example, BPH prefer to complete their life cycle on rice plant supplied with nitrogen. BPH can be reared on plants with high nitrogen content had high feeding rates and honeydew excretion less probing behavior, higher survival rates and population build-ups, higher fecundity and oocyte production and higher risk of economically important BPH outbreaks. The outbreak potential of BPH induced by the excessive application of fertilizer. Nitrogen fertilization has also significantly increased the populations of white-backed plant hoppers, green leaf hoppers, and small brown planthoppers. BPH on nitrogen-enriched plants consumed 37 times more, excreted 7 times more honeydew.

Key words - Brown plant hopper, Nitrogen.

SHORT TERM EFFECT OF DIFFERENT CROP ESTABLISHMENT TECHNIQUES AND RESIDUE MANAGEMENT PRACTICES ON NITROGEN CONTENT AND UPTAKE OF RICE (*ORYZA SATIVA*) CROP UNDER RICE (*ORYZA SATIVA*) BASED CROPPING SYSTEM**SUSHEEL KUMAR SINGH¹, B. P. DHYANI², R. LAIK³ AND DHARMENDRA KUMAR⁴**

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A field experiment was conducted from the winter 2009 at Patna, Bihar, to assess the impact of the short term practice of four different crop establishment and two residue-management treatments on nutrient uptake of rice (*Oryza sativa* L.) under rice (*Oryza sativa* L.) wheat (*Triticum aestivum* L.) / maize (*Zea mays*) cropping system in eastern Gangetic plains. Significantly higher straw and grain N content and uptake was found due to residue incorporation of preceding crops. Uptake of nitrogen by rice grain and straw increased by 12.3 and 30.0 % due to residue incorporation respectively. The maximum grain and straw N content 1.474 % and 0.550 % was found in E₄ (ZTDSR-ZTW/M) crop establishment technique (CTE) compare to 1.102% and 0.355 % E₁ (PTR-CTW/M) respectively. The maximum N uptake of rice grain and straw 64.87 and 37.03 kg ha⁻¹ significantly higher than the rest was found with the adoption of E₄ (ZTDSR-ZTW/M) CTE respectively. The interaction effect of different cropping system and crop establishment technique on the N content of rice grain (%) was significant. The maximum grain N content 1.488 % found with the adoption of E₄ (ZTDSR-ZTW/M) crop establishment technique for rice in rice-maize system was significantly higher than the most of the combinations. Minimum rice grain N content 1.081 % was found with E₁ (PTR-CTW/M) for rice in rice-maize system. In general rice grain N content was higher in rice-maize than rice-wheat system.

Keywords: Wheat, rice, maize, nitrogen

CONSTRAINTS FACED BY FARMERS ABOUT SCIENTIFIC CROP CULTIVATION OF MAIZE**SUSHEEP KUMAR¹, S.N. SINGH², KAUSHIK PRASAD³, MANOJ KUMAR⁴ AND SUBODH KUMAR⁵**

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The study was conducted in Karhal block of Mainpuri district (UP) selected purposively, because block area has more popular for area and production of maize as criteria. A total number of hundreds maize growers were selected through random sampling from five selected villages panchayats on the basis of twenty respondents from each selected villages panchayats. Out the of 13 common constraints of maximum number of the respondents 95% with adopt a rank of first were agreed with the statements that "Low price for produce" is the common problem, followed by "High cost of chemical fertilizers" 92% at ranks second, "Lack of Education" 91% at rank third, "Lack of knowledge about high yielding varieties." 89% at rank fourth, "High labour cost" 79% at rank fifth, "Lack of post-harvest management" 78% at ranks sixth, "Lack of proper information" 76% at rank seventh, "High transportation cost" 71% at rank eighth, "Lack of interest viewing the new practices" 66% at ranks ninth, "Lack of knowledge about pest and disease" 65% at the ranks tenth,

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“High cost of planting materials” 47% at the ranks eleventh, “Lack of skilled labour” 35% at the ranks twelfth and “Lack of storage facilities” 30% at the ranks thirteen, respectively.

Keywords: Constraints, knowledge and sampling, awareness, scientific cultivation, etc.

RECENT ADVANCES IN THE GENETIC IMPROVEMENT OF NATURAL ENEMIES OF INSECTS

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Biological control using natural enemies such as parasitoids, predators and pathogens, is an age-old sustainable practice of the control of crop pests. Genetic control of insect pest concept started with sterilization of Screw worm fly, a serious pest of livestock. Cryopreservation is an insect preserves procedure for long-term storage in liquid nitrogen of embryos for lepidopterous insects. Haplodiploidy is a sex-determination system in which males develop from unfertilized eggs females develop from fertilized eggs. Biotechnological approaches can be used for mass production and quality control of *Trichogramma* sp and increased their longevity, vigour, and fecundity in the laboratory. Different types of nutritional needs for the preparations used in artificial rearing of entomophagous insects as Lipids, Carbohydrates and vitamins sources. Hybridization the process of combining different varieties of organisms to create a hybrid. Microinjection refers to the process of using a micro needle to deliver substances into a living cell. Transposable Elements DNA sequence that can change its position within the genome, Tc1 in Med fly, hAT in drosophila, discovered the first TEs in maize. Joining together of DNA molecules from two different species that are inserted into a host organism to produce new genetic combination The insecticides did not achieve the desired level of control of pest insects due to the evolution of resistance, showed deleterious effects like environment pollution, pest resurgence, and reduction in their natural enemies in the agro ecosystem. Genetic improvement involves directed purposeful genetic alterations to enhance the efficacy of natural enemies for biological control.

Key Words: Parasitoids, Predators, DNA, Haplodiploidy & Microinjection

ROLE OF PRECISION FARMING IN HORTICULTURE

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With increasing population, urbanization and contagious depletion of natural resources, there has to be a paradigm shift in farmer's perception from production to productivity and to profitability. There is need for promoting farmer friendly location specific production system management technologies in a concerted manner to achieve vertical growth in horticulture production dully ensuring quality of produce and better remuneration per unit of area with judicious use of natural resources. In this endeavour, precision farming aims to have efficient utilization of resources per unit of time and area for achieving targeted production of horticultural produce. Precision agriculture (PA) can be defined as management of spatial and temporal variability in fields using information and communications technologies (ICT). Information, technology and management are the keys to success in this production system. Precision farming is a comprehensive information based farm management system to identify, analyse and manage variability within fields for optimum profitability, sustainability and protection of land resources. It basically means adding the right amount of treatment at the right time and the right location within a field. Precision farming calls for an efficient management of resources through location specific high tech interventions which includes fertigation, protected/ greenhouse cultivation, soil and leaf nutrient based fertilizer management, mulching for in-situ moisture conservation, micro-propagation, high density planting, drip irrigation etc. Precision farming integrates environmental health, economic profitability and social and economic equity by giving emphasis on crop management using technologies like GIS, GPS, remote sensing (RS) along with ground equipment like variable rate applicators (VRA), yield monitors and computers along with appropriate software. Thus, precision agriculture is conceptualized by a system approach to re-organize the total system of agriculture towards a low-input, high-efficiency, and sustainable agriculture. Looking to the pressure arising population and erratic climatic variation, more attention required towards the development of technology driven horticulture precision farming is being reviewed as a promise in this regard. Precision farming is also referred to as site-specific management. Site specific nutrient management (SSNM) is adopted in big orchards requiring differential fertilizer treatments in patches as per the nature of surface and sub-surface soil properties so as to improve the orchard efficiency (average yield of specified trees in relation to average orchard yield) in ultimate terms.

Keywords: Precision Farming, Remote sensing, GIS, GPS

TERMINATOR SEED TECHNOLOGY AND ETHICAL ISSUES INVOLVED IN ITS USE

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Terminator seed technology is the genetic modification of plant to make them produce sterile seeds. Biodiversity and food security

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especially in developing countries are under great danger by a newly patented technique for preventing plants from producing viable seeds. The method dubbed "the suicide seeds" by critics was developed in a joint venture between the United State Department of Agriculture (USDA) and Mississippi based Delta and Pine Land Company, the largest cotton seed company in the world. Ethically, the technology will make our farmers dependent on these multi-national seed companies for supply of seed inputs and other chemical inducers. Sooner this technology is being advocated to be used in food crop as well, as they are already being used in cotton and tobacco. The advocates of the new technology argue that for patents to be protected effectively, the technique has to be incorporated into seeds. However, multi-national seed companies, like Monsanto, control the supply of these seeds and farmers in developing countries will be forced to use these seeds. Several criticism has been made, that this technology endangers biodiversity and well-being of 1.4 billion rural people world wide, especially, in developing countries like India, that normally depend on farm-saved seed. Impressed by the higher yield of the new varieties, farmers could quickly become dependent on them and abandon their traditional varieties. Once get used to it, however, and with the traditional varieties gone, farmers will have no alternative but to continue to buy commercially bred "terminator seed" whether they might be interested or not.

IMPORTANCE OF VALUE ADDITION IN FLORICULTURE

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Floriculture is presently considered as the most lucrative horti-enterprise to make profit in the global market. Since flowers are the highly perishable, there remains some hindrance in proper marketing following the standard postharvest management practices by the common farmers. Hence, value addition has become very popular towards the expansion of floricultural trade by the art of preserving ornamental plants and the creation of novel products that appeal to the tastes and preferences of the consumers. It ensures high premium to the grower, while providing more acceptable quality products for the domestic and export market, and provides the most important aspects of marketing and give the customers a reason to buy such products. Profit potential is increased when an indistinctive raw commodity is converted into a unique product. Working with flowers is of course a benefit, but a successful operation requires a great deal of highly specialised knowledge and skills. The value-added products include adoption of postharvest technology and improved logistics. The procreative skills such as flower arrangements, artificial colouring of flowers, aqua packing for better appearance, garlands, venis, bouquets, greeting cards, dry flowers, wall hangings, button holes, wreath, floral crown, potpourris, essential oil, concrete, fragrance, gulkand, rose water, vanilla products etc. are some of the value-added products that have acquired a good position in the global market. Other value added products obtained from flower crops are pharmaceutical and nutraceutical compounds, insecticidal and nematocidal compounds etc. These value added products also helps in avoidance of post harvest losses, industrialization, creates employment generation, export, extended availability of produce, foreign exchange earnings and product diversification, etc.

EFFECT OF ABIOTIC STRESS ON GROWTH AND DEVELOPMENT OF FRUIT CROPS WITH SPECIAL EMPHASIS ON WATER STRESS

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Perennial fruit crops show qualitative responses towards water stress similar to other crops. However, the levels of water potential at which these responses occur, are generally lower than in annual crops. A number of physiological and morphological responses in plants generates due to water stress which depend on its intensity and duration as well as the plant species and development stage. Water stress occurs when the water in a plant's cells is reduced to less than normal levels. This can occur because of a lack of water in the plant's root zone, higher rates of transpiration than the rate of moisture uptake by the roots. In fruit plants, water stress affects plant development through cumulative effects which modify the plant functions, architecture and production over time. Both the vegetative and reproductive growth in fruit trees is sensitive to water stress. Additionally, reproductive growth is differentially sensitive to water stress at different times of the season. It has been reported that mild water stress applied during the intermediate developmental period of slow fruit growth has no effect on crop yields but significantly reduces vegetative growth. Water stress can occur in both excess and deficit condition of water availability. Only harmful effects of water stress is not there, some beneficial effect has also been observed by various scientist. This paper mainly focuses on the effect of water stress on plants in both negative and positive ways.

ROLE OF NANOTECHNOLOGY IN CROP IMPROVEMENT

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Nanotechnology has the potential mission toward evergreen revolution by enhancing agricultural productivity with limited inputs.

Direct applications of nanotechnology in agriculture include delivery of agrochemicals and nutrition, pesticides, nano-scale carriers, smart packing, nanosensors, veterinary care, fisheries and aquaculture, detection of nutrient deficiencies. It is emerging as a paradigm shift and evolving as a promising tool to begin a new era of precise farming techniques and therefore may provide a possible solution for crop improvement, even in challenging environments. Nowadays Nano-fertilizers are increasingly been used as alternates to bulk fertilizers and reduce pollution of soil and water by different agrochemicals. Nano-fertilizers facilitate the slow and steady release of nutrients and thereby reduce the loss of nutrients and enhance the nutrient use efficiency. Nanotechnology improves the nutrient use efficiency and reduces costs of environmental protection, slow-release fertilizers are the excellent replacement to soluble fertilizers. Overriding influences of different carbon, metal-based and metal oxide nanoparticles on different growth parameters (number of seminal root initiation, root elongation, shoot length, number of seeds, flowers and its quality), ultimately leading to increased plant biomass and yield have been presented. The beneficial role of nanoparticles through enhanced seed germination, increased root and shoot length, fruit and crop yield, and substantial increase in vegetative biomass of seedlings and plants in many crops including maize, wheat, alfalfa, soybean, mustard, mung bean, tomato, potato, lettuce, spinach, onion, peanut, borage, Arabidopsis, cluster bean, and bitter melon is highlighted. Although implementation of nanotechnology for agriculture sustainability via enhanced yield, biomass, and secondary metabolite is at juvenile stage, world will witness exceptional and unparalleled prospective of nanoparticles for invigorating agriculture in many ways. This work focused on the applications of nanotechnology in agriculture sector improvement, especially in the area of plant nutrition and plant protection.

STUDIES ON PHENO-PHYSIOLOGY AND POLLINATION EFFECTS IN COMMERCIAL CULTIVARS OF LITCHI (*LITCHI CHINENSIS* SONN.)

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Present experiment entitled "Studies on pheno-physiology and pollination effects in commercial cultivars of litchi (*Litchi chinensis* Sonn.)" was conducted during the year 2016-17 in horticulture garden, BAU, Sabour with 4 cultivars viz; Deshi, Purbi, Bedana and Kasba as treatments and one plant of each cultivar treating as one replication under RBD design. The date of flush emergence ranged from 18/07/2016 to 12/02/2017 in all 4 cultivars under study. Deshi was the earliest to initiate flush emergence. Bedana has the longest duration of flushing pattern. Deshi was the earliest to initiate panicle emergence followed by Purbi at Sabour condition. Length and width of panicle was recorded to be the longest in Purbi (41.8 cm) whereas the shortest (31.6 cm) in Bedana. Flushes emerged during mid-season had maximum percentage of shoots that flowered. Duration of flowering was observed to be the longest in Kasba (16.6 days) followed by Purbi which took 15.6 days. All four cultivars under study differed significantly with respect to sex-ratio. Poor self-compatibility has been found in these cultivars. C/N ratio was found to be significantly higher at flowering stage. Physiological parameters like photosynthesis, stomatal conductance, internal CO₂, chlorophyll, carotene and xanthophyll content were found to be higher at flowering stage than pre-flowering stage. The fruit growth started from seed development and later aril development had started after 17 days from the fruit set. T.S.S./ acid ratio was found to be the highest in cv. Beadana (67.64) followed by Purbi (64.66). This pheno-physiology and pollination study in these cultivars provide the basic knowledge of flushing pattern, flowering and fruiting behaviour and physiology behind the development process and will help farmers to manipulate the production technology for better yield and quality.

INTEGRATED MANAGEMENT OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA*-WILT FUNGUS, *FUSARIUM OXYSPORUM* DISEASE COMPLEX OF TOMATO, *LYCOPERSICON ESCULENTUM*, UNDER FIELD CONDITIONS.

SYEDABUZAR

Regulatory Affairs & Registrations Coromandel International Limited Coromandel House

A field experiment study was conducted to determine the comparative efficacy of carbofuran at 1 mg a.i. /kg soil, bavistin at 1 mg a.i./kg soil, neem (*Azadirachta indica*) seed powder at 50 mg/kg soil, green mould (*Trichoderma harzianum*) at 50.0 ml/kg soil, rhizobacteria (*Pseudomonas fluorescens*) at 50.0 ml/kg soil against root-knot nematode, *Meloidogyne incognita* wilt fungus, *Fusarium oxysporum* disease complex on Tomato, *Lycopersicon esculentum*. All the treatments significantly improved the growth of the plants as compared to untreated inoculated plants. Analysis of data showed that carbofuran and *A. indica* seed powder increased plant growth and yield significantly more in comparison to Bavistin and *P. fluorescens*. Carbofuran was highly effective against nematode, Bavistin against fungus, *A. indica* seed powder against both the pathogens and both the bioagents were moderately effective against both the pathogens.

Keywords: Meloidogyne incognita, Fusarium oxysporum, Disease complex, Integrated management, Vigna mungo

EFFECTIVENESS OF PLANT GROWTH PROMOTING RHIZOBACTERIA WITH SOIL AMENDMENTS AND INORGANIC FERTILIZER ON PIGEON PEA, *CAJANUS CAJAN* L.**SYED ABUZAR***Regulatory Affairs & Registrations Coromandel International Limited Coromandel House*

A field experiment was conducted to study and investigate the effect of the soil application of two Rhizobacteria, (MTCC-1 and PF-5) and urea treatments, separately and in combination on free living and plant parasitic nematodes. All the treatments significantly decreased the number of plant-parasitic nematodes with the remarkable increasing of plant growth. Both Rhizobacteria and urea were separately or alone effective in suppressing plant-parasitic nematode populations. The Rhizobacteria in combination with urea decreased the numbers of free-living nematodes and plant-parasitic nematode populations. However, population of nematodes increased in the untreated plots. The growth of pigeon pea, *Cajanus cajan* L. was improved under all the treatments and also control the population of plant-parasitic nematodes and found significant reduction in the Root knot index when compared with untreated control plots.

Key words: Rhizobacteria Plant-parasitic nematodes, Free-living nematodes, Nematode control, Urea, Pigeon Pea.

EFFECT OF COMBINATIONS OF ACEPHATE 50 % + FIPRONIL 5 % WDG ON INSECT PESTS OF RICE AND THEIR NATURAL ENEMIES**SYED ABUZAR AND PALAKSHATIPPANAGOUDA***Regulatory Affairs & Registrations Coromandel International Limited Coromandel House*

Field experiments were carried out during kharif and rabi seasons of 2016-17 to test the efficacy of combination, of Acephate 50 % + Fipronil 5 % WDG at four different doses against insect pests of rice along with Acephate 75% SP (1000 gm/ha), Fipronil 5 % SC (1500 ml/ha), Deltamethrin 0.72 % + Buprofezin 5.65 % EC (1500 ml/ha), Ethofenprox 10 % EC (750 ml/ha) at farmers' field in Karnataka. Acephate 50 % + Fipronil 5 % WDG @ 1000 gm/ha was proved to be significantly superior over all other treatments with lowest % dead hearts, % white ear, % leaf damage by leaf folder and lowest incidence of brown planthopper and Yellow stem borer during both seasons of 2016-17. Maximum grain yield (63.90 and 63.32 q/ha) with highest cost benefit ratio (1:2.07 and 1:2.03) observed in Acephate 50 % + Fipronil 5 % WDG @ 1000 & 1200 gm/ha respectively during kharif and rabi 2016-17. All the doses of Acephate 50 % + Fipronil 5 % WDG were found safer to natural enemies in rice ecosystem i.e. spiders. Acephate 50 % + Fipronil 5 % WDG was found to be effective against both borers, hoppers and leaf folder.

Keywords: Acephate, Rice, Fipronil, Stem borer, Plant hopper, Leaf folder

BIOFORTIFICATION: A NEW TOOL TO REDUCE MICRONUTRIENT MALNUTRITION.**SYED TALIB¹, MOHD ANWAR BHAT², ASHA QHUSSAIN², AND SAJAD HASSAIN DAR³**

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As a result of intensive agriculture, the Zn deficiency has become a widespread problem in cereal crops causing reduction in their growth and yield. About half of the world's population suffers from Zn deficiency. In this backdrop a field experiment in rice was conducted on slightly clay loam soil low in available N, medium in P and K and deficient in Zn with neutral pH at Mountain Research Centre for Field Crops (MRCFC), Khudwani during kharif 2011 and 2012 to assess the response of rice to Zn fertilization. Factorial combinations of three levels of Zn (3, 6 and 9 kg ha⁻¹) supplied through five sources (ZnSO₄, ZnO, Zinc enriched urea, Zinc FYM- incubated and Zn-EDTA) and one absolute control was laid out in RCBD with three replications. A significant response was observed to Zn application upto 6 kg ha⁻¹ in respect of growth parameters like plant height, LAI, dry matter accumulations, and number of tillers hill⁻¹. Zn sources had a significant effect on LAI, number of tillers only. Zinc enriched urea, Zn incubated FYM and Zn-EDTA recorded a significant superiority over ZnSO₄ and ZnO. Yield attributes namely panicles m⁻², panicle length, and grains panicle⁻¹ also got significantly increased upto 6 kg Zn ha⁻¹, and the same were at par with 9 kg Zn ha⁻¹. Different sources of Zn failed to produce any significant difference in the yield attributes except panicles m⁻². Application of 3 and 6 kg Zn ha⁻¹ increased the grain yield by 5.7% and 10.9% over control during 2011, respectively. The corresponding figures for the year 2012 were 7.1% and 14.3%, respectively. The data averaged of two years showed that Zn-EDTA though at par with Zn enriched urea and Zn-incubated FYM, realised 6.4% and 7.6% higher grain yield compared to ZnO and ZnSO₄, respectively.

STUDIES ON MANAGEMENT PRACTICES ADOPTED BY JAFFRABADI BUFFALO OWNERS IN THE DHULE CITY TADAVI F. R*, MALI R. G. AND U. S. GAIKWAD

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The present investigation entitled "Studies on management practices adopted by Jaffrabadi buffalo owners in the Dhule city" was under taken during the period of January 2015 to March 2015. For this study 150 Jaffrabadi buffalo owners were randomly selected for collecting the data. The data were collected through pretested questionnaire. The owners were distributed in three groups on the basis of number of buffaloes possessed by them as group I (< 5), Group II (6-10) and group III (>11) buffaloes. The majority of the owners (54.45%) were providing 14.1-18 kg green roughages to milch animal per day. Small numbers (8.91 %) of owners were offering 10-12 kg green roughages/animal/day. It was observed that majority of the owners (56.43%) were providing 8.1-12 kg dry roughages to milch animal per day. Thus the overall observation indicates that, there was shortage of roughages and concentrate in feed supply to their buffalo, also was lack of awareness about scientific feeding, which could limit, for the production, and reproduction performance of buffaloes in the study area. The average feeding of roughages were 16.43 kg and 8.40 kg green and dry roughages, respectively. It was also seen that majority of farmers (62.37%) fed their buffaloes with 1.1-3 kg concentrates mixture/animal/day. Bellowing and discharge of mucus from vulva were important signs of heat. These buffaloes were found in heat mostly during the winter season, whereas maximum calving were observed in rainy season. Almost all the owners kept their pregnant buffaloes together with other buffaloes and they were supplied average 0.65 kg concentrate as a pregnancy allowance. Overall 100 per cent of respondents were used to wash, clean and dry the udder before milking, while 78 per cent respondents milked their buffaloes with knuckling method of milking. It was observed that 70.00 per cent of respondents of all groups allowed suckling method of rearing of calf from 0 to 4 months. It was observed, that on an average 31.33 per cent of respondents adopted the advance vaccination programme to control of disease, out of that 68.67 per cent of respondent not followed vaccination programme. Only 25.34 per cent of respondents were followed deworming out of 150 respondents, under study, control of disease, out of that 68.67 per cent of respondent not followed vaccination programme. Only 25.34 per cent of respondents were followed deworming out of 150 respondents, under study. All the buffalo owners were put forth the most basic difficulties like non availability of improved buffalo breeds at local market, non-availability of progeny tested breeding bull, and improved seed of fodder crops, irrigation and drinking water facilities. There were financial constraints like inadequate and timely supply of loan and lengthy procedure for procurement of loans. Moreover lack of extension services, poor technical knowledge and non remunerative prices given for The producer's milk were the important difficulties faced by most of the respondents in Dhule City.

EFFECT OF IRON FERTILIZATION ON GROWTH, YIELD AND QUALITY OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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A field experiment was conducted to study the effect of iron fertilization on growth, yield and quality of groundnut (*Arachis hypogaea* L.) during *kharif*, 2016 at Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner. Research was conducted by considering following objectives: a) To study the effect of iron on growth, yield and quality of groundnut, b) To find out efficient method of iron fertilization, c) To work out the economics of the treatments. The results revealed that application of FeSO_4 @ 25 kg ha⁻¹ as basal + foliar spray of FeSO_4 @ 0.5% at 45 and 75 DAS + Citric acid @ 0.1% at 45 and 75 DAS + 5 t FYM ha⁻¹ significantly increased growth parameters viz., dry matter accumulation plant⁻¹ total chlorophyll content, Relative growth rate (RGR), Crop growth rate (CGR) and yield attributes viz., pods plant⁻¹, kernels pod⁻¹ and seed index. Increased yield attributes with FeSO_4 @ 25 kg ha⁻¹ as basal + Foliar spray of FeSO_4 @ 0.5% at 45 and 75 DAS + Citric acid @ 0.1% at 45 and 75 DAS + 5 t FYM ha⁻¹ increased pod yield, haulm yield biological yield and harvest index compared to other treatment combinations. Similarly, N and Fe content and uptake and protein content in kernels also enhanced with application of FeSO_4 @ 25 kg ha⁻¹ as basal + Foliar spray of FeSO_4 @ 0.5% at 45 and 75 DAS + Citric acid @ 0.1% at 45 and 75 DAS + 5 t FYM ha⁻¹. However oil content and shelling percentage was not influenced due to soil and foliar applied iron treatment alone or in combinations. The maximum benefit : cost ratio from this was obtained when application of foliar spray of FeSO_4 @ 0.5% at 45 and 75 DAS + Citric acid @ 0.1% at 45 and 75 DAS + 5 t FYM ha⁻¹.

Key words: Groundnut, iron, FYM, citric acid

ROLE OF PLANT GROWTH REGULATORS IN CUCURBITS

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Indian agriculture becomes more mechanized and science increases the possibilities for using inputs to enhance production and food

safety, the role of plant growth regulators becomes more vital. Plant growth regulators provide an immediate impact on crop improvement programmes and are less time consuming. Applications of plant growth regulators must lead to quantifiable advantages for the user. Plant growth regulators must be specific in their action and toxicologically and environmentally safe. In general plants are known to produce five classes of hormone namely auxins, gibberellin, cytokinin, abscisic acid and ethylene, both auxin and gibberellins cause stem elongation by different mechanism while abscisic acid and ethylene inhibits stem growth. Foliar application of gibberellic acid (GA₃) in a dioecious cucurbit *Trichosanthes dioica* increased the number of female flowers and decreased abortion of female flowers and resulting in increased fruit-setting. The plants sprayed with growth regulators showed induction of female flowers at lower nodes with 3-5 more pistillate flowers per vine and higher sex ratio as compared to unsprayed control. Application of NAA proved to be better for different yield and yield related traits in bitter melon. Application of GABA application as foliar spray could be the suitable concentration for enhancing growth and yield of bitter melon. Spraying of ethep at 3-4 leaf stage and 15 days after the first spray highly influences on sex modification in yellow melon cultivar than other cultivars in pumpkin. Thus, plant growth regulators play an important role in production technology of cucurbits.

Keywords: Dioecious cucurbit, NAA, ethep, GA₃, sex expression, higher sex ratio

GENETIC ASSESSMENT OF MORPHOMETRIC AND QUALITY TRAITS IN OATS (*AVENASATIVAL*.)

TANVISOOD

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The investigation was undertaken to assess the nature of variation and associations among different morphometric and quality traits with forage yield so as to identify promising genotypes for the future breeding programme. The experimental material comprising 45 different genotypes of oats were evaluated in Randomized Block Design during Rabi 2013-14 with three replications for different morphometric and quality traits. Analysis of variance revealed significant differences among genotypes for all the traits studied. High heritability coupled with high genetic advance was observed for plant height, dry matter yield per plant, crude protein yield per plant, grain yield per plant, harvest index and 100-seed weight indicating selection for these traits would be effective. Fresh fodder yield per plant exhibited significant positive correlation with days to 50 per cent flowering, dry matter yield per plant, crude protein yield per plant, grain yield per plant and harvest index. Crude protein yield per plant and harvest index were observed as best selection indices for increasing fresh fodder yield per plant. On the basis of powdery mildew resistance and various morphometric traits, genotypes IG-03-250, IG-03-214 and IG-03-208 were found promising and need to be further tested over locations and years.

RNA EDITING EVENTS IN MITOCHONDRIAL GENES: A COMPARISON BETWEEN MALE STERILE AND FERTILE PIGEONPEA

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RNA editing is a process which results in the post-transcriptional alteration of the nucleotide sequence of the corresponding mRNA molecule, which ultimately results in synonymous and non-synonymous changes at the protein level. With the help of next generation sequencing technologies, we have explored the editing status of 20 major mitochondrial transcripts in both male sterile (AKCMS11) and male fertile (AKPR303) pigeonpea. The editing sites were predicted by in silico analysis and the sites showing editing changes were validated by mapping RNA-seq reads onto the amplified mitochondrial genes. A total of 165 and 159 editing sites were observed in bud tissues of the male sterile and fertile genotypes of pigeonpea respectively. Among the amino acid alterations observed, the most frequent one was the conversion of hydrophilic amino acids to hydrophobic, accounting for 48.7% of conversion in AKCMS11 and 49.3% in AKPR303. Overall, the predicted editing events resulted in an increased proportion of transmembrane regions and the accumulation of β sheets. Thus, the above changes could impact the biological functions of these proteins. Although differences in editing status of mitochondrial genes were seen among both genotypes but no significant differences were seen among them, which could account for CMS phenotype. However, the observed extent and spread of RNA editing in these two genotypes provides an insight into the behaviour of the pigeonpea mitochondrial genome in native and alloplasmic state and could hold clues in identification of editing factors and their role in adaptive evolution in pigeonpea.

GENETICALLY MODIFIED CROPS AND THEIR ROLE IN INSECT PEST MANAGEMENT

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GMCs are plants used in agriculture, the DNA of which has been modified using genetic engineering methods. The aim is to introduce a new trait to the plant which does not occur naturally in the species. With the advent of genetic transformation techniques, it has become

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possible to clone and insert genes into the crop plants to confer resistance to insect pests. Resistance to insects has been demonstrated in transgenic plants expressing genes for delta-endotoxin from *Bacillus thuringiensis* (*Bt*), protease inhibitors, α -amylase inhibitors, enzymes and plant lectins. It should also be harmless to the natural enemies, target the sites in insects that have developed resistance to the conventional pesticides, flexible enough to allow ready deployment of alternatives (if and when the resistance is developed by the pest), and preferably produce acute rather than chronic effects on the target insects. Genes conferring resistance to insects have been inserted into crop plants such as maize, cotton, potato, tobacco, potatoes, rice broccoli, lettuce, walnuts, apples, alfalfa and soybean. The need for genetic transformation of crops to improve crop production in the developing world has been discussed. There is an urgent need to develop a scientifically sound strategy to deploy exotic genes for minimizing the extent of losses caused by insect pests. Equally important is the need for following the biosafety regulations, more responsible public debate, social attitude and better presentation of the benefits for a rational deployment of the genetically transformed plants.

Key word: - Genetically modified crops, *Bt*, enzyme inhibitors, biosafety regulations

EFFECT OF TIME WEED REMOVAL ON SEED PRODUCTION AND QUALITY OF FORAGE LEGUME COWPEA

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A field experiment on crop-weed competition was studied to determine the critical period in cowpea during *kharif* season of 2014 at the Research Farm of ICAR-National Dairy Research Institute, Karnal, Haryana. The experiment consisted of ten weed management treatments with four replications in a randomized block design. There were ten treatments consisting initial weed-free periods of 20, 40, 60, 80 DAS and season long and weedy up to 20, 40, 60, 80 DAS and season long. Cowpea cv 'C-152' was sown on June, 23, 2014 with row distance of 45 cm and seed rate 25 kg/ha. *Cyperus rotundus* (L.), *Echinochloa colona* (L.), among narrow leaf weeds and *Trianthema monogyana* (L.), *Commelina benghalensis* (L.) and *Digera arvensis* Forsk., among broad leaf weeds were the dominated weed species associated with the crop. Critical period of weed-free competition was found to be between 25-57 days after sowing. Among weed competition treatments, Seed yield of cowpea increased significantly with the increase in initial duration of weed-free condition up to 60 days after sowing which was 63.24% higher than season long weedy check. The highest seed germination was observed in weed free plot.

Key words: Cowpea, Critical period, Seed quality, Seed yield, Weed-free, Weedy-check.

DEHYDRATION ON HORTICULTURAL CROPS

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Fresh foods like vegetables, fruits, and other products have high water activity and they are highly heat sensitive and easily degradable which can be reduced to a great extent by dehydrating them. Dehydration or drying is the application of heat under controlled conditions to remove the majority of the water normally present in a food by evaporation. In fact it is the oldest method of food preservation technique which has been used from ages in order to retain the shelf life of the products. There are different types of dehydration techniques like sun drying, spray drying, freeze drying, vacuum drying, osmotic dehydration etc. which are used accordingly for different products. Dried products are good source of energy because they contain concentrated fruit sugars in dried fruits. They also contain large amount of CHO, vitamins, proteins, fats and minerals. Drying and dehydration minimizes losses of horticultural crops when they are available in large quantity. It also saves energy, money and space in shipping, packaging, storing and transportation. In recent years, the achievement in drying or dehydration of fruits and other products have led to the development of more improve methods and techniques.

APPLICATION OF HIGH HYDROSTATIC PRESSURE ON FOOD PRODUCTS

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High hydrostatic pressure (HHP) technology subjects foods, which can be liquid or solid, packaged or unpackaged, to pressures between 40,000 and 80,000 PSI, usually for five minutes or less. The high pressure does not destroy the food, because it is applied evenly from all sides. What it does do is inactivate microorganisms living both on the surface and in the interior of the food. It does this by affecting the molecular structure of chemical compounds necessary for metabolic metabolism in the microorganisms. The effect of hydrostatic pressure in a food product is dependent upon the amount of pressure applied, duration of compression, depressurization rate, temperature

of treatment, water activity of product and salt concentration etc. this techniques work on the basic principles that is to determine the effect of high pressure on foods. The first is the Pascal's iso- static principle which indicates the pressure applied to a sample including biological products is transmitted in uniform and quasi-instantaneous manner. The pressurization process is independent of sample volume, product size and geometry, in contract to thermal processing. The process by HHP is usually carried out a low compressibility liquid such as water. The second principle is that of Lechatalier, which states that phenomenon of phase transition chemical changes are accompanied by decrease in volume is favored by pressure and vice versa. HHP offers several advantages such as: reduced process times; reduced physical and chemical changes; retention of freshness, flavor, texture, appearance, and color; elimination of vitamin C loss; reduced ice crystal damage; and reduced functionality alterations compared to traditional thermal processing.

EFFECT OF TEMPERATURE-HUMIDITY INDEX ON REPRODUCTION AND PRODUCTION PERFORMANCE IN RED SINDHI CATTLE

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The data on reproduction and production performance of Red Sindhi cattle maintained at Division of Animal Husbandry and Dairy Science, College of Agriculture, Dhule, (M.H) were utilized for present study. The least squares means of age at first calving, service period, calving interval, lactation milk yield (kg), 300 days milk yield (kg), peak milk yield (kg), lactation length (days), dry period (days) and WTDMY at different stages of lactation were estimated by considering the effects of period of calving, season of calving, lactation order and THI as non-genetic effects. The frequency distribution patterns for PMY according to THI were worked out. The overall least squares means for AFC, service period, calving interval, lactation milk yield(kg), 300 days milk yield (kg), PMY (kg), lactation length (days) and dry period (days) 1359.02 $\pm$ 28.83 (days), 94.36 $\pm$ 6.29 (days), 384.49 $\pm$ 7.62 (days), 1892.57 $\pm$ 43.16 kg, 1878.22 $\pm$ 46.35 kg, 9.56 $\pm$ 0.14 kg, 305.84 $\pm$ 5.80 (days), 83.33 $\pm$ 5.41 (days) respectively. The effect of period of calving was significant on age at first calving, LMY, 300 days milk yield, lactation length, peak milk yield ($P < 0.01$) and calving interval ($p < 0.05$), while non-significant on service period and dry period. The variation due to season of calving was non-significant on all reproduction and production traits in Red Sindhi cattle. The influence of lactation order on lactation length was significant ($P < 0.01$), while on service period, calving interval, LMY, 300 days milk yield, dry period, and peak milk yield were non-significant. The THI at calving had non-significant influence on all the reproduction and production performance, indicating that the Red Sindhi cows were acclimatised to the local climate if, optimum feeding with sound management are provided. However, the THI had non-significant influence on WTDMY at initial, peak milk yield and dry stages of lactation. The frequency distribution pattern for PMY according to THI indicated maximum number of cows giving PMY more than 8 kg was lies under THI5 (> 89), THI3 (83-86) and THI4 (86-89). Under THI5 a total of 51 (85.00%) cows yielded more than 8 kg PMY, THI3 a total of 45 (88.23%) cows yielded more than 8 kg PMY and THI4 a total of 45 (81.81%) cows yielded more than 8 kg PMY. This was indicated that for the Red Sindhi cattle were comfortable between 83-89 zones THI (THI₃ and THI₅).

GRAFTING IN VEGETABLE CROPS

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Grafting can be defined as the natural or deliberate fusion of plant parts so that vascular continuity is established between them and the resulting genetically composite organism functions as a single plant. Grafting used for a long time ago to increase uniformity, vigour and resistance to biotic and abiotic stresses of vegetatively propagated plants. Grafting in vegetables has emerged as a promising surgical alternative over relatively slow conventional breeding methods aimed at increasing tolerance to biotic and abiotic stresses. Fruit vegetables mainly grafted by tongue, cleft and splice method of grafting and their success is varied among the crops being grafted. Investigations conducted on tomato, cucumber, watermelon and eggplant revealed grafting had a pronounced positive effect on yield, quality, on tackling soil borne diseases, stress due to water and salinity, heavy chemical and drins. In spite of the role of grafting in fruit vegetables there are challenges related to the incomplete resistance of grafted seedlings, presence of high number of scion/rootstock combinations, the need for skilled workers, cost of grafted seedlings and limited research works obstruct the diffusion of this technology. Though application of grafting has aforementioned problems, breeding programs for production of multipurpose rootstocks, developing efficient grafting machines and improved grafting techniques will undoubtedly encourage use of grafted seedlings all over the world. In addition introduction of new rootstocks with desirable traits compatible with locally selected scions can boost the status of grafting technology. The higher physiological activities like antioxidant content, lipoxxygenase activity, osmotic adjustment, membrane selectivity, development of adventitious root and aerenchymatous tissue in plants grafted onto potential rootstocks provide broad insight

into stress response mechanisms and thus, grafting is proposed to mitigate the adverse impact of climate change on productivity and quality of vegetable crops. Therefore, application of grafting in fruit vegetables has bright prospects in the world.

INTEGRATED WEED MANAGEMENT: AN APPROACH TO MANAGE WEEDS UNDER DIRECT SEEDED RICE IN TRANS-INDO-GANGATIC PLAINS OF INDIA

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In Trans- Indo-Gangetic Plains (IGP) of India, rice (*Oryza sativa* L.) is taken by conventional tilled puddled transplanting (CT-PTR) method. CT-PTR requires a lot of water (2000-2500 mm) of which major portion comes from groundwater. Due to burgeoning population, industrialization and metropolitan resulted in continuous depletion of ground water table. Which leads to change in water use habit of folk ensuing increased dependence to ground water. Along with water crises, manpower is another major problem in CT-PTR. Thus, declining water table and changing climate, the sustainability of CT-PTR rice is under immense pressure. Therefore, alternative of CT-PTR could be direct seeded rice (DSR) which requires less water, labor, initial cost and energy than CT-PTR. But with introduction of new technique of rice cultivation, certain constraints also emerged as direct seeded rice is heavily infested with weeds which cause severe loss to the grain yield. Weeds are the major biological constraint in direct seeded rice (DSR) due to the synchronized emergence of competitive weeds, absence of water to suppress weeds at the time of seedling emergence and emergence of difficult to control weeds. Strategies on weed management in direct seeded rice depend on critical period of weed control, weed flora and method to be adopted. As a single chemical weed control method may not be successful on a long-term basis, weed problem in direct seeded rice needs to be solved by integrated approach. Integration of different weed management strategies like cultural, mechanical and chemical methods along with highly competitive cultivars with effective allelopathic properties, effective weed management on long term sustainable basis can be achieved.

Key words: CT-PTR, DSR, burgeoning population, weed flora.

VALUE ADDITION: A NOTABLE APPROACH TO REDUCE THE POST HARVEST LOSSES IN VEGETABLE CROPS

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Vegetables are of immense significance to mankind in providing nutrients like minerals, vitamins, fats, proteins, carbohydrates, etc. About 10-15% vegetables shrivel and decay, lowering their market value and consumer acceptability. Minimizing these losses can increase their supply without bringing additional land under cultivation. Farmers used to face glut in the prices of production due to bumper production during that season. The lack of cold storage chains lead to increase in concern for post harvest losses. Improper handling and storage cause physical damage due to tissue breakdown. Mechanical losses include bruising, cracking, cuts, microbial spoilage by fungi and bacteria, whereas physiological losses include changes in respiration, transpiration, pigments, organic acids and flavour. Value addition is one of the approach to reduce the post harvest losses in vegetables. For example, potato chips, French fries, tomato products like ketchup, sauce, paste, soup, puree, chutney, etc., petha preparation from ash gourd, etc. Dehydrated onion powder can be utilized in reducing the losses in onion production. Thus, value addition is not only helpful for creating job opportunities but also improve the economic conditions of people and enhance the quality of the produce.

Keywords: storage, vegetables, farmers, value addition

STUDIES ON THE APPLICATION OF ORGANIC, INORGANIC FERTILIZERS AND THEIR COMBINATIONS ON YIELD AND QUALITY OF CAULIFLOWER (*BRASSICA OLERACEA* L. VAR. *BOTRYTIS*) CV. PUSA SNOWBALL K-1 THAKUR ASTHA¹ AND RANA RS²

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Cauliflower (*Brassica oleracea* L. var. *botrytis*) is one of the most important winter vegetable grown throughout the country. The indiscriminate use of chemical fertilizers has simultaneously resulted in many problems like degradation of soil productivity, environmental pollution and depletion of non-renewable sources of energy. Thus, attention is now being shifted towards the alternate sources of nutrients from the inorganic ones. Therefore in order to counterpart the ill effects of the inorganic fertilizers present investigation was carried out during *Rabi* season of 2014-15 and 2015-16 in the Experimental Research Farm of the Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. Twenty-five treatments combination of organic (Vermicompost, Farmyard manure and Neem manure), inorganic (N, P and K) and bio-fertilizers (*Azotobacter* and PSB) were replicated thrice and was laid in Randomized Complete Block Design with the spacing of 60 cm × 45 cm. The seed of cauliflower cv. Pusa Snowball K- 1 was sown in nursery beds on 1st week of September during both the years. The results revealed that

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treatment combination (T₁₆) -100% RDF + *Azotobacter* (5.0 kg/ha) + PSB (5.0 kg/ha) resulted in maximum curd yield and quality which was at par with the treatment combination (T₂₃) - RDF (33.3%) + FYM (33.3%) + NM (33.3%) + *Azotobacter* (5.0 kg/ha) + PSB (5.0 kg/ha) consistently during both the years. Therefore, balanced integration of nutrients viz., organic manures and bio-fertilizers with reduced dose of inorganic fertilizers sustains yield potential as well as maintains the soil health and fertility with minimum severity of black rot.

Keywords: Organic manures, Biofertilizers, Curd yield and Quality.

EFFECTS OF ORGANIC AND NON-IPM MODULES ON SEED YIELD, QUALITY AND ECONOMICS OF OKRA [*ABELMOSCHUS ESCULENTUS* (L) MOENCH] IN HIMACHAL PRADESH

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Okra [*Abelmoschus esculentus* (L) Moench] also known as *Bhindi* or *Lady Finger* is an annual vegetable crop of tropical and subtropical parts of the world usually grown during *kharif* and summer seasons. The indiscriminate use of chemicals has caused myriads of problem to environment, humans as well as pest resurgence and development of resistance in pests. Therefore, an alternative to insecticides and to minimize their use, farmers can easily rely on IPM strategies as well as other organic interventions. To assess the effect of organic and non-IPM on seed yield, quality and economics of okra, the experiment was carried out at Experimental Research Farm, Dr YSP UHF, Nauni, Solan, (HP) during *kharif* season of 2017-2018. The experiment was laid under RBD with five replications and eight treatment modules viz., T₁- Organic module, T₂- Insecticidal module, T₃- Environmental traps, T₄- Jeevamrit 11%, T₅- Jeevamrit 9 %, T₆- Neemastra 11%, T₇- Neemastra 9 % and T₈- Untreated control. The results revealed that the treatment T₅- Jeevamrit 9 % and T₆- Neemastra 11% recorded higher values for yield attributing parameters (number of seed per fruit- 69.22 and seed yield per hectare- 24.14 q/ha, respectively). For seed quality characters the treatment T₅- Jeevamrit 9 % recorded higher values for seedling length- 22.68 cm, seedling dry weight- 28.34 mg, seed vigour index-II- 2427.61 but 100 seed weight- 6.67 g was higher in T₆- Neemastra 11%. The treatment T₅- Jeevamrit 9 % gave highest benefit: cost ratio (4.45: 1), followed by treatment T₆ (4.34: 1) and T₂ (4.05: 1). Therefore economically, the treatments jeevamrit and neemastra performed better as compare to the treatment T₂- insecticidal module in yield and quality parameters of seed with maximum benefit cost ratio.

Keywords: Organic module, Insecticidal module, Seed yield, Quality and Economics.

EFFECT OF INM (ORGANIC, INORGANIC & BIOFERTILIZERS) ON THE GROWTH PARAMETERS OF URDBEAN THANGJAM CHURACHAND SINGH*, V.K.SINGH & K.S. SHEKHAR

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A field experiment was conducted during *kharif* season of 2017-18 in D6 block of Dr. Norman E. Borlaug Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar which is located at 29°N latitude, 79.3°E longitude and at an altitude of 243.84 metre above mean sea level in the *tarai* belt of shivalik range of Himalayan foothills. Twenty four treatment combinations consisting of two levels of organic manure, three levels of biofertilizer and four levels of inorganic fertilizer. i.e. in main plot: combinations of two levels of organic manure and three levels of biofertilizer and in sub plot: four levels of inorganic fertilizer were taken and laid out in split plot design. Results from the present experiment has shown that treatment combinations of different levels of organic manure, biofertilizers and with different doses of inorganic fertilizers shows significant effect on different growth parameters (plant height, number of branches per plant, number of root nodules per plant, dry weight of nodules and dry matter production per plant at 30, 45, 60 DAS and at harvest) comparing to all the treatment combinations without biofertilizers and organic manure. Results further shows that treatment combination with organic manure and inorganic fertilizers without biofertilizers shows inferior performance as compared to that of treatment combinations of different levels of organic manure, biofertilizers and with different doses of inorganic fertilizers.

POST TRANSCRIPTIONAL GENE SILENCING (RNAI) MECHANISMS IN PERENNIAL FRUIT CROPS IMPROVEMENT

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Post transcriptional gene silencing or RNA interference (RNAi) gene silencing technology is relatively new phenomenon which was first identified by Andrew Fire and Craig Mello in the nematode worm *Caenorhabditis elegans*. It is an evolutionarily conserved defence mechanism occurring naturally against double-stranded RNA (dsRNA) that can target cellular and viral mRNAs. Several classes of small non-coding regulatory RNAs have been discovered in different model organisms. In plants miRNA and siRNA mediated

regulations are most prevalent, process for the biogenesis of miRNA and siRNA initially differs to form their respective dsRNA precursors. Later on, both siRNAs and miRNAs are produced by the cleavage of dsRNA precursors by Dicer or Dicer-like enzyme, a member of the RNase III family of dsRNA specific endonucleases. Finally, the small non-coding RNAs (miRNAs and siRNAs) in association with RNA-induced silencing complex (RISC), Argonaute (AGO) and other effector proteins lead to gene silencing. Since the discovery of RNAi and its regulatory potentials in gene silencing, it has become evident that RNAi has immense potential in opening a new vista for crop improvement. In perennial fruit crops RNAi gene silencing technology is already being exploited in crop improvement aspects. Consumer attractive and genetically modified private sector varieties of apple 'Arctic®' and 'Rose' pineapple is developed using this technology and got approval for cultivation. Broad spectrum PRSV resistance papaya lines have developed by silencing conserved sequences of PRSV. Efficiency of gene silencing by RNAi was tested in banana for race 1 *Fusarium* wilt resistance. As the fruit crops are perennial and perishable in nature, this transgenic tool can be utilised to overcome various hurdles in fruit crop improvement such as long juvenile phase, heterozygosity, less shelf life, high susceptibility to diseases and pests etc. Genetically-edited /modified fruit crops in addition to other horticultural crops have the potential to find solutions for many of the world's hunger and malnutrition problems, and to help protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides. Hence, RNAi gene silencing is an effective tool to improve our perennial fruit crops in lesser time.

PRECISION AGRICULTURE, SOIL AND WATER CONSERVATION FOR SUSTAINABLE

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Conservation of soil and water resources is important for sustainability of agriculture and environment. Soil and water resources are under immense pressure due to ever increasing population there by ensuing growing demand for food, fiber and shelter. Soil and water resources are being deteriorated due to different anthropogenic and natural factors. Precision agriculture, as the name implies, means application of precise and correct amount of inputs like water, fertilizer, pesticides etc. at the correct time to the crop for increasing its productivity and maximizing its yields. Precision agriculture management practices can significantly reduce the amount of nutrient and other crop inputs used while boosting yields. Farmers thus obtain a return on their investment by saving on water, pesticide, and fertilizer costs. The concept of soil conservation cannot be materialized without conserving and efficient use of water resources. It is therefore prerequisite that soil conservation practices should be adopted. Soil conservation practice include soil management, crop management and also includes some other practices. The sustainable agriculture helps in growth of future and also increases the scope of usage of precision agriculture.

Key words: Precision agriculture-conservation-soil and water resources-Anthropogenic-maximizing-yield

SURVEY OF PIGEON PEA WILT CAUSED BY CYST NEMATODE (*HETERODERA CAJANI*) IN TRANS YAMUNA AND GANGA TALUKS OF ALLAHABAD DISTRICT, INDIA

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A roving survey was conducted in the trans Yamuna and Ganga taluks of Allahabad district to evaluate the outburst of cyst nematode (*Heterodera cajani*) on pigeon pea wilt. The maximum cysts population was recorded in Kuan village where in 51 cysts were found in 500 g of soil followed by Telghana (41) and the lowest population was recorded in Panwar (41) per 500 g of soil followed by Karchhana (18). Highest larval population was found in the soil sample of Telghana (664) followed by Dera (659) in all the surveyed villages of trans Yamuna and Ganga taluks of Allahabad.

Keywords:- *Heterodera cajani*, Pigeon pea, Cysts.

EVALUATION OF GRAFTED BRINJAL WITH WILD ROOTSTOCK

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Brinjal (*Solanum melongena* L.) is one of the most popular and principal vegetable crops grown in India and other parts of the world. Eggplant is one of the most popular vegetables both in the summer and in the winter. It is susceptible to numerous diseases and parasites, particularly the bacterial wilt, *Fusarium* and *Verticillium* wilts, nematodes and insects. Soil-borne pathogens and pests such as *Verticillium*, *Fusarium* and *Meloidogyne* spp. may cause yield losses of up to 78% in production areas infested with *Verticillium* wilt. Difficulties in chemical control of these diseases, absence of crop rotation and sexual barriers between eggplant and its wild relatives indicate that the only short-term practical solution of the problem is the growing of susceptible eggplant cultivars, grafted on rootstocks with multiple pathogen resistance. Use of grafting techniques provides new possibilities as resistant rootstocks can be grafted with preferred commercial varieties of brinjal. Vegetable production by grafting on resistant rootstocks has become a common practice to

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control soil-borne pathogens. A wild relative, *Solanum torvum* was identified as resistant type Seedlings of the cultivated, local brinjal types, Debjhuri Hazari and other lines were grafted on wild type *Solanum torvum*. Field evaluation of the grafts indicated the complete protection from bacterial wilt. Grafted plants yielded fruits similar to that of the seedling type indicating its acceptability among the growers and consumers. This technology could be a promising strategy in the management of bacterial wilt. When grafted onto *S. torvum*, from a substantial increase in antioxidant fruit content. As consumers' demand for fruits and vegetables rich in compounds important for human health is steadily increasing, these landrace/rootstock combinations should deserve more attention by plant nurseries involved in grafted seedling production and interested in the valorization and conservation of eggplant biodiversity.

Keywords: Brinjal grafting, Rootstock, Bacterial wilt, *Ralstonia solanacearum*, *Solanum torvum*,

A COMPARATIVE STUDY ON POSTURAL BEHAVIOUR OF STUD BULLS**TRIPTI KUMARI**

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Present study was done on 20 stud bulls (five from each breed viz., Sahiwal, Gir, Jersey cross and Holstein Friesian (H.F) cross) at Frozen Semen Bull Station, Haringhata, Nadia (West Bengal) in two seasons, i.e., winter and summer with the aim to assess the effect of breed, season and breed x season interaction, temperature, humidity and temperature-humidity index (THI) on time spent by bulls in several postural behaviour. Postural behaviour consists standing, sitting, lying and sleeping activities). Hourly scan sampling method was done for assessing the behaviour. Data were recorded till 2 hrs per day at morning (09:00 to 11:00 A.M) and afternoon (02:30 to 04:30 P.M). It was found that significant effect of breed was seen on sitting ($P<0.01$), lying ($P<0.01$) and sleeping time ($P<0.01$), season on sitting time ($P<0.01$), breed x season interaction on lying ($P<0.01$) and sleeping time ($P<0.01$), air temperature on sleeping time ($P<0.05$) whereas humidity on sitting ($P<0.01$) and lying time ($P<0.01$). No effect was found to be significant on standing time of bulls. Different genetic groups responded differently in expression of different subcomponents of postural behaviour under different climatic conditions. The information generated from the study might be helpful to find out the better management practices on the farm for maintaining the animals.

ADOPTION OF MANAGEMENT PRACTICES TO CONTROL SUB CLINICAL MASTITIS IN DAIRY CATTLE**TRIPTI KUMARI¹, CHAMPAK BHAKAT¹, JYOTIMALA SAHU¹, RAJEEV KUMAR CHOUDHARY² AND SUBHRANSU PAN²**

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The study was conducted on 100 farmers and 150 cows at surrounding villages of Nadia district, West Bengal to investigate the level of management practices adopted by the farmers for maintaining their cattle as well as to detect the incidence of sub clinical mastitis on the basis of their adopted management practices. Survey on the basis of questionnaire was done with the farmers. Simultaneously milk samples from the animal were taken to detect the incidence of sub clinical mastitis. Farmers as well as cows were divided into three groups on the basis of their management practices as, Group I, Group II and Group III which includes poor, fair and good management practices respectively. Each group comprises 50 animals. Comparisons were made between the groups and it was found that farmers adopted about 20% poor (group I), 45% fair (group II), whereas 35 % good (group III) management practices. Further, when milk sample was tested to detect the incidence of sub clinical mastitis, it was found that in Group I, all 50 cows (100%), Group II, 46 (92%) out of 50 cows and Group III, 1 (2%) out of 50 cows (might be due to individual immunity level or differences in adaptability to local climate) were observed positive for sub clinical mastitis. Hence, the result revealed that the incidence of sub clinical mastitis was higher in the poor and fair than good management practices, which signifies that exploration of knowledge to the farmers about good management practices for maintaining their cattle is still needed. Thus, dissemination of knowledge based on the study will support in the production of high quality, good, clean and safe milk, which has a high demand. This will provide a major financial support to the farmers.

EFFECT OF BREED, SEASON AND THEIR INTERACTION ON THERMAL ADAPTABILITY OF STUD BULLS**TRIPTI KUMARI*, SUBHRANSU PAN AND RAJEEV KUMAR CHOUDHARY**

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Present study was done on 20 stud bulls (five from each breed viz., Sahiwal, Gir, Jersey cross and Holstein Friesian (H.F) cross) at Frozen Semen Bull Station, Haringhata, Nadia (West Bengal) in two seasons, i.e., winter and summer with the aim to assess the effect of breed, season and breed x season interaction on thermal adaptability of bull so that better management practices could be adopted in the farm for maintaining the animals. Rectal temperature, pulse rate and respiration rate of bulls were recorded both at morning (6.00 to 7.00 AM) and

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afternoon (1.30 to 2.30 PM). Thermal adaptability of bulls were assessed by calculating three heat tolerance indices i.e., Iberia heat tolerance indices (IHTC), Benezara Coefficient of Adaptability (BCA) and Dairy Search Index (DSI). Ranking of bulls were also done for finding the best adaptable breed. From the result it was found that the effects of breed, season and of breed x season interaction on thermo-adaptability were significant statistically ($P < 0.01$). Jersey cross, Gir and Gir were found to be highest overall IHTC, BCA and DSI respectively irrespective of season. On the basis of ranking among breeds, Sahiwal, Gir and Jersey cross have shown good thermo-adaptability, where as H.F cross have shown poor thermo-adaptability. During summer season heat tolerance coefficient values showed maximum deviation from their respective values under thermo-neutral condition. Bulls were more comfortable during winter than summer season. Hence response of bulls of different breeds varied according to their individual adaptive ability under different climatic conditions.

A COMPARATIVE STUDY ON INGESTIVE BEHAVIOUR OF STUD BULLS**TRIPTI KUMARI*, SUBHRANSU PAN AND RAJEEV KUMAR CHOUDHARY**

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Present study was done on 20 stud bulls (five from each breed viz., Sahiwal, Gir, Jersey cross and Holstein Friesian (H.F) cross) at Frozen Semen Bull Station, Haringhata, Nadia (West Bengal) in two seasons, i.e., winter and summer with the aim to assess the effect of breed, season and breed x season interaction, temperature, humidity and temperature-humidity index (THI) on ingestive behaviour (feed consumption/day, eating, drinking and rumination time) of bull to find out the better management practices on the farm for maintaining the animals. Bulls were provided feed twice a day and water ad libitum. Offered and refusals of feed have been weighed for calculating amount of feed consumed by the bull per day. Hourly scan sampling method was done for assessing the behaviour. Data were recorded till 2 hrs per day at morning (09:00 to 11:00 A.M) and afternoon (02:30 to 04:30 P.M). The result revealed that amount of feed consumed by the bull was significantly affected by breed, temperature and THI at 5, 5 and 1% level statistically. Time spent by bulls in eating was significantly affected by breed, humidity and THI at 5, 1 and 5% level statistically and drinking by air temperature ($P < 0.05$). There was significant effect of season ($P < 0.05$) and humidity ($P < 0.01$) on rumination time. Hence, duration of various activities performed by the bulls varies according to different breeds and environmental conditions.

EFFECT OF BREED, SEASON AND BREED X SEASON INTERACTION ON SEXUAL BEHAVIOURAL TRAITS OF STUD BULLS**TRIPTI KUMARI*, SUBHRANSU PAN AND RAJEEV KUMAR CHOUDHARY**

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Stud bull plays a unique role in the cattle breeding. A study was done to assess the effect of breed, season and breed x season interaction on sexual behavioural traits of stud bulls. The experiment was carried out on 20 stud bulls (five bulls each from four breeds i.e., Sahiwal, Gir, Jersey cross and H.F. cross.) at Frozen Semen Bull Station, Haringhata, Nadia, West Bengal, India. Sexual behavioural traits consist reaction time (RT), flehmen response (FR), flehmen intensity (FI), temperament score (TS) and libido score (LS). The result revealed that RT, TS and LS were significantly ($P < 0.01$) affected by all the effects i.e. breed, season and breed x season interaction. Better RT (second) was shown by Jersey cross bull (47.9 ± 2.5), followed by H.F cross (52.1 ± 2.6), Sahiwal (79.4 ± 2.6) and Gir (82.7 ± 2.6) bulls and was observed more during winter than summer season. There was significant difference ($P < 0.05$) between each breed among winter and summer seasons. Good TS was observed by H.F. cross bull (1.50 ± 0.13) followed by Gir (1.75 ± 0.19), Jersey cross (1.80 ± 0.16) and Sahiwal bull (2.06 ± 0.16). TS was found better in summer season and only Jersey cross bull was found to have significant ($P < 0.05$) variation among winter and summer season. More LS was found in Sahiwal (1.82 ± 0.11) followed by Gir (1.72 ± 0.04), H.F cross (1.50 ± 0.12) and Jersey cross (1.44 ± 0.11) bulls. It was highest during winter than summer season. Sahiwal, Gir and H.F cross bulls showed significant ($P < 0.05$) variation in LS among winter and summer season. All the effects were found to be non-significant on flehmen response and flehmen intensity of bulls. Hence, information generated from the study might be helpful in adopting the better management condition on the farm for exhibiting optimum sexual behaviour performances during each season.

STUDIES ON THE MANAGEMENT PRACTICES TO CONTROL SUB CLINICAL MASTITIS IN THE DAIRY CATTLE**TRIPTI KUMARI*, CHAMPAK BHAKAT AND RAJEEV KUMAR CHOUDHARY**

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The study was conducted on 100 farmers and 40 cows at surrounding villages of Nadia district, West Bengal to investigate the level of adoption of management practices done by the farmers for rearing their cattle as well as to assess the effect of tri-sodium citrate (TSC) for

controlling sub clinical mastitis (SCM) and its impact on milk quality and quantity. Survey on the basis of questionnaire was done with the farmers to find the adoption level. Farmers were divided into three groups based on the criteria of their adopted management practices as, Group I (poor), Group II (fair) and Group III (good). Simultaneously milk samples from the cows were analyzed by Modified California Mastitis Test (MCMT) to detect the incidence of sub clinical mastitis. Selected animals (N=40) having SCM were divided into two groups i.e., control (n=20) and treatment (n=20). Supplementation of TSC @ 30mg/kg body wt. orally till 10 days was provided in the treatment group, whereas in control group only SCM affected animals were present. Milk parameters were evaluated as somatic cell count (SCC), pH, electrical conductivity (EC), milk yield, fat, SNF, protein and lactose. The result revealed that farmers adopted about 20% poor (group I), 45% fair (group II) and 35 % good (group III) management practices. Further, when milk sample was tested to detect the incidence of sub clinical mastitis, it was found that MCMT is a good diagnostic test. MCMT score and somatic cell count was less in the treatment than control group. Hence, animals recovered from the infection and cure rate was 0 and 87.5% in control and treatment groups respectively. Milk pH and EC decreased and comes to the normal level whereas milk yield (kg/day), fat, SNF, protein and lactose(%) were found to be significantly more in treatment than control group. Therefore, it can be inferred that adoption level was higher in fair than poor and good management practices, which signifies that exploration of knowledge to the farmers about good management practices for maintaining their cattle is still needed. Use of tri-sodium citrate proved to be safe, economical and effective and considered as a good management practice to control SCM in dairy cattle. It can provide financial support to the farmers by increasing their income due to increase in milk quantity (yield) and quality.

RECENT ADVANCES IN NUTRIENT MANAGEMENT OF FRUIT CROPS

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Nutrient management is the process of managing the amount, source, timing and method of nutrient application with the goal of optimizing productivity and minimizing nutrient losses. Some important factors that need to be considered when managing nutrients include (a) the application of nutrients considering crop quality and achievable optimum yields; (b) application, and timing and management, of nutrients using a budget based on all sources and sinks active at the site; and (c) the management of soil, water, and crop to minimize the off-site transport of nutrients from nutrient leaching out of the root zone, surface runoff, and volatilization. It is a very important concept in ensuring efficient nutrient use and avoiding or minimising adverse environmental impacts. It combines production and environmental aspects of nutrient input and output management, rather than considering manufactured fertiliser use in isolation. Nutrient use efficiency can be improved by use of controlled-release fertilizers like Neem coated urea, sulfur coated urea which can improve nitrogen use efficiency by 10-50%. Other methods include fertigation, foliar fertilization, biofertilizers and Organic matter. Fertilizers are provided when soil fertility does not allow trees to express their genetic potential and time and rate of application should be scheduled to promote quality fruit. Fertilizers are mostly applied in the form of foliar application to boost nutrient density in crops and to correct nutrient deficiencies. The main benefits of foliar spraying are that it can have up to a 90% efficiency rate of uptake as opposed to 10% efficiency from soil applications. Also it becomes immediately available in the plant because they are 100% water soluble. This makes them perfect for correcting nutrient deficiencies. Integrated nutrient management implies managing all nutrient sources - fertilisers, organic manures, waste materials suitable for recycling nutrients, soil reserves, biological nitrogen fixation (BNF) and biofertilisers - in such a way that yield is not knowingly jeopardized whilst every effort is made to minimise losses of nutrients to environment.

VERMICOMPOST

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Vermicompost is the product of composting process using various species of worms, usually red wiggler, white worms & other earthworms, to create a heterogeneous mixture of decomposing vegetable, food waste, bedding materials, & vermicast also called worm castings, is the end product of breakdown of organic matter by an earthworm. Containing water soluble nutrients, vermicompost is an excellent, nutrient-rich organic fertilizers & soil conditioner. This process of producing vermicompost is vermicomposting. One of the most commonly used species for composting is the red wiggler. Blueworms may be used in the tropics. These species are commonly found in organic rich soils throughout Europe and North America & live in rotting vegetation. Large-scale vermicomposting is practice in Canada, Italy, Japan, Malaysia and the US. Two main methods of large scale are: . Windrow Flow-through system There may be differences in vermicompost methods depending on the climate. It is necessary to monitor the temperature of large scale bin systems. The most common worms used in the composting systems red worms feed most rapidly at temperature of 15-25deg. celcius Temperature above 30deg. celcius may harm them. If a worm bin is kept outside, it should be placed in a sheltered position away from direct sunlight &

insulated against frost in winter. Vermicompost is ready for harvest when it contains few to no scrap of uneaten food or bedding. There are several methods of harvesting from small-scale systems: a) dump & hand sort let the worms do the sorting Alternate Divide & dump. The pyramid methods of harvesting worm compost is considered the simplest method for single layer bins. It is commonly used in small scale vermiculture. Unlike other compost worm castings also contain worm mucus which helps to prevent nutrients from washing away with the first watering & holds moisture better than plain soil. Increase in available nitrogen & phosphorus. Reduction in the bioavailability of heavy metals.

Keywords: Vermicompost, vermicast, red wiggler blueworms, vermiculture

STUDIES ON FERTILITY STATUS OF SOILS (2016-17) OF GHAZIABAD DISTRICT TULSARANI, DEVENDRA PAL, VIPIN KUMAR, P.K. MADKE AND SATYA PRAKASH

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Soil fertility is one of the important factor controlling yield of the crops. Soil characterization in relation to evaluation of fertility status of soil of an area or region is an important aspect in context of sustainable agriculture production, because of imbalanced and inadequate fertilizer use coupled with low deficiency of other input, the response efficiency of nutrients has declined tremendously under intensive agriculture in recent year. An investigation was carried out to study the fertility status of 1500 representative soil samples (0-15 cm.) were collected from four blocks i.e. Muradnagar, Bhojpur, Loni and Rajapur of Ghaziabad District. The soil samples were analyzed for pH, EC, OC, available nitrogen, phosphorus and potassium. The data revealed that the 2.3 percent were alkaline (pH 8.5-9.3) in nature some like this salinity problem was also not observed significantly. Sample 2.4 percent showed salinity more than 1.0 dSm⁻¹. But 58.4 percent were low (< 0.5 percent) in organic carbon and 36.6 percent were in medium (0.5-0.8 percent) and only 5 percent sample showed high status of organic carbon (70.8 percent). In case of phosphorus availability only 20.3 percent (10-20 Kg. ha⁻¹) was found low, 78.6 percent (20-40 Kg ha⁻¹) in medium and 1.2 percent high (>40.0 Kg ha⁻¹) in phosphorus availability. Whereas 33.6, 58.2 and 9.2 percent showed the potassium availability, low (<137.0 Kg ha⁻¹), medium (137.0-337.5 Kg ha⁻¹) and high (>337.5 Kg ha⁻¹) respectively.

REVERSE BREEDING-A NOVEL BREEDING APPROACH TWINKLE KUMARI BHAGAT* ANIL KUMAR

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Reverse breeding can be considered as a new approach for superior hybrid seeds production which is much faster than conventional breeding. Conventional form of breeding takes many years to accomplish, which represents a very long time span given the need to rapidly address issues linked to climate change and food security. In order to speed up the process and allow for more precision and efficiency, new methods are needed. Among which reverse breeding is one. Reverse Breeding allows production of new hybrid plant varieties in a much shorter time frame and ambient numbers compared to conventional plant breeding techniques. It is a novel plant breeding technique designed to directly produce parental lines for any heterozygous plant. It generates perfectly complementing homozygous parental lines through engineered meiosis. The method is based on reducing genetic recombination in the selected heterozygote by eliminating meiotic crossing over. Male or female spores obtained from such plants contain combinations of non-recombinant parental chromosomes which can be cultured in vitro to generate homozygous double haploid plants (DHs). From these DHs, complementary parents can be selected and used to reconstitute the heterozygote in perpetuity. The approach not only allows fixation of uncharacterized germplasm but provides breeders with a breeding tool that, when applied to plants of known backgrounds, allows the rapid generation of chromosome substitutions that will facilitate breeding on an individual chromosome level. Since the fixation of unknown heterozygous genotypes is impossible in traditional plant breeding, RB could fundamentally change future of plant breeding. Reverse Breeding accelerates the breeding process considerably and increases the number of available genetic combinations which allows breeders to respond much quicker to the needs of farmers and growers with better varieties.

Keywords- reverse breeding, engineered meiosis, double haploids

EFFECT OF FLUORIDE TOXICITY ON AGRICULTURAL CROPS UDAY PRATAP SINGH, BHUDEORANAYASHU

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Fluoride is the simplest fluorine anion. In terms of charge and size, the fluoride ion resembles the hydroxide ion. Fluoride ions occur on earth in several minerals, particularly fluorite and fluorapatite, but are only present in trace quantities in bodies of water in nature. Fluoride enters the atmosphere mainly from anthropogenic sources. The principal anthropogenic sources include aluminum smelters, fertilizer factories, and industrial activities such as brick, tile, pottery and cement works, ceramic industries, and glass manufacture. Gaseous fluoride enters in plant through stomata and migrates towards tip of the leaves. Fluoride present in soil enters into plant through root and after absorption, it moves into shoot. The initial visual symptom in fluoride toxicity in plants are development of

necrotic spots at the tip and margins of leaves and after, leaves become necrotic. Increased levels of fluoride in plants are reported to inhibit root length, shoot length, plant height, leaf size, number of leaves per plant, fruit and seed setting and test weight. In plants fluoride concentration is reported to be the maximum in root than in shoot and the minimum in grains. Fluoride has important biological effects, especially on vegetation. This is because its compounds damage plants at concentrations about 1,000 times lower than those causing detectable human health effects.

Key word: -Fluoride, Anthropogenic, Biological, Fertilizer

SHELFLIFE MANAGEMENT OF CAPSICUM BY EXOGENOUS APPLICATION OF ABSCISIC ACID

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Capsicum is highly priced vegetable of solanaceae family, cultivated extensively for its variable colours, rich nutritional composition and bioactive compounds. Under ambient condition shelflife of capsicum was recorded very less i.e. 3- 4 days. Various physical, chemical and biological postharvest treatments have been given till now to extend shelflife, but abscisic acid was not utilised so far in capsicum fruits. Absciscic acid is a phytohormone mainly responsible for ripening, seed dormancy, stomatal opening etc. Its positive effects have also been observed in grapes, tomato, and persimmon for quality management. Looking in to the research gap present work is mainly focussed on analysing the effect of exogenous ABA on capsicum fruits. 300 µmol/L of abscisic acid was used for giving postharvest treatment by dipping method for 10 minutes and different parameters like firmness, PLW, total carotenoid, TSS and acidity have been measured at 2 days interval during 8 days of storage. Results showed that exogenous application of ABA at breaker stage (red variety of capsicum viz. Natasha) initiated the carotenoid accumulation at increasing rate, also other parameters like TSS and acidity not showed significant difference during storage period. PLW and firmness was increased slightly in ABA treated fruits as compared to control. Hence, from this study it has been concluded that ABA is involved in capsicum postharvest quality management which was confirmed by biochemical basis. There is need for further investigation on the role of ABA and its metabolites in shelflife and quality management of capsicum.

DOUBLING FARMERS INCOME THROUGH INNOVATIVE APPROACH

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Agriculture is the backbone of Indian economy. In present scenario, the increasing demand for diversified agricultural produce such as food grains, pulses, fruits vegetables, meat fishes and milk. Adoptions of new technologies and skill development have been the major driving force for increasing agricultural productivity & promoting overall economy development improve small farm productivity and increase farming income. In this regards, precision farming, mechanization of farm operations using smart machines e.g. power filler macro sprayer etc. devices and tools, use of nanotechnology, storage technologies, cleaning sorting and processing at the farm level, e-commerce, renewable power based machines for all operations are some of the important measures to archived the goal smoothly. There is urgent need to focus skill development programme & technology transformation for the farmer and youth of the country to fulfil the dreams of doubling farmer's income. Doubling rural income in nominal terms is possible by increasing agriculture output by 12% minimum support prices every year with additional land likely to be utilized for agricultural activity. Possibility, not only to double the income of farmers through enhancement in production, productivity changes in cropping pattern, increase additional income with the help of the food processing industry and infusing value addition of agricultural produce.

Key words :-Backbone, Agricultural productivity, Precision farming, Nanotechnology, Renewable, Enhancement & Cropping pattern.

BIO-PESTICIDES FOR SUSTAINABLE AGRICULTURE

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The over use of chemical pesticides causes environmental and health problem have been the matter of concern so plant extracts which are known as biocide/ biopesticides or green pesticides can be an alternative good source of chemical pesticide due to their safe, eco-friendly and more compatible properties. These are being used to manage the pest and minimize the yield loss. The different types of plant extract used as biocides such as neem, garlic, tobacco, kappettiya, syringe, ginger and many others are being utilized to control and manage the pest or disease of different plants. . Synthetic chemicals are generally used to control insect pests, which cause harmful impacts on the environment and non-target living systems including human beings. For these reasons, biopesticides are gaining increasing importance as they are alternatives to chemical pesticides and are a major component of many pest control programs worldwide. The most important biopesticides on the market in commercial terms are microbial pesticides, pyrethrum, rotenone, neem oil and various essential oils. Eve's

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apple latex/ fruit/ seeds extract, lilac flower extract, neem leaf/ seeds or it oil all are act as potential insecticide to tea, rice, betel leaf and vegetables pest.

Key words: Bio-pesticides, extracts, plant, Pest, control.

GENETIC VARIABILITY, HERITABILITY AND CORRELATION STUDIES IN BRINJAL (*SOLANUM MELONGENA* L.)

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The field experiment was conducted in the new orchard of Main Agricultural Research Station, Raichur, during the year 2016-17. The present investigation was under taken to study the Genetic variability in brinjal (*Solanum melongena* L.). Sixteen genotypes of brinjal were evaluated in Randomized Complete Block Design with two replications. Analysis of variance revealed that considerable variability among the genotypes for all the characters. Fruit length exhibited the highest values of coefficient of phenotypic and genotypic variance (34.44 and 33.00% respectively). The maximum estimate of heritability in broad sense (H^2_{BS}) was noticed for leaf area (97%). Fruit length gave the highest value for genetic advance over mean (65.13 %). The number of leaves per plant exhibited highest positive significant association with fruit yield per plant at both genotypic and phenotypic level (0.9419 and 0.7448). Brinjal is one of the important solanaeaceous vegetable crop due to different flower morphology lot of variability available in brinjal. There is a need for utilization of existing variability among different genotypes for obtaining best breeding lines for further development of high yielding varieties and hybrids for increasing the productivity.

SEASONAL INCIDENCE OF FRUIT FLY (MAGGOT POPLATION), *BACTROCERASPP.* ON GUAVA CROP DURING RAINY AND WINTER SEASON

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Abstract: The present study entitled “Seasonal Incidence of fruit fly (maggot poplation), *Bactrocera*spp. on guava crop during rainy and winter season” were carried out during both rainy and winter season at farmer's field at village Sunderpur, District Rohtak, Haryana during 2016-17. The maggot population of guava fruit fly, *Bactrocera* spp. started appearing from 29th SMW (4.8 maggots/infested fruit) reaching its maximum in 31st SMW (32.3 maggots/infested fruit). During winter season, the maggot population was at its peak during 44th SMW (12.1 maggots/infested fruit) which went on decreasing till 48th SMW (1.12 maggots/infested fruit). There was no maggot population from 49th to 9th SMW. During termination phase of winter crop season, a low maggot population *i.e.* 2.29 and 3.31 maggots/infested fruit were recorded in 10th and 11th SMW, respectively.

Keywords: Guava, fruit fly, *Bactrocera* spp., methyl eugenol, traps

PHENOTYPIC DIVERSITY STUDIES IN CHICKPEA

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Bundelkhand region is known as the pulse bowl of India. Among other legumes such as mungbean, urdbean, lentil etc., chickpea is widely consumed as food crop in India with 9330 thousand tonnes production in 2016-17 with 40.65 % share in total production of pulses. At RLBCAU, Jhansi, made an efficient attempt to evaluate phenotypic diversity in chickpea germplasm. Sowing of same set of germplasm was done in three different plots with different sowing dates. First sowing was done in second week of November, 2018. There was difference of 15 days between the first, second and third dates of sowing. Various parameters such as plant height, 50% flowering, pod initiation and maturity were observed in all the three sets of germplasm. BGD 72 and BG1053 were used as checks. Among all the germplasm, ICCV 442203 attained a maximum height of 64.2, 52 and 44 cm in Germplasm I, II and III respectively. Minimum height was recorded in ICCV 53248 (32.6cm) in Germplasm I, ICCV 554984 (24.6cm) in Germplasm II and 448812 (13cm) in Germplasm III. On the other hand in checks maximum height observed was 63cm and 56.6 cm in BGD 72 and BG1053 respectively in the first date of sowing.

50% flowering observed for line ICCV 267272 was minimum among all the lines *i.e.* 59, 57 and 60 days respectively in all the three germplasm sets. Similarly, pod initiation (70, 65 and 70 days respectively) as well as maturity (105, 97 and 102 days respectively) was earliest in the same germplasm line ICCV 267272. For BGD72, 50% flowering was recorded as 74 (Germplasm I), 55 (Germplasm II) and 50 (Germplasm III) days and for BG1053, 69 (Germplasm I), 60 (Germplasm II) and 63 (Germplasm III) days. Similarly, pod initiation

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was 84(Germplasm I), 64(Germplasm II) and 56 days(Germplasm III) for BGD 72. BG1053 attained 78, 67, 73 days in pod initiation for the three germplasm sets respectively. In the same way maturity days were 118, 103, 72 days for BGD 72 and 109, 102, and 97 days for BG 1053. The germplasm lines are showing wide variability in almost all the traits taken into account so that it can be used in future breeding programmes in the development of new varieties in the background of high yield potential for the Bundelkhand region. However, there is need of further studies of these germplasm lines.

Key words: Phenotyping, Chick pea, Germplasm

STUDY ON RICE GENOTYPES IN VIEW OF DIFFERENT SEEDLING PARAMETERS UNDER NEW ALLUVIAL ZONE OF WEST BENGAL

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The study was allowed for 20 rice genotypes, where high variability was noticed in considerable seedling characters to analyse the nature of seed under normal and water stress. To measure seedling vigour, the considerable parameters were germination percentage, speed of germination, root-shoot length, fresh-dry weight, vigour index and water holding capacity at 24 hours. These may be responsible to indicate the selection strategy of a crop on seedling establishment supportive to create good plant. The cultivar, V₁₀ (GB 3) and V₁₈ (Kataribhog) were encouraging to grow quality seedling in both situation. High genetic variability among genotypes was noticed with superior value of V₁₀. High GCV (more than 20%) and least diversity with PCV for root length, fresh weight, dry weight and water absorption potential at 24 hours confirmed the high genetic variability favourable for selection. High heritability (H² %) coupled with high genetic advances (GA %) of the above characters can be used as an interpreter in selection procedure for quality seedling, a basic need for good plant. In association of seedlings parameters, vigour index showed high positive significant correlation with all characters under both normal and stress. The positive correlation of fresh and dry weight was highly significant to root-shoot length, vigour index and water holding capacity at 24 hours though it was not followed for shoot length in stress.

Key words: Correlation, heritability, rice, seedling, variability.

BREEDING FOR SUCKING PESTS RESISTANCE IN COTTON

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Cotton (*Gossypium spp.*) is a major fibre crop of global importance and has high commercial value. Cotton occupies 5% of the total cropped area distributed among three different agroclimatic zones in India, and consumes 55% pesticide share accounting for 40% of total production costs. Cotton harbors a rich arthropod biodiversity. Sucking pest's viz., jassids (*Amrasca biguttula biguttula* Ishida), aphids (*Aphis gossypii* Glover), whiteflies (*Bemisia tabaci* Gennadius) and thrips, (*Thrips tabaci* Lindeman) are deleterious to the process of cotton growth and development with their ability to build up to serious proportions as a result of rapid and prolific breeding in cotton plant. The cotton possesses a wide range of direct and indirect resistance mechanisms against insects. Wild species are the main resources for resistance breeding in cotton. Basis for sucking pests resistance are mainly three types like morphological (Trichomes, Leaf pubescence, Surface waxes, Thickening of cell walls and cuticle, Hardness of plant tissues etc), biochemical (Tannins, Flavonoids, Phenols etc) and molecular (Lectins, PIs, NBS-LRR, Molecular Marker etc). A series of major genes (H1, H2, H6, Sm2, Sm1-smooth stem, Sm sl-smooth leaf, Sm3) and modifier genes (H3-stem, H4-lower leaf surface, H5-length) of diverse origins (*G. hirsutum*, *G. barbadense*, *G. raimondii*, *G. tomentosum*, *G. armourianum*) influencing pubescence had been identified. Genetics of trichome and its association with fibre and agronomic traits was showed the 1:2:1 monohybrid ratio in F₂ population confirmed the incomplete dominance. A combined RFLP-SSR-AFLP linkage map are using for identification of QTLs in association with leaf and stem pubescence in cotton. Development of transgenic cotton lines expressing *Allium sativum* Agglutinin (ASAL) lectins for enhanced resistance against major sap-sucking pests in cotton. Recent development in breeding approaches will be giving a new way for resistance. Now research is going to develop NBS-LRR mediated resistance through R gene and Melon Vat gene in cotton aphids. Also defensive protein PIs is using for sucking pests resistance breeding in cotton. So, as compare to conventional breeding approaches, molecular and transgenic approaches is giving a powerful way to develop resistance mechanism in cotton.

Keywords: ASAL, Lectins, QTLs, NBS-LRR, RFLP-SSR-AFLP, Sucking pests

STUDY OF INTERCROPPING OF ANNUAL FLOWERS IN *ROSA INDICA* FOR VEGETATIVE AND FLOWERING ATTRIBUTES**UTSAV DEVDHARA¹, S. T. BHUT², TRUPTI DODIYA³ & GAWADE NAGESH⁴***1, 3 & 4 Junagadh Agricultural University, Junagadh-362001, 2 Assistant Professor, Navsari Agricultural University, Navsari*

The present investigation was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during the year 2014-15 to study the suitable intercrop in rose. The intercrops grown were African marigold, French marigold and Gaillardia. The experiment was laid out in Randomized Block Design with 10 treatments viz. T₁ = Rose + African marigold (1:1), T₂ = Rose + African marigold (1:2), T₃ = Rose + Gaillardia (1:1), T₄ = Rose + Gaillardia (1:2), T₅ = Rose + French marigold (1:1), T₆ = Rose + French marigold (1:2), T₇ = Rose sole, T₈ = Gaillardia sole, T₉ = African marigold sole, T₁₀ = French marigold sole. The result on effect of intercrops on the vegetative parameters of rose was significant result in different stage. Among the vegetative character plant height was recorded significant at the end of experiment. Moreover plant spread were shown non-significant at the time of planting of first intercropping season while at the end of first intercropping season, at the time of planting of second intercropping season and at the end of experiment it was recorded significant. As usually the no of branches were exhibited non-significant result during all stages. While days taken for first flower bud initiation recorded non-significant and flower diameter was also found non-significant.

EVALUATION OF MAIZE GENOTYPES FOR FODDER AND GRAIN YIELD IN NORTH-WESTERN HIMALAYAN REGION**V.K. SOOD, SAWAN KUMAR* AND ANJALI KUMARI***Department of Crop Improvement, CSK Himachal Pradesh Agricultural University, Palampur, H.P. (India) 176062*

The diversified use of maize crop is gaining demand as grain, animal feed and fodder and other industrial uses. Maize crop plays a very important role in human and animal nutrition. Both fodder and grain yield is governed by genetic variability and interaction of genotypes with environment. Therefore, it is prerequisite to evaluate the available variability for fodder and yield traits in maize. For this, 20 genotypes were evaluated in randomized block design with three replications during Kharif 2016 and 2017. Data were recorded on five morphological traits including plant height, green fodder yield, grain yield, straw yield and harvest index. Data was analyzed for the estimation of genetic variability among genotypes by method given by Burton and De Vane (1953). Wide range of estimates for all five characters studied in 2016 and grain yield and harvest index in 2017 reflects the existence of significant variations among all the genotypes. High heritability coupled with high genetic advance was observed for green fodder yield, grain yield, straw yield and harvest index which revealed that these characters were governed by additive gene action. Higher value of PCV than GCV was observed for all the traits studied and pooled ANOVA analysis indicated that variation for all five characters was influenced by Genotype × Environment interaction. On the basis of mean performance and estimation of genetic parameters, three genotypes i.e. PMG-3, PMG-14 and PMG-52 were found promising which can further be used in maize breeding program to increase the productivity of maize.

Keywords: Fodder traits, Genetic variability, Heritability, Maize

EFFECT OF DIFFERENT BOTANICAL EXTRACTS AGAINST DRY ROOT ROT OF CHICKPEA CAUSED BY *RHIZOCTONIA BATATICA* (TAUB.) BUTLER**V. K. JHARIYA, RAM CHANDRA AND SAURABH KUMAR***Deptt. of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005 (U.P.)*

Chickpea or chana is a very important pulse crop that grows as a plant named *Cicer arietinum* L. in the Leguminosae family. The main cause of this disease is a fungus, *Rhizoctonia bataticola* (Taub.) Butler in most of the gram growing regions. The tap root is dark, shows signs of rotting, and is devoid of most of its lateral and finer roots. Drooping of petioles and leaflets is confined to top of the plant and sometimes when the rest of the plant is dry, the top most leaves are chlorotic. The growth inhibition of mycelium of *Rhizoctonia bataticola* was tested by treatment of culture by four botanical organic extract viz. Neem leaf extract, Marigold leaf extract, Aloe Vera and Bitter gourd leaf extract and compared with control culture. These botanical extracts were added to the culture media at two concentration viz. 20 % and 30 % and tested by poisoned food technique. The result reveals that Neem leaf Extract was best botanical extract and found highly inhibiting the mycelia growth of *Rhizoctonia bataticola* at both the concentration viz. 20% and 30% (60.77% and 69.66% inhibition respectively) followed by Marigold Leaf Extract, Aloe Vera Extract and Bitter Guard Leaf Extract accordingly at both concentrations. In this way, this study will helpful to the farmers for selection of effective botanical extract for control of Dry Root Rot of Chickpea and also obtaining better Chickpea yield.

“RESPONSE OF VARIOUS LEVELS OF FERTILIZERS AND IRRIGATIONS ON THE GROWTH AND YIELD OF WHEAT (*TRITICUM AESTIVUM* L.) IN THE BUNDELKHAND REGION OF UTTAR PRADESH.”**V. K. SINGH¹, A. MAHAN^{2*}, U. CHANDRA³ AND B. K. PANDEY⁴**¹Brahmanand Post Graduate College, Rath, Hamirpur-210431, Uttar Pradesh, India, ²Student, Brahmanand Post Graduate College, Rath, Hamirpur-210431, Uttar Pradesh, India, ³Brahmanand Post Graduate College, Rath, Hamirpur-210431, Uttar Pradesh, India, ⁴Brahmanand Post Graduate College, Rath, Hamirpur-210431, Uttar Pradesh, India

An experiment was conducted in the Randomised Block design (RBD) during the rabi season of the year 2016-17 at the research farm of the Brahmanand Post Graduate College, Rath, Hamirpur, Uttar Pradesh, India to study the impact of various levels of fertilizers and different irrigations schedules on the growth and yield of wheat (*Triticum aestivum* L.) in the Bundelkhand region of U. P. The treatment details includes the four levels of fertilizers viz. F₀(Control), F₁ (40:20:20 NPK kg ha⁻¹), F₂(80:40:40 NPK kg ha⁻¹) and F₃ (120:60:60 NPK kg ha⁻¹) and four levels of irrigations I₀ (Control), I₁(one irrigation at CRI stage), I₂ (Two irrigations at CRI and flowering stage) and I₃ (three irrigations at CRI + flowering + dough stage) each. The number of replications followed was three. Observations on initial plant population, plant height (cm), number of leaves, number of tillers/plant, number of ears/plant, number of grains/ear, total biological yield and harvest index were recorded and analyzed statistically. Data on growth observations showed that the treatment F₃ (120:60:60 NPK kg ha⁻¹) was found to produce the highest plant populations, plant height, number of leaves and number of tillers/plant at 30, 60, 90 days after sowing and at harvest as well as yield attributing characters. Among the irrigation levels, it was found that the treatment I₃ attained the highest values of all the growth characters as well as yield attributing characters. Therefore, based on the above facts, it can be concluded that among the various levels of fertilizers, the treatment F₃ and among the irrigation levels, treatment I₃ may be selected for the general recommendation for the cultivation wheat to the farmers of Bundelkhand region.

(Key Words: Growth and yield of wheat, levels of fertilizers, irrigations)

BALANCED FERTILIZATION IN SUGARCANE POTATO BASED CROPPING SYSTEM FOR ENHANCING SUGARCANE YIELD, SUSTAINING SOIL HEALTH AND DOUBLING FARMER'S INCOME**(V.P.JAISWAL¹, S.K. SHUKLA², LALAN SHARMA³ & A. D. PATHAK³**

Sugarcane is being long duration, important pride cash crop produces a heavy tonnage and tends to remove substantial quantum of plant nutrients from soil. The use of NPK fertilizers alone could not maintain the higher yields over years because of emergence of secondary and micronutrient deficiency and deterioration of soil physical properties. The deficiency of any nutrient may result in retarded growth and decrease the yield and thus minimize the usefulness of other agricultural inputs including NPK fertilizers. The sulphur and zinc are also considered economic importance in sugarcane crop. In this view, the present investigation was conducted to evaluate the sulphur and zinc containing complex fertilizers for maximizing the yield, sustaining soil health and doubling farmers income. Field experiments were conducted at experimental field of ICAR IISR, Lucknow, India to evaluate the sulphur and zinc containing complex fertilizers in sugarcane-potato based intercropping cropping system. The treatment of cropping system was kept in main plot and nutritional management in sub plots. The eighteen treatments in combinations were conducted and replicated 3 times in split plot design. The experimental field was sandy loam with pH 7.45, low in available nitrogen (260.29 kg/ha) and available phosphorus (27.61 kg/ha) and high available potassium (400.79 kg/ha). Recommended doses of N,P,K for sugarcane (150:60:60) with variety CoPk 05191 and potato (175:80:100) with variety *Kufri Anand* were planted. Results revealed that soil organic carbon (SOC) and available NPK status significantly influenced with cropping system, recorded higher status of SOC with potato + sugarcane system. Potato-Sugarcane cropping system exhibited significantly higher N content in different parts of sugarcane highest at tillering stage followed by crop grand growth stage and least at harvest stage. Nutrient management schedule significantly affected the S and Zn accumulation and highest S and Zn content in sugarcane leaf was determined with application of NPS-1 and NPS-3, respectively. Sulphur content in different plant parts subsequently reduced at harvest stage and recorded higher sulphur content in stem followed by leaf, root and tuber. By and large, zinc accumulation followed similar trend. Highest nitrogen use efficiency was recorded with Rec. NPK + FYM and value ranged from 20-49%. Pooled analysis mean over two years revealed that significantly higher sugarcane yield (100.9 t/ha) was recorded in Potato + Sugarcane system as compared to Potato Sugarcane sequential system (96.0 t/ha). Recommended NPK + zinc and sulphur equivalent to NPSZn registered highest tuber yield (345.2 q/t ha) and sugarcane yield (110.0 t/ha) because of higher leaf area index and maximum photosynthetic rate (15.36 $\mu\text{mol m}^{-2} \text{s}^{-1}$). Highest net income (Rs. 3,20,000/ha) and benefit cost ratio (2.62) were also observed with Rec.NPK + S and Zn equivalent to NPSZn (Grade III) closely followed by Rec. P through NPSZn (Grade III). Potato + Sugarcane intercropping system recorded higher cane equivalent yield (129.4t/ha), benefit cost ratio (2.42) and net income (2.75 Lacs/ha) as compared to Potato-Sugarcane sequential system. Evaluating material, Rec. P through NPSZn (Grade III) was found comparatively better compared to NPS-2 (Grade II) and NPS-1 (Grade I) and improved the net profit by Rs. 17,000/- and Rs. 34,000/- respectively.

INTEGRATED FISH FARMING TECHNOLOGY: WAY TOWARDS SOCIO-ECONOMIC UPLIFTMENT AND WOMEN EMPOWERMENT IN RURAL AREAS OF WEST KAMENG DISTRICT ARUNACHAL PRADESH, N. E. R, INDIA**V.K. MISRA¹, C.P. SINGH², N.D. SINGH¹, T.S. MISHRA¹, N.K. MISHRA¹, A.N. TRIPATHI² AND SHASHANK SINGH³**¹K.V.K West Kameng, Dirang Arunachal Pradesh, ²K.V.K Lower Subansiri, Arunachal Pradesh, ³ College of Fisheries, Dholi, Dr. R.P C.A.U Bihar

In India more than 75% of the total population, involves in agriculture / allied sectors and lives in rural areas at subsistence or near subsistence level. These rural folk are greatly under-nourished, requires not only a large supplement of animal protein in their diet but also new sources of gainful employment for their socio-economic upliftment. In this reference Integrated Fish Farming may become a one of the best examples of mixed farming for sustainable development of the rural farming community. This type of farming practices in different forms in the various countries is one of the important ecological balanced sustainable technologies. The systems gives a good returns to the farmers in term of fish production, a handsome quantity of other agri./allied products and may become new sources of gainful employment for their overall development. In view of the above facts the present study were undertaken in the three villages i.e. Sangti, Chug and Salari of Dirang Circle during the year 2016-17 under West Kameng district of Arunachal Pradesh through the involvement of women farming community, as they plays an important and major role at household level for the upliftment of their family socioeconomic status. This district is lying approximately between 91° 30' to 92°40' East longitudes and 26° 54' to 28° 01' North latitudes, blessed with complex climatic environmental conditions having foothill as well as complex hill eco-system with the varying elevation ranging about from 300-4200 meter and covers about 7422 Sq.KM of geographical region accounting for 8.86% of the total area of the state. During the experimental period the observations were made periodically on monthly basis from each segment and data were analyzed for the proper evaluation of the system. The encouraging results were recorded from this system (IFS) in comparison to mono-cropping pattern of farming. On the agricultural front, the district is still at the stage of subsistence level of farming in this context Integrated Fish Farming may become a one of the best examples of mixed farming for sustainable development of the rural farming community through conservation and efficient utilization of their natural resources.

Key words: Integrated Farming, ecologically balanced, socioeconomic and sustainable etc.

EVALUATION OF LAWN GRASSES FOR TURF QUALITY FOR PHYSIOLOGICAL PARAMETERS AT PUNE CONDITION**VAIBHAV WADEKAR¹, P.V. PATIL², GB KADAM³, PUSHPANJALI BHOSALE⁴ AND NAGESH GAWADE⁵**^{1,2} & ⁴College of Agriculture, Pune-05, MPKV, Rahuri, ³Scientist ICAR-DFR Pune-05, ⁵Junagadh Agricultural University, Junagadh-362001

The present investigation was carried out during the year 2015-2016 at Modibaug garden of Horticulture Section, College of Agriculture, Pune. In the experiment, nine lawn grass species viz. Korean grass, Argentine grass, Pensacola grass, American blue grass, Weeping love grass, St. Augustine grass, Bermuda grass, Phosphelone grass and Taiwan grass were evaluated with three replications and was laid out in Randomized Block Design. The highest Chlorophyll content observed in Bermuda grass followed by recorded by American blue grass and Phosphelone grass. The maximum fresh weight of shoot and dry weight of roots was recorded in Weeping love grass whereas, the maximum fresh weight of roots was recorded in Argentine grass. The root to shoot ratio was maximum (0.95) recorded in Pensacola grass.

Key words: Lawn grasses and physiological parameters.

PRESERVATION OF FOOD BY OHMIC HEATING**VAISHALI, HARSH P. SHARMA, KAVINDRA SINGH***Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut- 250110*

Food is a perishable commodity. Main role of food preservation is to prevent or slow down the growth of microorganism that causes spoilage of food. Preservation extent the shelf life and maintain the nutritive value of food. Heat is most commonly used for preservation that kills micro-organisms. Ohmic heating is an electroheating technique depends on passage of electrical current through a food. This technique provide uniform rapid heating, less cooking time and lower capital cost as compared to other preservative technique. Ohmic heating gives high quality food with minimal changes to structural, nutritional and organoleptic properties of food. Micro-organism destroys by this process due to electroporation of cell membrane, membrane rupture and cell lysis. In electroporation excessive leakage of ions and intermolecular components results in cell death. Ohmic heating inactivates antinutritional factors like lipoxigenase, polyphenoloxidase and pectinase. Ohmic heating rate depends on the electrical field strength and electrical conductivity of product. The main application of ohmic heating is cooking, thawing, blanching, peeling, evaporation, extraction, dehydration and fermentation. Ideal foods for ohmic heating are viscous with particulates and this technology applied to different fruits and vegetables and their products, such as apples, strawberry, turnip, various purees, juices.

Key word: - Preservation, Ohmic heating, microorganisms.

ASSOCIATION OF TASRG6 GENE WITH DROUGHT STRESS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Wheat is basic food stuff and most widely grown cereal grain, provides staple food for 36% of world population. It is rich source of carbohydrate, protein and also rich in minerals and sugar. Drought stress is responsible for the crop loss annually and major factors reducing plant growth and productivity worldwide about 21%. The several transcription factors involved in a complex control mechanism for responding to abiotic stresses in plant. In the present study the differential expression pattern and the role of TaSrg6 gene under induced drought stress condition is studied. Four wheat genotypes (DBW71, HD3086, HD2888 and RAJ3765) were taken and treated with different concentration of PEG-6000 (5, 10 and 15%). The expression level of TaSrg6 gene was quantitatively analyzed using real time PCR with TaSrg6 gene specific primers. In control condition the genotype HD2888 and RAJ3765 have the higher ΔC_q value already but under drought stress condition TaSrg6 gene expressed highly in genotype DBW71 and HD3086. The sequence of TaSrg6 gene was shows similarity from 79 to 100% in nucleotide and 76 to 99% in amino acid sequences with other Srg6 gene sequences of different plants species. The expression level of TaSrg6 gene was increase and then decreases slightly as stress level increase. Based on the nature of its early expression after stress treatment, TaSrg6 gene shows association with drought stress and may be act as potential transcriptional regulator triggered by abiotic stress.

Key words: TaSrg6 gene, Differential expression, Drought stress and wheat.

EFFECT OF PESTICIDES ON CROPS

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Pesticides are widely used chemical substances throughout the world in agriculture and public health. Because of their high biological activity, and in some cases of their persistence in the environment, the use of pesticides may cause undesired effects on human health and to environment. On the other hand, pesticides play a significant role in rural health program comprises of the control of biting, noxious, irritating, annoying or contaminating insects and other pests, which infest human and animals. Pesticide residues in food and feed crops, meat and poultry, fish and aquaculture as well as milk products generally arise from their indiscriminate use in agriculture and public health.

GENETICS OF HYBRID INCOMPATIBILITIES IN PLANTS

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Species is a group of potentially interbreeding natural populations that are reproductively isolated from other groups. Reproductive barriers are important to maintain identity of established species. Reproductive isolation is divided into two forms depending on the stage in which it occurs: Pre zygotic barriers and Post zygotic barriers. Pre-zygotic barriers act earlier in the life history preventing the formation of hybrid zygotes and consist of forces that reduce the chance of mating success. Post zygotic barriers, on the other hand, result from fitness aberration in hybrids causing hybrid sterility and thus preventing the exchange of genes between species or subspecies. Hybrid incompatibility (HI) is a measurable reduction in fitness in F_1 , F_2 , or BC_1 generation of inter-specific hybrids. According to the DobzhanskyMuller Model, Hybrid Incompatibilities results from a deleterious interaction between functionally diverged genes from the hybridizing species. In this model, independent mutations appear and get fixed in different populations, these mutant loci are reported to interact negatively causing genetic incompatibilities in the background of hybrids when brought together in a common genome. Gene transposition, Transposable elements, Genome Dosage Imbalance, Genome Imprinting, Evolutionary Forces and Chromosome rearrangements or divergent evolution among duplicate genes is also a cause of genetic incompatibilities between isolated populations. Incompatibilities in inter-specific hybrids, expressed as sterility and lethality, are widely observed which causes reproductive isolation and thus contribute to speciation. Hybrid sterility hinders the transferring of useful genes between two species or subspecies and is a major obstacle for utilization of the potential heterosis in the hybrids.

Keywords : zygotic barrier, hybrid incompatibility, hybrid, generation, gene

PROSPECTS AND CONSTRAINTS OF ALTERING CROP GEOMETRY AND WEED MANAGEMENT IN AEROBIC RICE**VASUNDHARA KAUSHIK¹ AND AARADHANA CHILWAL²**¹GBPUAT, Pantnagar, ²PAU, Ludhiana

Rice is an staple food of more than half of the world's population more than 3.5 billion people depend on rice for more than 20% of their daily calories. Rice provided 19% of global human per capita energy and 13% of per capita protein. World's rice demand is projected to increase upto 25% by 2025. Meeting ever increasing rice demand in a sustainable way with shrinking natural resources is a great challenge. Transplanted rice has deleterious effects on the soil environment for the succeeding wheat and other upland crops. Different problems like lowering water table, scarcity of labour during peak periods and deteriorating soil health demands some alternative establishment methods to sustain productivity of rice as well as natural resources. Direct seeded rice (DSR), probably the oldest method of crop establishment, is gaining popularity because of its low-input demand, it saves labour, requires less water, less drudgery, early crop maturity, low production cost, better soil physical conditions for following crops and provides better option to be the best fit in different cropping systems. Weeds, however, are one of the major biological constraints in these systems which cause a substantial rice yield loss upto 80%. The risk of yield loss from weeds in direct- seeded rice is greater than transplanted rice. Crop geometry plays a significant role for optimization of rice yield due to efficient utilization of solar radiation as well as nutrients in direct seeded rice. Narrow crop row spacing could be considered as an agronomic tool for weed control. Narrow crop row spacing provided better competition of paddy crop against weeds due to early crop canopy cover which smothered weed and gave rise to higher productive tiller and grain yield of rice. Planting geometry is directly correlated with plant population and as the plant population is been increased by reducing the spacing, weed population also reduces but at the same time crop yield also get affect negatively. To maintain the symmetry in weed management and yield, optimum plant spacing (20-25 cm can prove better in combination with proper weed management practices in direct seeded rice. Combination of stale seedbed preparation +Herbicidal weed management (Pre and post emergence) + one hand weeding can be adopted to achieve higher productivity.

IMPACT OF CONSERVATION AGRICULTURE ON CROP YIELD AND SOIL HEALTH**VED PRAKASH^{1*}, DAYANIDHI CHAUBEY², RAHUL MISHRA³, ANKIT KUMAR PANDEY⁴ AND ROHIT KUMAR SINGH⁵**^{1,2,3,5}Department of Agronomy, ⁴Department of horticulture (fruits and fruits Technology), ^{1,2,4} Bihar Agricultural University, Sabour-813 210, Bhagalpur, ²Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, ⁵University of Lucknow U.P.

Conservation agriculture (CA) is the technologies to save and conserve the natural resources, increases the production and productivity while simultaneously conserving the environment. The total area under CA is 124.8 m ha in the world, while 1.5 m ha in India. The key elements of CA include no tillage, adequate retention of crop residues on the soil surface for mulching, innovative cropping systems and measure to reduce soil compaction through controlled traffic. Freewheeling of the farm machinery in moist fields creates clods and compact soils. This must be avoided if zero till is to be practiced for a longer period. These CA principles are not site specific but represent unvarying objectives that are practiced to extend CA technologies efficiently across all production conditions. Continued puddling over decades has led to deterioration of soil physical properties through structural breakdown of soil aggregates. Therefore, it is imperative that alternative method of growing crops that are more water efficient and less labour intensive to be developed to enable farmers to produce more with less cost of cultivation. Conventional methods of sowing require excessive tillage, delays sowing and reduce yield, but the same can be accomplished efficiently by use of improved machines like zero till seed drill, rotary seed drill and bed planter etc. to save the time, diesel, energy and cost. There was a significant difference in the soil bulk density with residue tillage (RT) and no-tillage (NT) compared to CT in the topsoil layer (0-5 cm). Similar results for soil bulk density, the lowest values of soil OM, N, P, K, Ca and Mg were recorded in conventional till plots and it could be due to the inversion of top soil during ploughing which changes less fertile subsoil to the surface in addition to possible leaching. The retention of crop residues in agro ecosystems, especially those with conservation tillage, is expected to increase earthworm numbers and biomass.

Key word: *Conservation agriculture, Conventional till, Agro-ecosystems, Natural resources, Cropping systems***EFFECT OF POTASSIUM AND SULPHUR ON THE PERFORMANCE OF WINTER SEASON BERSEEM (TRIFOLIUM ALEXANDRIANUM L.) IN BUNDELKHAND SOIL****VEENAMALVI¹, S.P. YADAV¹, C.K. DOTANIYA², SANDEEP MOHBE², R.K. DOUTANIYA³**¹ Dept. of Soil Science and Agriculture Chemistry- Nehru P.G. collage Lalitpur, Bundelkhand University Jhansi, U.P. 284403, ² Dept. of Soil Science- ICAR-Indian Institute of Soil Science Bhopal, M.P. 462038, ³Department of Agronomy- O.P.J.S. University Churu, Rajasthan 331303

A Pot experiment was conducted on Fodder Berseem during winter season of 2014-15, at Agriculture experimental field, Nehru P.G. Collage Lalitpur, Bundelkhand University Jhansi (U.P.) situated in summer and cold winter Betwa River Uttar Pradesh region. The

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treatments consist of four Potassium (K) levels viz. 0, 30, 60 and 90 Kg K/ha and four Sulphur(S) levels viz. 0, 10, 20 and 40 Kg S/ha. The experiment was lead out in Randomized Block Design (Factorial) with three replications. Application of 90 kg Potassium ha⁻¹ and Sulphur 40 kg ha⁻¹ to the Winter Season Berseem crop significantly increased the potassium and sulphur content in green fodder and Dry fodder yield. The results showed that maximum green fodder (548.74 and 350.42 q ha⁻¹) and dry fodder yield (62.95 and 40.17 q ha⁻¹) yield of fodder berseem at first to five cut, respectively potassium and sulphur protein content viz. (34.82 and 16.74%), Nitrogen content viz. (2.68%) and Uptake of Nitrogen, Phosphorus, Potassium and Sulphur (160.81, 23.73, 1.5 and 17.67 Kg/ha) were recorded with 90 kg K ha⁻¹ and 40 Kg S/ha. Further, Significant increase in green fodder yield and dry yield compared with over control.

Keywords: NPK and Sulphur, Green and Dry Fodder Yield, Winter Season Berseem

SUBTHEME- DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH INTEGRATED FARMING SYSTEM FOR DOUBLING FARMERS INCOME

*Veenesh Rajpoot**; Richa Sharma; Manmohan Singh, *Livestock Production Management, NDRI, Karnal (Haryana), India*

An integrated livestock farming system model was envisaged keeping farmer as a focal point for judicious utilization and conservation of plant, animal and fish genetic resources with well-designed technological interventions to increase production, "adding value" to the farm produce and their marketing were accorded paramount importance for enhancing the livelihood security and empowerment of local people. There are the several point strategy for doubling farmer's income by 2022 like increase in production, effective use of input cost, reduction of post - harvest losses, value addition, reforms in agriculture marketing, risk, security and assistance and promoting allied activities which include that Integrated Farming system, Rural Backyard Poultry Development, Blue Revolution, Sub-Mission on Agro-forestry, White Revolution etc. So integrated livestock farming system is the beneficial for the doubling the farmers income. Traditionally farmers do crop- livestock based farming system but this is not provide profitable income. So farmers can use different livestock based integration like Fish-Livestock along with Livestock-Crop farming is the major concept in Livestock based integrated farming system. Livestock fish farming is the beneficial for the farmers which include that A unit of 5-6 cows can provide adequate manure for 1 ha of pond. In addition to 9,000 kg of milk, about 3,000-4,000 kg fish/ha/year can also be harvested with such integration and Twenty to thirty thousand kg of biogas slurry are recycled in 1 ha water area to get over 4000 kg of fish without feed or any fertilizer application. Similarly pig fish farming and Duck-fish farming is also good for doubling the farming income. So integration of livestock with crops is the best approach to get maximum benefits from limited resources.

Keywords : integrated, doubling, livestock, farming

EFFECT OF ZINC & SILICON ON GROWTH, YIELD AND ECONOMIC OF AROMATIC RICE (*ORYZA SATIVA*) IN NORTH PLAIN ZONE OF INDIA

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The present study entitled impact of Effect Zinc & silicon levels on rice in north plain zone of India was carried out at School of Agricultural Sciences and Engineering, IFTM University Moradabad in 2017-18. the effect of zinc is mainly is rice. Zinc deficiency being a major constraint to reduce the potential yield of rice. Field experiments were carried out to find out the effect of three different levels of zinc on rice. The effect silicon is the second most abundant element and diseases resistance, grain quality improve in the earth's crust after oxygen and accounts for about 28% of the soil weight, but is not considered essential for growth of higher plants develops necrosis, disturbance in leaf photosynthetic efficiently growth retardation and reduces grain yield in cereals role of zinc & silicon in plant health and growth has been investigated in silicon accumulating crops and it seemed significantly effecting with treatment T₁ control T₂ (120:80:40) T₃ (120:80:40) + two spray of zinc 2% /lit water (at 30 & 45 DAT), T₄ (120:80:40) two spray of silicon @ 2ml/lit water (at 30 & 45 DAT), T₅ (120:80:40)+two spray of silicon @3ml/lit water T₆ (150:80:40), T₇ (150:80:40)+two spray of zinc 2%/lit water (at 30 & 45 DAT), T₈ (150:80:40)+two spray of silicon @2ml/lit water (at 30 & 45 DAT), T₉ (150:80:40)+ two spray of silicon @3ml/lit water (at 30 & 45).

AN ANALYSIS OF CROPPING PATTERN IN MALAPRABHA PROJECT COMMAND AREA

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Analysis of cropping pattern in a region is of vital importance and it helps to decide which is the best suitable crop for particular geographical area. The present study was taken up in Malaprabha Project Zone (MPZ), Karnataka. It aimed at analyzing the cropping pattern prevailing in the study area and also comparing the recommended cropping pattern with the actual practice and identify the deviation. The study made use of both primary and secondary data for analyses. Primary data was collected from farmer respondents of

villages in Head and Tail regions of Malaprabha Left Bank Canal (MLBC). Secondary data was collected from Department of Agriculture, Malaprabha Project Zone (MPZ). Markov Chain Analysis was used to analyze the time series data on area coverage of different crops grown in Malaprabha Project command area from 1999-2015 and simple tabular analysis was used to analyze the primary data. The results revealed that maize was the major cereal crop, pigeon pea, green gram and bengal gram were the major pulse crops. Ground nut and sunflower were the major oil seed crops. Vegetables were grown in summer and sugarcane, cotton and chilly were the major annual/bi seasonal crops grown by the sample farmers in the command area. It was also observed that cotton, maize and groundnut were predominantly and farmers deviated from the recommended cropping pattern by Command Area Development Authority (CADA).

Key words: Cropping pattern, CADA and command area.

NOVEL SPECTROPHOTOMETRIC TECHNIQUE FOR THE QUANTITATIVE ESTIMATION OF REDUCING SUGAR FROM PAPAYA (*CARICA PAPAYA*) PEELS

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The mixture of alkaline copper tartarate and potassium ferrocyanide was found to be useful in the spectrophotometric determination of reducing sugar from papaya peel by hydrolyzing the polysaccharide by varying the concentration of acid, temperature and time of exposure. The absorbance formed at 670 nm was proportional to the concentration of copper; with reference to Cu-glucose equivalence table quantitative estimation of reducing sugar is arrived. The novelty in this method is utilization of Cu (II) oxidative state instead of reduced Cu (I) for analysis which makes it different from usual standard methods. This method is rapid, convenient with a minimal relative percentage error i.e. 0.8%.

Key words: Papaya (*Carica papaya*), Reducing sugars, Hydrolysis.

PESTICIDAL PROPERTIES OF MEDICINAL AND AROMATIC PLANTS AND THEIR APPLICATION IN PLANT PROTECTION

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Pesticides are chemical substances used for destroying insects or other organisms harmful to cultivated plants. It has been estimated that about 2.5 million tons of pesticides are used on crops each year and the worldwide damage caused by pesticides reaches \$100 billion annually. By using more pesticides some crop species become resistant to multiple pesticides, making their control by chemical methods to be extremely difficult and expensive. Due to misuse and overuse of pesticides, presence of pesticide residues in medicinal and aromatic crops may adversely affect on quality of secondary metabolites which are used in preparation of herbal drugs. Therefore, looking for alternative plant-based pesticides could be a possible and viable solution to address this catastrophe which could serve as potent "Ecofriendly-agrochemicals". Medicinal and aromatic plants are a group of plants having unique properties in their plant parts. Certain chemicals (secondary metabolites) being used as biocides (Botanical pesticides). The Botanicals are plant products (essential oils, flavonoids, alkaloids, glycosides, esters and fatty acids) that have been used to control pests. Several classes of secondary plant substances present in medicinal and aromatic crops are responsible for pest management. Secondary metabolites of medicinal and aromatic crops which act as botanical pesticides used in the elimination of insects in different ways, namely repellents, ovicidal, antifeedants, toxicants, growth retardants, and attractants. Majorly Neem extracts are used in pest control which acts as anti feedant, repellent, insecticidal, etc. Botanical pesticides affect only target insects, not destroy beneficial natural enemies and provide residue-free phytochemicals which are used in herbal drugs.

EVALUATION OF MUNGBEAN (*VIGNA RADIATA* L.) FOR YIELD AND YIELD ATTRIBUTING TRAITS

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Mungbean (*Vigna radiata* L. Wilczek), occupies third important pulse crop after Pigeonpea and Chickpea, it is an important wide spreading herbaceous, annual, self-pollinated, diploid ($2n = 2x = 22$) legume crop. It is grown throughout Asia, Australia, West Indies, South and North America, Tropical and Subtropical Africa of which, India is the largest producer and consumer of mungbean accounting for about 65% of the world's acreage and 54% of the world's production. India is the world's largest producer and consumer of mungbean grown in tropical and sub-tropical areas. These are the source of high protein, fibre, vitamins and also suppliers of high quality

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carbohydrates, minerals and vitamins. It is an excellent and cheap source of easily digestible high quality protein for the largest vegetarian population of India. The present experiment was carried out in Pulses Section, Department of Genetics & Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The genetic evaluation of yield and yield component revealed the magnitude of phenotypic coefficient of variation were higher than the corresponding genotypic coefficient of variation for all the traits studied which indicates the role of environment in manifestation of these traits. The genotypes which showed high variability along with high genetic advance can be selected in breeding programme for improving yield and yield attributing traits.

Key Words: mungbean, yield, variability, quality, selection

THEME: RECENT TRENDS IN AGRICULTURAL SCIENCES AND TECHNOLOGY**SUB-THEME: HORTICULTURAL INNOVATIONS, FOOD PROCESSING AND VALUE ADDITION**

Vegetable Grafting: An Innovative Tool for Doubling Farmers' Income, Vibhuti Sharma, Pardeep Kumar and Parveen Sharma, Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur*

Grafting is a centuries-old technique but a relatively new one in vegetable cultivation. It has opened new ventures and opportunities for increasing yield per unit area. There are many reasons to why one should adopt grafting in vegetables as it controls many soil-borne and foliar pathogens, enhances plant vigour, extends harvesting period, increases nutrient uptake, fruit size is increased and also the fruits harvested are of uniform size. Grafting is an environmental-friendly alternative method to control various diseases and pests which has become popular in recent years. Grafting also allows plants to tolerate low and high temperatures, to cope with salinity and heavy metal stress, and to increase tolerance to drought and water logging. Grafting scions on resistant rootstocks make it possible to control soil borne diseases and increase yield of susceptible cultivars. Grafting further increases yield as rootstocks used provide resistance and scion improves quality of produce. The use of resistant rootstocks reduces dependency on agrochemicals. Therefore, grafting is considered eco-friendly for sustainable vegetable production. This technology also limits excessive use of chemicals and pesticides, thus this will surely help in reducing input cost by ensuring handsome returns by doubling their income. Vegetable production and productivity is very high under protected environment as compared to open field conditions. But production under protected conditions has suffered a great setback due to attack of serious diseases like bacterial wilt and nematode infestation. Both these problems are not easy to manage and there is no effective chemical treatment to manage these problems under polyhouses. In order to combine various horticultural traits in solanaceous vegetables along with resistance to diseases, the most appropriate approach is grafting of desirable scion on resistant rootstocks. This will further lead to improved yield in terms of quantity and quality along with high remunerative returns to the farmers.

Keywords: agrochemicals, grafting, polyhouse, rootstock, yield

NUTRACEUTICAL VALUE OF FINGER MILLET [*ELEUSINE CORACANA* (L.)**VIBHUTI SINGH JHALA¹ AND S. S. BHATT¹**

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Finger millet has been perceived as a potential “super cereal” by the United States National Academies being one of the most nutritious among all major cereals. From the nutritional perspective, finger millet is considerably rich in minerals and its micronutrient density is higher than that of the world's major cereal grains; rice and wheat. Recent research has shown that diets rich in plant-based foods, particularly whole-grain cereals, are protective against several degenerative diseases such as diabetes, cardiovascular diseases, and few types of cancers, metabolic syndrome and Parkinson's disease. In spite of the dearth of literary evidence on role of finger millet for disease prevention, its relation to alleviate health benefits is quite substantial. It is a storehouse of salubrious properties being rich in proteins, dietary fibers, minor and major nutrients, and phytochemicals required for human health. However, these ingredients need to be isolated and developed as nutraceuticals and functional food, without disturbing the inherent functional and nutritional traits and in a cost-efficient manner. Nutraceutical properties of finger millet are discussed in details in the following sections. Finger millet grains, particularly the seed coat, contain high amount of various phenolic compounds (mostly derivatives of benzoic acid) which have been reported to exhibit antioxidant activity. On an average, white finger millet contains 0.040.09% polyphenols and brown varieties have 0.083.47%. Finger millet can also inhibit collagen cross-linking, thereby can be used to slow down aging by reducing the stiffness of elastic tissues in tendons, skin and blood vessels. However, processing of finger millet like thermal or hydrothermal treatments, germination, decortication, or fermentation has been found to generally decrease the polyphenol levels resulting in a reduced radical quenching ability than that of the unprocessed grain.

IMPORTANCE OF POST-HARVEST TECHNOLOGY IN HORTICULTURE CROPS**VIDYAR*¹ AND KYATHI SINGH²**

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Production of fruits and vegetables for export has grown rapidly in a number of countries over the last decade. Horticultural produce and

processed products from the developing countries are becoming increasingly popular both in domestic and in international markets. Global production and exports are rising steadily. India is the largest producer of fruits and 2nd largest producer of vegetables. Experience shows that horticulture can offer good opportunities for poverty reduction because it increases income and generates employment. Though production of fruits and vegetables make us believe in our strength for self-sufficiency, significant qualitative and quantitative loss occurs in the produce from harvest till consumption. For self-sufficiency and also for processing, export and to meet additional requirements, a lot of emphasis need to be given to reduce post-harvest losses besides increasing production and productivity of horticulture produces. Processing plays an important role in conservation and effective utilization of perishable commodities. However, only less than 2% of total production of fruits and vegetables are processed. All fresh commodities are high in water content and these are subjected to desiccation, mechanical injury and susceptible to attack by bacteria and fungi. A recent survey shows that in India, about 50% of total fruits and vegetables produced annually are being lost due to poor post-harvest practices. Cost of preventing losses after harvest in general is less than cost of producing them. The concept of post-harvest food loss reduction, as a significant means to increase the food availability and the self sufficiency of a country.

Key words: production, processing, fruits and vegetables

IMPORTANCE OF PRECISION NUTRIENT MANAGEMENT IN CONTEMPORARY AGRICULTURE

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Precision farming is combined information depends on farm management system for identification, analyse and manage variability within fields for optimum profitability, sustainability and protection of land resources. It basically means adding the right source, right rate, right time and right place within a field. Precision farming is an efficient management of resources with location specific high technological interventions, they are fertigation, protected/ greenhouse cultivation, soil grid sampling and plant based nutrient management, mulching for in-situ moisture conservation, micro-propagation, high density planting, drip irrigation etc. It integrates environmental health, economic profitability, social and economic equity by giving emphasis on crop management using technologies like GIS, GPS, remote sensing (RS), SPAD meter, green seeker along with ground equipment like variable rate applicators (VRA), yield monitors and computers along with appropriate software. It supplies the nutrient when plant needs, based on the soil test and plant based analysis indicates the plant nutrient requirement so it reduces the fertiliser losses which means low input high output from the field. In present situation increasing population needs to increase food production with less input and in less area and also erratic climatic variation, more attention required towards the development of technology driven horticulture precision farming is being reviewed as a promise in this consideration.

Key words: Precision farming, SPAD, Remote sensing, greenseeker, sustainability and Global positioning system

INTEGRATED MODE OF STCR APPLICATION IN DIRECT SEEDED RICE: AN ALTERNATIVE OF TRANSPLANTED RICE

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Rice (*Oryza sativa*) is the staple food of more than half of the population in the world. Therefore, to ensure food security and livelihoods to the millions of the people this crop is of pivotal importance. Due to imminent water crisis, water-demanding nature of traditionally cultivated rice and climbing labour costs hike the search for alternative management methods to increase water productivity, system sustainability and profitability. Direct seeded rice (DSR) technique is becoming popular now a days due to its low input demanding nature. It provides a very exciting opportunity to improve water and environmental sustainability. Application of Nutrients based on Soil Test Crop Response (STCR) enhanced significantly the growth and yield attributing characters viz., plant height, total tillers/ m², leaf area index (LAI), panicle length, productive tillers, total number of grains per panicle and dry matter production over other nutrient management practices. Integrated Plant Nutrient System (IPNS) approach, resulted in higher grain yield of rice as compared to inorganic mode of nutrient application. The yield response of fertilizers, manure application and profit were more in IPNS approach in rice over general recommended dose and control. After knowing the nutrient requirement for a given yield target, fertilizer requirement can be calculated by taking in to account the efficiency of soil and fertilizer nutrients. The STCR technology is effective in changing skill, attitude and knowledge of farmers. Direct seeded rice with suitable conservation practices has potential to produce slightly lower or comparable yields as that of transplanted rice (TPR) and appears to be a viable alternative to overcome the problem of labour and water shortage. Thus, the practice of fertilizing a crop on the basis of yield targets is precise, meaningful and eco-friendly which needs to be popularized among farmers to enhance the integrated nutrient management taking into account balanced nutrients through the complementary and synergistic effect of combined use of mineral, organic and biological source of nutrients for sustained crop

production.

Key words: Direct seeded rice, STCR, Yield, Organic, Inorganic, Nutrient.

ASTRATEGIES MANAGEMENT OF SOLANACEOUS CROP INSECT PEST

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Solanaceous crop is a very important vegetable family which include different types of vegetable. Various type of insect pest viz.: sucking insect, fruit borer, mite etc. cause heavy losses. The numerous insect pests causes heavy loss in potato crop namely aphids, cut worms, white fly & tuber moth. Potato tuber moth is very destructive pest, its caused damaged about 30-70% tubers in storage and 0-45% tuber damage in field (Mathur and Upadhyay, 2008). Tomato fruit borer is major destructive pest of tomato, damage starts from flowering. Eggs are laid on young leaves which are damaged by young larvae, later they migrate to developing fruits. They bore the fruits with half of the body outside fruit. One larva feeds on many fruits, causing 5 - 50% losses. In severe cases of infestation, more than 80 % fruits get damage. Application of different types of cultural practices for management of insect pest and to maintain ecological balance. Management of sucking pest spray of neem seed kernel extract (NSKE) @ 5% and use of pheromone trap @ 10/ha for monitoring and mass trapping of moths. For management fruit borer sprays of N.P.V @ 250 LE/ ha at 28, 35 and 42 days after transplanting and release *Trichogramma brassiliensis* 2,50,000/ha. Tomato serpentine leaf miner they formed serpentine shaped tunnels in the leaf lamina and management by spray Dimethoate 30 EC @2 ml/l or N.S.K.E 4% extract. Management for PTM spray of Carbaryl 50WP @ 2kg/ha, Quinolphos dust @250/g in stored potato.

IMPACT OF FRONTLINE DEMONSTRATIONS ON THE YIELD AND ECONOMICS OF LINSEED (*LINUM USITATISSIMUM*) IN MANDLA DISTRICT OF MADHYA PRADESH

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The present study was carried out during Rabi season in seven villages of Mandla district during 2013-14 to 2015-16 in 11 ha. Frontline demonstrations were conducted on linseed by active participation of farmers with the objective to demonstrate the improved technologies of linseed production potential. The improved technologies consist of replacement of old variety with promising high yielding improved variety, balanced fertilizers application (soil test based) and integrated pest and disease management. One of the major constraints of traditional linseed farming is low productivity because of non-adoption of advanced technologies like improved varieties. To increase the production, productivity and quality of agricultural produce, front line demonstrations are being conducted at various farmer's field. All the recommended practices were provided to the selected farmers. Result of the present study revealed that linseed variety, JLS-27 recorded the higher yield (7.57 q ha⁻¹) as compared to the farmers practice (4.98 q ha⁻¹) traditionally adopted by the farmers. The percentage increase in the yield over farmer's practice was 50.27%. The technology gap, extension gap and technology index values were 10.43 q ha⁻¹, 2.58 q ha⁻¹ and 57.90%. The research practice gave higher gross return (Rs. 26,813 ha⁻¹), net return (Rs. 20,346 ha⁻¹) with B:C ratio (1:4.01) as compared to farmer's practice. The result of the study indicated the gap existed in the potential and demonstration yield is due to soil fertility and weather conditions. Present results clearly show that the yield and economics of linseed can be boost up by adopting recommended technologies.

Keywords: Linseed, Frontline Demonstration, Yield and Economics

EFFECT OF GROWTH REGULATORS AND MICRONUTRIENTS SPRAY ON YIELD ATTRIBUTING CHARACTER OF LITCHI (*LITCHI CHINENSIS* SONN.) CV. CALCUTTIA

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The present experiment was laid out at the Regional Horticulture Research and Training Station, Dhaulakuan, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-Solan (HP). The experiment consisted of 19 treatments with three replications laid out in Randomized Block Design. The growth regulators and micronutrients applied were GA₃ (T₁=25 ppm, T₂= 50 ppm, T₃= 75 ppm), CPPU (T₄= 5 ppm, T₅= 10 ppm, T₆= 15 ppm), ZnSO₄ (T₇= 0.25%, T₈= 0.50%, T₉= 0.75%), Boric acid (T₁₀= 0.25%, T₁₁= 0.50%, T₁₂= 0.75%), GA₃ + CPPU (T₁₃= 25+5 ppm, T₁₄= 50+5 ppm, T₁₅= 75+5 ppm), Boric acid + ZnSO₄ (T₁₆= 0.25+0.50%, T₁₇= 0.50+0.50%, T₁₈= 0.75+0.50%) and T₁₉ control. The results revealed that growth regulators and micronutrients significantly improved yield and yield attributing characters. Decrease in fruit drop and increase in the yield was found with application of zinc at 0.50 % and

0.75 % respectively. Fruit set and fruit retention was found to be maximum with treatment number T₁₂. CPPU @10 ppm has decreased the fruit cracking percentage.

Key word: Boric acid, Zinc Sulphate, CPPU, GA₃

ENABLING GANDHI NAGAR FARMERS TO COPE WITH HEAT WAVE AND WATER STRESS/DROUGHT SITUATION

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Gandhi Nagar district of Jhansi is one of the heat wave and water stress/ drought situation /prone district of the state. Groundnut and wheat being major crops kharif season. Most of it gets damaged during droughts which generally occur during the month of June-July. Traditional groundnut cultivars are long duration (125-130 days) which is sown in July. If the sowing is delayed beyond mid July, the livelihood of harvesting of groundnut getting coincided with drought is very high. Therefore, it is necessary to go for short duration groundnut cultivars (105-110 days) so that they can escape from drought. Drought is another climatic constraint which can be tackled by the late cultivars of groundnut by promoting protected fields. Keeping this in view, key interventions were demonstrated to minimize losses due to drought/water stress in Gandhi Nagar village. This village is located at a distance of 15 km away from Jhansi district H.Q. During 2011-12 kharif season the village was affected by drought/water stress, nearly 95 ha of cultivable land was affected badly. Though the drought was of moderate intensity, regular local groundnut cultivars in the village were severely affected by the drought/water stress in upland areas. The extent of loss was about 50-70 percent as the harvesting stage of local varieties yield. However, under NICRA project, the demonstration of high yielding short duration groundnut variety TG 37A could escape water stress/drought due to its shorter duration. In some parts of the village, cucurbitaceous vegetables and okra were also damaged by drought. The livestock suffered from lack of green fodder. Farmers start to feed straw, tree leaves etc to their live stock. The health condition of animals was deteriorating. Under this project, the livestock programs were regular introduced as H.S.vaccination, deworming, balance nutrition in animals etc. These interventions were very affected in livestock production. These interventions are fully capitalized by farmers in the village and they could realize some reasonable yield by minimizing losses due to drought/water stress. The KVK Jhansi also plans to take up vegetable cultivation during rabi on a large scale to compensate for the losses of farmers suffered due to drought in kharif season. Farmers are enthusiastic about cultivating winter vegetables. If they are made available improved varieties and better management practices. The KVK Jhansi is also striving to introduce poultry and goat to farming help the small farmers cope with the losses due to drought/water stress. Selected farmers were trained and supported with material and technical know how to build low cost poultry sheds. So far, three farmers have been trained in the village in this system. while "Van Raja" poultry bird are made available. These systems are gradually attracting the KVK to help them set up the integrated system on their farmers to cope with natural calamities like drought to climatic variability.

GENETIC STUDIES ON VARIABILITY FOR YIELD AND ITS CONTRIBUTING TRAITS IN SPINE GOURD (*MOMORDICA DIOICA* ROXB.)

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Spine gourd (*Momordica dioica* Roxb.) is a dioecious member of family cucurbitaceae. This minor vegetable has high demand in market because of good nutritional, medicinal value, high keeping quality ability, high market price and good export potential. Evaluation of available variability is prerequisite for planning the quality improvement programmes. Knowledge of the nature and magnitude of variation promotes a rational choice of the character in which selection can be exercised. Due to high degree of cross-pollination, high genetic variation exists in this crop, the observed variability is a combined estimate of genetic and environmental causes, of which only the former one is heritable. However the estimate of heritability alone does not provide an idea about the expected gain in next generation but it has to be considered in conjunction with genetic advance. Therefore, the present study was undertaken to estimate the extent of genetic variability, heritability and genetic gain for fruit yield and its important attributes in 16 spine gourd genotypes at experimental farm of ICAR-IIVR-RRS, Sargatia, Kushinagar, Uttar Pradesh during spring-summer season of the year 2017. Fruit yield per plant ranges between 922.00 - 1865.67 g. Maximum fruit yield per plant found in VRSEG-10 (1865.67 g) followed by VRSEG-09 (1856.33 g) and VRSEG-07 (1852.33 g). The estimates of PCV were higher than corresponding GCV which indicates that the variation is not only due to genotypes but also due to the influence of environment. High PCV and GCV values were observed for the characters viz., node number to first pistillate flower appearance, peduncle length, blossom end length, number of fruits per plant and fruit yield per plant which suggested the presence of substantial variability for the traits thereby ensuring ample scope for improvement of these characters through selection. High heritability coupled with high genetic advance as percent of mean was observed for node number to first

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pistillate flower appearance, number of fruits per plant and fruit yield per plant which indicated that the selection for these traits would be very effective for improvement.

Key word: Spine gourd, variability, heritability, genetic advance

EFFECT OF DIFFERENT NUTRIENTS CONCENTRATION AND DRY TEA EXTRACT ON GROWTH PARAMETER OF STRAWBERRY UNDER HYDROPONIC SYSTEM.

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Strawberry is popular due to the softness. It is mainly grown in sub-tropical regions on elevation on the 3000 meter. The U.S.A production is more in the world. In India Maharashtra gives the more production according to National Horticulture Board. It contains the Vit A, Vit B1, B2, Vit-C, Niacin and good source of antioxidant. In India mostly in hilly area Chandler and Winter Down is more cultivated. In research work we were taken the strawberry on hydroponic system with seven treatments (T1 to T3 10:20:30: tea extract + 90:80:70 cocopeat respectively and 10:20:30 sewage sludge + 90:80:70 cocopeat). In the treatment tea extract, cocopeat, and sewage sludge was used. At 90 days T6 (30% sewage sludge + 70 cocopeat) shows significantly good results of plant height, leaf area, stem girth, number of flowers/plant, and yield/ plants. Due to the availability of nutrient and high dose of sewage sludge was used in T6 it gives best quality fruits. Hydroponic system having negligible soil born disease, reduce fruit rot disease and about 70% less water was used in hydroponic as compared to soil experiment. Due to less availability of disease and attack of insect hydroponically grown strawberry shows the best quality product.

Key word: Chandler, Tea extract, sewage sludge.

EFFECT OF FOLIAR APPLICATION OF CHEMICALS ON GROWTH, AND PHYSIOLOGICAL TRAITS OF RICE (*ORYZA SATIVA* L.) GROWN UNDER RAIN FED CONDITION

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The investigation entitled "Effect of foliar application of chemicals on growth, physiological traits of rice (*Oryza sativa* L.) grown under rain fed condition" was conducted during the *kharif* season in 2016 at Students' Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad-224229 (U.P.). The experiment was carried out in Rainout Shelter in randomized block design with three replications and nine treatments on rice variety (Sahbhagi dhan) under rain fed condition. The treatments comprised of T₁- Control, T₂- KCl (0.5 and 1.0%), MgSO₄ (1.0 and 2.0%), Boric acid (0.3 and 0.6%) and Salicylic acid (0.25 and 0.5%) these concentrations of KCl, MgSO₄, Boric acid and Salicylic acid were applied as foliar application first at 15 DAT (Vegetative stage) and second at grain filling (Milking stage). Observations were recorded at 30, 60, and 90 DAT. Results of the experiments indicated that growth parameters like Plant height, Number of tillers plant⁻¹, Dry weight plant⁻¹, and physiological traits like Relative water content, Chlorophyll content, Proline content, Catalase content, Peroxidase content, were improved by different chemical concentrations. So, foliar spray of chemicals like KCl, MgSO₄, Boric acid and Salicylic acid can be used as a toll to improve growth and physiological traits of rice under rain fed condition.

ROLE OF INTEGRATED FARMING SYSTEM IN DOUBLING FARMERS' INCOME

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Integrated farming system is farming system which consists of at least two separate but logically interdependent farm enterprises. Integration in IFS occurs when output of one enterprise is used as an input in another enterprise. The Indian agriculture is dominated by small and marginal farmers having low investment capacity. The role and factors associated with integrated farming system have been studied as a potential option to improve farmers' income and ensure their sustainable livelihood. The contribution of different combinations of enterprises such as poultry, fishery, sheep and goat and horticulture; with crop and dairy as base enterprises have been analyzed for their impact on farmers' total income. In India's present scenario, Integrated Farming System (IFS) plays an imperial role for maximizing profit and production to meet nutritional requirement with food security with less investment. IFS is gaining more attention due to deteriorating resource base, low rate of farm resource recycling, narrowed biodiversity, employment generation, climate change and sustainability issues. IFS can be one of the strategies for doubling the farmers' income as the farmer can get income from different enterprises round the year. The constraints faced by farmers in adoption of IFS include shortage of labor, Lack of availability of critical inputs like seeds etc. at proper time, low investment capacity due to small size of land holdings and lack of awareness about benefits of integrated Farming System.

Key words: Integrated farming system, doubling farmers' income etc.

MITIGATE THE CLIMATE CHANGE BY CONSERVATION AGRICULTURE

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Climate change is a modification in the factual circulation of climate pattern when that change goes on for a broadened timeframe (i.e., decades to a large number of years). Climate change may allude to an adjustment in normal climate conditions, or in the time variety of climate inside the setting of longer-term normal conditions. Environmental change is caused by components, for example, biotic procedures, varieties in sun oriented radiation gotten by Earth, plate tectonics, and volcanic emissions. Over the future decades south Asia is expected to be worst-affected by climate change. Predictions propose a worrying scenario for the region's producers; increasing water shortage, growing food uncertainty, and negative impact on the region's biodiversity. Although the region's production systems—mainly rainfed cereals and animal keeping activity have previously been resistant, this is no longer guaranteed. Conservation agriculture is the integrated management of the available natural resource use. It provides sustainability in farming production through maintain the quality of natural resources by stable or semi-stable organic cover to soil. Zero or minimum tillage or no-till and minimum disturbance of soil along with varying rotation of crops is a must for future prospects. It is an integrated approach to cultivation that helps enhance food security, allay poverty, conserve biological diversity, and preserve ecosystem services. Conservation agriculture practices are also helpful in making farming systems more resilient to recent climatic changes. Conservation agriculture can comprise wide-ranging practices such as management of forage and farm animals, fallows improvement, combined cultivation of agricultural crops and trees as agro forestry, management of wasteland, and management of areas which are reserved for village and community people.

Key word: Climate change, Conservation, Zero or minimum tillage

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH PARAMETERS OF FENNEL (*FOENICULUM VULGARE* MILL.)

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Integrated nutrient management includes the combined use of organics (i.e. manures, compost, biofertilizers, green manures and crop residues) and inorganic fertilizers to increase the crop yield and farmers profits, improve crop quality and to minimise the nutrient losses to the environment. Nutrient management through organic source and fertilizer alone or in combination significantly improve growth parameters. Therefore a field experiment was conducted during winter season of 2016-17 and 2017-18 at the research farm department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University Hisar to study the effect of integrated nutrient management on various growth parameters of fennel. The experiment was laid out in randomised block design with 16 treatments and 3 replications. Among the various treatments, the maximum plant height, number of primary branches and number of secondary branches was reported in the treatment T₁₁ i.e. RDF (100%) + PSB + Azotobacter, followed by the treatment (T₅) RDF (100%) + Azotobacter, (T₁₂) RDF (75%) + PSB + Azotobacter and (T₉) 100% RDN through Vermicompost + PSB + Azotobacter. The results revealed that appropriate use of biofertilizers with inorganic fertilizers increase the growth performance of fennel.

Keywords: Plant height, Fertilizers, Biofertilizers, Fennel

DOUBLING THE FARMERS INCOME THROUGH PROTECTED VEGETABLE PRODUCTION SYSTEM

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Agriculture is a primitive science as well as art being practiced over the globe since unmemorable time. Agriculture sector is facing intolerable population pressure due to its exponential growth and additive growth in agriculture production. It resulted continuous increase in inputs to achieve more and more yield due to which great ecological imbalance and diminishing return have been realised after green revolution. creation of national agriculture market, removing distortions and e-platforms, various crop insurance schemes like 'Pradhanmatri Fasal Bima Yojna' with minimum premium and maximum security. The present study was conducted to analyze the reason for which diversification towards vegetable production is taken as a pathway for increasing farmer's income as well as employment. This has resulted in appreciation by the farmers to adopt the technology by "seeing is believing". The technology was adopted by 52 farmers out of 100 farmers, by constructing Naturally Ventilated Polyhouses and cultivation of suitable crops. The study was undertaken on a macro framework based on data collected from secondary source like www.indiastat.com. The programme of Doubling Farmers' Income was announced by the Finance Minister, Mr. Arun Jaitley during his budget speech on February 29, 2016. The targeted year that has been set by the govt. for doubling the farmers income is 2022 i.e. from 2015-16 to 2021-22 (Six years) with the

objective to double the real income of farmers.

SERO-DIAGNOSIS; A POTENT TOOL FOR IDENTIFICATION AND MANAGEMENT OF PLANT PATHOGENS.

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Serology is the method using the specificity of the antigen-antibody reaction for the detection and identification of antigenic substances and the organism that carry them. Antigen is a protein that when injected into a warm-blooded animal causes the formation of an antibody. Antibody is a protein produced in a warm-blooded animal in reaction to the injected foreign antigen and capable of reacting specially with that antigen. Monoclonal antibody production is also possible for pure lines (clones) of antibodies that react only with a single antigenic determinant of a protein (or a pathogen) and such antibodies are called monoclonal antibody. Polyclonal antibody is an antibody preparation that is the product of more than one clones of plasma cells. Such antibodies react with different components of antigen. Serum is a clear watery protein of the blood remaining after the coagulation. Antiserum is the blood serum containing antibodies possessed by a warm blooded animal among various serological techniques. The precipitin test in which the reactants (crude or purified seed extracts and virus antiserum) are mixed to combine with their specific antibodies. This is being done in capillary tubes/slides and the precipitation indicates the positive result. Under Enzyme-linked immune sorbent assay test (ELISA test) the substrate being allowed to turn colour due to presence of enzymes and even very low virus titers are detectable. Virus concentration also can be quantified by measuring the color intensity. ELISA allows rapid testing of numerous plants using only small sap sample once antibodies are available. Immunosorbent electron microscopy (ISEM) is a combined test involves serology and morphology, having more sensitivity than ELISA. Overall, serological tools or the serology based detection method are very much helpful in the detection and identification of plant pathogenic bacteria and viruses.

EVALUATION OF CHICKPEA (*CICER ARIETINUM* L.) UNDER DIFFERENT ABIOTIC STRESS CONDITIONS

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Chickpea (*Cicer arietinum* L.) is the third most important pulse crop globally after common bean and field pea. The chromosome no. of chickpea is $2n=16$. Chickpea being a winter season crop, often experiences abnormally high temperature during its reproductive phase resulting in severe yield losses due to the direct effect of high temperatures on different physiological processes. The experiment was conducted in Pulses research area of Chaudhary Charan Singh Haryana Agricultural University, Hisar during *rabi* season 2017-18. The chickpea genotypes evaluated under normal sowing and late sowing conditions to study the effect of different abiotic stresses. It was observed that genotypes have high variability and shown different response to epigenetic factors

Key Words: Chickpea, Yield,

EFFECT OF SUCKING INSECT-PESTS ON BIOCHEMICAL PARAMETERS OF COTTON (*GOSSYPIMUM HIRSUTUM* L.) GENOTYPES

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Abstract Sucking insect-pests are a type of insects with sap sucking feeding mechanism. The damage caused by the sap sucking pests can be direct as well as indirect. Direct damage occurs due to the removal of nutrients by the feeding of insects on plant phloem which reduces plant vigour and causes shoot and leaf distortion. We investigated effects of sucking insect-pests infestation on two cotton genotypes in terms of biochemical changes in leaves. The results showed that highly tolerant genotype strongly compensate the effect of sucking insect-pests by change in biochemical parameters. However, highly susceptible genotype cannot compensate the effect of sucking insect-pests strongly.

Keywords: Sucking insect-pests; cotton genotypes; biochemical parameters

EFFICACY OF ORGANIC AMENDMENTS ON GROWTH, YIELD AND QUALITY OF GARLIC (*ALLIUM SATIVUM* L.)

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It is very essential to develop sustainable and compatible good agriculture practices through organic resources for different crops based on scientific facts. Keeping in view the present investigation was carried out during *rabi* season 2016-17 in the Experimental Farm of Department of Vegetable Science, Dr Y S Parmar university of Horticulture and Forestry, Nauni, Solan (HP). Ten treatments combinations of organic amendments were replicated thrice in a plot having dimensions of 2.0 m x 2.0 m. The experimental was laid out

in randomized block design and spacing of 20 cm x 10 cm was followed. Out of the ten treatments, 90% RDN (Recommended doses of nutrients applied through FYM, Vermicompost, Sheep and Goat manure) + Panchagavya (5%) + Jeevamrut (5%) was significantly higher plant height (67.23 cm), bulb weight (45.60 g), number of cloves per bulb (13.20), bulb diameter (4.80 cm), number of bulb per kg (22.60), dry matter content (38.39 %) and oleoresin content (1.17%). It can be concluded from the study that the profitable yield (159.89 q/ha) of garlic cv. Kandaghat selection can be obtained with the application of 90% RDN + Panchagavya (5%) + Jeevamrut (5%) with maximum benefit: cost ratio (2.06). It can be concluded that organic agriculture is getting hold of movements in India due to individual as well as group efforts to protect environment and contamination of farm produce from use of chemical inputs. This is the method of cultivation which preserves the reproductive and generative capacity of the soil and plant nutrition. The indiscriminate use of chemicals has led to degeneration of soil, water and ultimately the quality of food materials. So, at this moment a keen awareness has started in all parts of India for adoption of organic cultivation to cure the ills of modern organic agriculture.

Key words: panchagavya, jeevamrut, bulb weight, B: C ratio, yield

EMERGING TRENDS IN SOYBEAN INDUSTRY

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Soybean is one of the leading crop commodities produced traded and utilized globally. Barring some small portion, the bulk of it needs industrial processing and value addition. Besides its numerous uses, soybean is predominantly used as soymeal typically as source of high protein for animal feed and as edible oil. Soybean is the most globalized, traded and processed crop commodity. USA, Argentina and Brazil continue to be the top three producers and exporters of soybean and soymeal. Indian soyindustry has also made a mark in the national and global arena. While soymeal, soyoil, lecithin and other soy-derivatives stand to be driven up by commerce, the soyfoods for human health and nutrition need to be further promoted. The changing habitat of commerce in soyderivatives necessitates a shift in strategy, technological tools and policy environment to make Indian soybean industry continue to thrive in the new industrial era. Terms of trade for soyfarming and soy-industry could be further improved. Industrial world, through three main industrial revolutions, has undergone a paradigm shift from hand tools and basic machines to (i) powered mechanization, (ii) mass production along assembly lines, and (iii) automation and globalization. Present trends, volatilities, slowdowns, challenges faced and associated desiderata are accordingly spelt out in the present article.

Key words: Soybean, Indian soybean industry, soybean derivatives, soybean trends

SCREENING OF NOVEL CMS SOURCES IN SUNFLOWER FOR OIL AND QUALITY TRAITS UNDER VARIED MOISTURE ENVIRONMENTS

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The single cytoplasmic male-sterile (CMS) PET-1 source and the corresponding fertility restoration gene Rf1 is used for commercial hybrid sunflower seed production worldwide, involves a potential risk if it became susceptible to a new strain of disease. The present investigation is based on development of a set of nine cms analogues from different cytoplasmic sources viz; cms-XA (Unknown), E002-91, PKU-2 (*H. annuus*), ARG-2, ARG-3, ARG-6 (*H. argophyllus*), DV-10A (*H. debilis spp. vestitus*), PHIR-27 (*H. praecox spp. Hirtus*) and PRUN-29A (*H. praecox spp. runyonic*) along with a common maintainer NC-41B (*H. petiolaris*). All cms analogues along with NC-41B (common maintainer) were crossed with four common perfect restorers from PET-1 source in a line × tester fashion, thus 40 F₁ hybrids developed and study the effect of novel cytoplasmic sources on performance of hybrids for oil content and quality traits. The experiment was carried-out in randomized complete block design with three replications at Punjab Agricultural University, Ludhiana, Punjab, India, over the two different environments (normal irrigation and water stress). In stress environment the irrigation was stopped after the anthesis was complete. The oil content was estimated using a benchtop pulsed nuclear magnetic resonance (NMR)MQC-5 analyser (oxford, London). The gas liquid chromatography (GLC) was used for fatty acid estimation. The main role in the inheritance was played by the non-additive component of genetic variance as shown by analysis of variance of combining abilities and analysis of genetic variance components for oil content and quality traits under normal and stress environment. GCA estimates revealed that cms analogues cms-XA (Unknown), ARG-2A (*H. argophyllus*) and PRUN-29A (*H. praecox spp. runyonic*) were recorded as very good combiner for oil content under both normal and water stress environments. The male parent RCR-8297 and P69R were recorded as very good combiner under stress environment, whereas, P100R was recorded very good combiner under normal environment. SCA estimates determined the suitability of hybrids and the hybrids E002-91A × P124R, E002-91A × P100R, ARG-3A × RCR-8297, ARG-6A × P124R, DV-10A × P69R, PRUN-29A × P100R and NC-41B × RCR-8297 were identified with high sca effects for oil content under both the environments. The CMS analogues ARG-2A (*H. argophyllus*) and PRUN-29A (*H. praecox spp. runyonic*) may be new CMS source

for development of high oil and quality hybrids in sunflower. This will diversify the cms sources for sunflower breeding and facilitate understanding of the interaction between the cytoplasm and nuclear genes.

EFFECT OF FOLIAR SPRAY OF ZINC SULPHATE ON GROWTH AND YIELD OF TOMATO (SOLANUM LYCOPERSICON L.) UNDER POLYHOUSE

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The field experiment was conducted at Horticulture farm, College of Agriculture, Bikaner (Rajasthan) from December, 2016 to June, 2017. The treatment consisted of five levels of zinc sulphate (0, 50, 100, 150, 200 ppm) and number of sprays (first, second and third) making there by 15 treatment combination which were replicated three times in the Factorial Complete Randomized Design having bed size of 10 m x 1 m with a row to row distance of 45 cm and plant to plant 60 cm. The first, second and third spray of zinc sulphate was done 20, 40 and 60 days after transplanting respectively. The increasing levels of zinc sulphate and number of sprays significantly increased the growth and yield by increasing number of plant height, number of branches, number of flowers, chlorophyll content, length of fruits, weight of fruits, number of fruits per plant, fruits yield per plant, fruits yield q ha⁻¹. The three spray of zinc sulphate gave the maximum net return of Rs. 800412.816 with the cost benefit ratio of 1 : 2.66.

ADVANCED TECHNOLOGIES FOR INSECT PESTS MANAGEMENT

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Abstract: Reducing the use of synthetic pesticides, especially broad-spectrum insecticides in plant protection and using more alternative and novel methods for pest control or biorational control are the challenges of pest control for the twenty-first century. This overview is based on advanced and novel technologies for managing insect pests. These technologies focus on safer and environmentally friendly (biorational) approaches. There are four segment for managing insect pest. One such approach is based on disrupting the activity of specific biochemical sites serving as targets for insecticide discovery. Another section is related to screening potential insecticides by cell-based and other advance screens. The third segment deals with novel biotechnology control strategies (the genetic approach). The last section covers many other new aspects of pest control such as the usefulness of plant natural-product mixtures, optical manipulation for controlling sucking pests, recent progress in bed bug management, and insect pests in store food and the utilization of nanotechnology for development of potent insecticides. Advance technology is effective for the insect pests management and it has reducing harmful effect on environment and surrounding area.

PGPR: MECHANISM AGAINST THE PATHOGENS

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The internal tissues of plants provide a relatively uniform and protected environment when compared with the rhizosphere and rhizoplane. Plant growth promoting rhizobacteria (PGPR) belonging to *Pseudomonas* spp. are being exploited commercially for plant protection to induce systemic resistance against various pests and diseases. Influence of plant growth promotion and induced systemic resistance (ISR) in enhancing the disease resistance in plants. Lipopolysaccharides, siderophores and salicylic acid are the major determinants of PGPR-mediated ISR. The performance of PGPR has been successful against certain pathogens, insect and nematode pests under field conditions. SAR is expressed to a maximum level when the inducing organism causes necrosis, whereas ISR by PGPR typically do not cause any necrotic symptoms on the host plants. Both SAR and ISR are the activation of latent resistant mechanisms that are expressed upon subsequent or challenge inoculation with a pathogen. PGPR provide different mechanisms for suppressing plant pathogens. They include competition for nutrients and space, antibiosis by producing antibiotics viz., pyrrolnitrin, pyocyanine, 2,4-diacetyl phloroglucinol and production of siderophores (fluorescent yellow green pigment), viz., pseudobactin which limits the availability of iron necessary for the growth of pathogens. PGPR can also induce systemic protection against bacterial diseases. Seed treated with *P. fluorescens* protected beans against halo blight disease caused by *Pseudomonas syringae* pv. *Phaseolicola*. Induction of systemic resistance by PGPR against viral disease Seed-treatment with *P. fluorescens* and *S. marcescens* has consistently reduced the cucumber mosaic virus-infected plants.

Keywords: Rhizosphere, Rhizoplane, Siderophores.

ECO FRIENDLY ENHANCEMENT OF STRESS RESISTANCE IN CROP PLANTS**VINAY MAHADEV HEGDE, UNDER THE SUPERVISION OF PROF DR.J.PSRIVASTAV***Previous, Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi*

Food security remains one of the most challenging tasks for growing population rapid changes in climate imposes increasing biotic and abiotic stress of crop plants. In recent years melatonin has emerged as research highlight in stress resistance of plants. The main functions of melatonin are related to abiotic stresses such as drought, radiation, extreme temperature and chemical stresses. Melatonin found in flowers and developing fruits of *Datura metel*. It is found to be highest level in developed flower buds. Regulatory effect of melatonin will generate when plant face harsh environmental condition. Evidence suggests that concentration increase the level of endogenous melatonin in plants. Exogenously applied melatonin can also improve the ability of plant to tolerate abiotic stresses. Over expression of melatonin biosynthetic genes increases melatonin levels in plants.

Keywords: melatonin, biotic, abiotic, drought, datura.

SURVEY OF PURPLE BLOTCH DISEASE OF ONION (*ALTERNARIA PORRI*) OF ALLAHABAD DISTRICT**VINNY JOHN, SOBITA DEVI SIMON, AMIT KUMAR MAURYA AND ABHILASHA A. LAL***Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P.) - 211 007, INDIA*

A survey was conducted in the onion growing fields of Allahabad district. For the survey ten villages' viz., Hadha, Thanthanwa, Ghoorpur, Chaka, Pahluka purwa, Karchana, Jari, Kanti, Soraon and Phool pur were selected to evaluate the disease incidence of purple blotch of onion caused by *Alternaria porri*. From each village eight fields were from each the lowest incidence of purple blotch was found in Phool pur (4.12%). The maximum was found (16.00%) in Jari village followed by Karchana (15.37%), Pahluka purwa (14.87%), Kanti (14.75%), in 2016. It was observed that purple blotch of onion is a major problem in Allahabad district of India. Diseased samples were collected from the selected fields to record the disease incidence and isolation of the pathogen.

Key words: *A. porri*, onion and purple blotch.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON ECONOMIC YIELD AND BIOLOGICAL OF CORIANDER (*CORIANDRUM SATIVUM* L.)**VINOD KUMAR AND S.K. TEHLAN***Department of Vegetable Science, CCSHAU, Hisar-125004*

The present investigation was carried out at the Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar to assess the effect of integrated nutrient management on seed yield, biological yield and harvest index of coriander in 2016-17. The material comprised of a single variety "Hisar Bhoomit" with eighteen treatment combinations of organic manures (Farm yard manure and vermicompost), inorganic fertilizers and biofertilizers (*Azotobacter* and PSB in combined application as seed treatment). All the treatment combinations were evaluated for seed yield, biological yield and harvest index. Among the treatments, 100 % RDN (Inorganic) + Azoto + PSB showed better performance in terms of seed yield (2120.18 kg/ha) and harvest index (37.14 %) which was at par with the treatment 75 % RDN (Inorganic) + 25 % RDN through vermicompost + Azoto + PSB, but in case of biological yield treatment 50 % RDN (Inorganic) + 50 % RDN through vermicompost + Azoto + PSB recorded highest biological yield (5781.92 kg/ha) which was at par with the treatment 100 % RDN (Inorganic) + Azoto + PSB (5708.63 kg/ha). Minimum seed yield (1320.24 kg/ha), biological yield (4523.38 kg/ha) and harvest index (29.19%) was recorded in control which was closely followed by the treatment Azoto + PSB (seed treatment only) in terms of seed yield (1380.25 kg/ha), biological yield (4420.24 kg/ha) and harvest index (30.55 %).

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH CORIANDER (*CORIANDRUM SATIVUM* L.)**VINOD KUMAR AND S.K. TEHLAN***Department of Vegetable Science, CCSHAU, Hisar-125004*

A field experiment was carried out at Research Farm of the Department of Vegetable Science in 2016-17 to study the effect of integrated nutrient management on growth parameters of coriander. The field experiment was done with eighteen treatments on the basis of recommended dose of nitrogen (RDN @ 60 kg/ha) for coriander with different sources of nutrient i.e inorganic source, organic manures (Farm yard manure and vermicompost) and biofertilizers (*Azotobacter* + PSB for seed treatment). From the experimental result it was found that significantly maximum plant height (15.33, 99.50 and 138.00), number of primary branches per plant (1.87, 8.27 and 11.40) and number of secondary branches per plant (0, 21.30 and 32.77) was found in treatment 100 % RDN (Inorganic) + *Azotobacter* + PSB (T₁) which was at par with the treatments, 75 % RDN (Inorganic) + 25 % RDN through vermicompost + *Azotobacter* + PSB (T₉) and 75 % RDN (Inorganic) + 25 % RDN through FYM + *Azotobacter* + PSB (T₇) at 45, 90 days after sowing and at harvesting, respectively.

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Minimum plant height (10.60, 76.67 and 111.63), number of primary branches per plant (1.33, 6.57 and 8.93) and number of secondary branches per plant (0, 16.17 and 24.53) was found in control at 45, 90 days after sowing and at harvesting, respectively.

ROLE OF PULSE IN CROP DIVERSIFICATION

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Pulses are considered as life blood of Indian agriculture because of their uniqueness in every known system of farming. India is the largest producer of pulses in the world with 26% share in the global production. Being rich in protein and several essential amino acid like lysine, cystine, and arginine, they are the ideal supplement to the cereal rich diet of predominantly vegetarian mass of the country. Their long recognized properties of biological nitrogen fixation and restoration of soil fertility are the additional advantages associated with pulses. The ill impacts created by green revolution and the imbalance of rice-wheat cropping system in food and nutritional security can be restored through crop diversification which is also the potential way to increasing over existing land management and cropping system through horizontal and vertical utilization of resources. It is a strategy of shifting from less profitable to more profitable crops. Crop diversification in India is generally viewed as shift from traditional grown less remunerative crops to more remunerative. Market infrastructure development and certain other price related support also induced crop shift often low and high value crops like pulses and in crop diversification. Crop diversification also have wider flexibility in the growing of large number of crops and under *rainfed* conditions tends to reduce the risk factor of crop failure due to drought or less rain. Crop diversification is also considered as an important tool for acceleration of agriculture growth by promoting food and nutritional security, income and employment generation, judicious use of natural resources and ecological management promising cropping system that have higher with stable yield and profit under irrigated conditions have been identified. the adoption of pulses such as mungbean, cowpea and pigeonpea etc can tremendously benefit the nutrient exhaustive rice-wheat cropping system through nitrogen fertilizer saving, increase in crop yields and higher income per unit area as these crops increased the level of NPK, normal the soil PH and improves the soil structure. Pulses are also capable to fix the atmospheric nitrogen with the help of *Rhizobium*.

INTEGRATED PEST MANAGEMENT IN VEGETABLE CROPS

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Vegetables contribute important nutrients and vitamins for the human body. Eating and vegetable lowers the risk of developing many chronic diseases and can also help with weight management. Some important constraints in vegetable production. Availability of high-quality seed, high cost of production due to excessive use of pesticides to control pest and diseases and declining soil fertility. Many species of pest and diseases inflict vegetable crops in India. Crop losses in major vegetable crops range from 46 to 100 % due to insect pest and 5 to 90 % due to diseases. The major vegetable pest like fruit borer in tomato, shoot and fruit borer in okra, diamond black moth, aphid and Cabbage borer in Cole crops and Fruit fly in cucurbits. The Integrated Pest management practices such as manipulation in sowing time, sowing resistant variety, tillage of soil, inter cropping, trap Crop, biological/ Microbial, Pheromone trap and control and safe use of chemicals. The use of botanical pesticide and microbial pesticide use and avoid more toxic insecticides. The most insecticide use in vegetable IPM such as Cypermethrin for sucking insect Imidacloprid for Jassid, aphid, thrips, Emamectin benzoate for DBM Chilli Fruit borer, thrips and mite Brinjal Fruit and shoot borer, Novaluron Cabbage DBM 75 Tomato Fruit borer, Chilli Fruit borer and tobacco caterpillar. The main elements of pest management in vegetable crops and others have been studied and recommended but most are not sufficiently advanced to be of value to end users in practical sense under field conditions

Keyword: Vegetable, Integrated Pest Management

NUTRIENT MANAGEMENT FOR LATE SOWN WHEAT (*TRITICUM AESTIVUM* L.) CROP

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In India, the crop occupies an area of about 30.2 million hectares with total production of 96.85 million tones and a productivity of 32.07 kg ha⁻¹ and shares 12.86 percent of total production of world (Anonymous, 2016). Wheat is grown as timely or late sown. In western Uttar Pradesh which is sugarcane dominated area most of wheat is sown as late. The nitrogen application in timely and late sown wheat is different. Recommendation of nutrient application to any crop is made on the basis of soil test value. With the extensive cropping, the present soil test value is lower than earlier therefore we can 'not rely on the recommendation of N made earlier for higher productivity. Different factor is responsible for reduction and stagnation of wheat productivity and among them soil fertility is one. To realize the full yield potential crop must be nourished with adequate and balanced nutrition. Available literature reveal that Indian soils are becoming poor in soil fertility. 90 % soils are deficit in N, 80% in P, 50 % in K, 41% in S, 48% in Zn, 33% in B, 12% in Fe, 13% in Mo (Rattan 2013).

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Level of organic matter is also declining in soil. In N deficit condition realization of full yield potential is difficult. Significant increase in grain yield of wheat with the high dose of N application than recommended dose in different part of country. In last it may be conducted that high N application than recommended is required for higher wheat grain productivity in late sown condition. Nitrogen is reported to prolong the maturity and due to this reason full dose of nitrogen is not applied in late sown wheat. Question arise that whether this reduced level of N application in present soil fertility conditions is enough for potential production or it should be increased with change in the N application schedule.

EFFECT OF DIFFERENT TYPE OF ORGANIC SOURCES ON VEGETATIVE GROWTH AND OIL YIELD IN TULSI (*OCIMUM SANCTUM* L.)

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The present investigation entitled "Effect of different type of organic sources on vegetative growth and oil yield in Tulsi (*Ocimum Sanctum* L.)" was conducted at Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during the year 2016-17. The cost of chemical fertilizer is increasing day by day therefore, farmers are looking for alternate sources which may lower the cost of cultivation and also maintain the fertility status of the soil. Since information on organic cultivation is scanty especially in medicinal plant and particularly in tulsi. The experiment was laid out in Randomized Block Design (RBD) with 11 treatments i.e. control, FYM 5 ton/ha, FYM 7.5 ton/ha, vermin compost 2.5 ton/ha, vermin compost 3.5 ton/ha, press mud 5 ton/ha, press mud 7.5 ton/ha, bio-fertilizer (PSB) 12 kg/ha, FYM 5ton/ha + PSB 12 kg/ha, vermin compost 2.5 ton/ha + PSB 12 kg/ha and press mud 5ton/ha + PSB 12 kg/ha, three replications were arranged and considering five plants as unit. The observations were recorded for vegetative growth, oil and economics of tulsi. The maximum no. of branches/ plant (19.53) was recorded with the application of T3 (FYM 10 ton/ha) and maximum plant spread (80.77 cm²) was recorded with the application of T3 (FYM 10 t/ha) which was found significantly superior over rest of treatments except T7 (Press mud 10 t/ha). The minimum plant spread (47.44 cm) was observed under T1 (Control) treatment. However, the maximum no. of branches/ plant (19.53) was recorded with the application of T3 (FYM 10 ton/ha) However minimum no. of branches per plant (9.82) were recorded in T1 (Control) treatment. Oil contain (64.18 lit/ha) was obtained with the application of FYM (10 t/ha) with the application of T7 (Pressmud 10 t/ha). The minimum oil (30.75 lit/ha) was obtained in control. The maximum carotene content (23.59 µg/100g) was recorded with the application of FYM 10 ton/ha which was found non-significant superior over with the application of T7 (Pressmud 10 t/ha) and control.

IMPORTANCE OF HURDLE TECHNOLOGY IN FOOD PRESERVATION

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Hurdle technology is a method of ensuring that pathogens in food products can be eliminated or controlled. This means the food products will be safe for consumption, and their shelf life will be extended. Hurdle technology usually works by combining more than one approach. These approaches can be thought of as "hurdles" the pathogen has to overcome if it is to remain active in the food. Hurdle technology has been defined by Leistner (2000) as an intelligent combination of hurdles which secures the microbial safety and stability as well as the organoleptic and nutritional quality and the economic viability of food products. The Hurdle Technology makes minimal sensory and nutritional changes in the product and is valuable and acceptable than traditional methods of preservation. The paper contributes the aspects of this technology and the prospects of the future goal of a multi target preservation of foods with effective applications of this technology in the food industry. Using hurdle technology, fermented sausages are produced that are stable at ambient temperature for extended periods. A sequence of hurdles is important at different stages of the ripening process. The first hurdles used are the preservatives, salt and nitrite, which inhibit many of the bacteria present in the batter. This technology has been applied in many dairy products to enhance the shelf life as well as Hurdle technology applied in the preservation of high moisture fruit products.

Keyword: Hurdle Technology, food, preservation, dairy products.

ASSESSMENT THE VARIOUS CULTIVARS PERFORMANCE OF THESE PLANTING DEPTH AND SPACING OF TUBEROSE (*POLIANTHES TUBEROSAL*.) CV. DOUBLE

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An experiment was carried out at Research Farm, Flower Cafeteria Unit (FCU), KVK, Hastinapur, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (UP) during 2015-16 to 2016-17 to assess various cultivars performance of these different

planting depth and spacing for the improving the yield and quality of tuberose. A field trial consisting three different planting depths (4.5, 5.5 and 6.5 cm) and three adequate spacing (10 X 10, 15 X 15 and 20 X 20 cm). An important commercial cut flowers crop of India and waxy white flowers are highly valued for the preparing grand garlands, bouquets and for table or vase decoration. Cultivar double *i.e.*, Vaibhav, Subhasni, Swarn Rekha, Paerl double with considered most suitable for their flowers is used for garland making and as well as cut flowers too. These cultivars is most popular in cut bulbous flowers in Western Uttar Pradesh and because of its attractive spikes, sweet fragrance and high economic value in the market. The experiment was laid out in factorial Randomized Block Design (RBD) with three replications. Maximum number of sprouts per clum (3.81 and 5.07), number of leaves per plant (21.98 and 38.61), length of longest leaf (51.28 cm and 57.37 cm) at 65 and 85 days after the planting were found under the treatment D₂, where the bulbs were planted at the depth of 5.5 cm. Adequate wider spacing for the cultivation of tuberose for produced spacing (20 X 20 cm) maximum number of sprouts per clum (3.87 and 4.90) and highest number of leaves per plant (22.88 and 39.87). Maximum height of plant (43.08 and 50.87 cm) at 65 and 85 days after the planting were found under the treatment S₃, where the bulbs were planted at the depth of 5.5 cm. Adequate spacing had no significant effect on length of longest leaf and height of the tuberose plant. Therefore 5.5 cm depth of planting and 20 X 20 cm spacing may be recommended for the better vegetative growth and yield of tuberose cultivar double under the agro-climatic condition of Meerut western region.

INTEGRATED NUTRIENT MANAGEMENT: A SUSTAINABLE APPROACHES

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Integrated nutrient management (INM) is a holistic sense of "land husbandry". It is a broader term of management practices of embraces soil, nutrient, water, crop, and vegetation. Thus, INM tailored to a particular cropping and farming system, undertaken with the aim of improving and sustaining soil fertility and land productivity without reducing environmental degradation. Integrated Nutrient Management aims to optimize the condition of the soil, with regard to its physical, chemical, biological and hydrological properties, for the purpose of enhancing crop productivity, whilst minimizing land degradation. There is now greater awareness that INM can, not only provide tangible benefits in terms of higher yields, but simultaneously and almost imperceptibly conserve the soil resource itself. The field level management practices considered under the heading of INM would include the use of organic resources form of farm yard manure, green manures, cover crops, legumes, crop residues and farm wastes as well as inorganic fertilizers, soil amendments, and other agronomic tillage practices, to conserve both water and soil. Production efficiencies are gained through the integrated nutrient management practices promoting combined use of mineral, organic and biological resources in a reasoned way to balance efficient use of farm resources and ensure ecosystem sustainability against nutrient mining and degradation of soil and water resources. For example, efficient fertilizer use requires that correct quantities be applied and that the application method minimizes losses to air and water. An integrated nutrient management practice provides sustainability for a longer time with economically and socially to farmers living.

Key words: Integrated nutrient management, soil fertility, soil productivity and organic resources.

STUDY ON THE POPULATION DYNAMICS OF MUSTARD APHID, *LIPAPHIS ERYSIMI* (KALT.) IN RELATION TO WEATHER PARAMETERS

VISHVENDRA AND SANDEEP KUMAR

The population dynamics of mustard aphid, *Lipaphis erysimi* (kalt.) on six variety and germplasm of mustard in relation to weather parameters was studied at C.R.C. Meerut during the Rabi 20015-16 crop season. This study will provide an opportunity to fact the pest challenge by manipulating the manageable ecological parameters in the form of planting or harvesting time adjustment, varieties selection, correct time of pesticide application, etc. The natural appearance of mustard aphid on variety and germplasm of mustard was observed on January 03, 2007 (50 days after sowing) and disappeared after mid February (92 days after sowing). The peak aphid population was found at a minimum, maximum and average temperature of 15.51, 22.27 and 17.92 respectively and a mean relative humidity of 84.86% on 18th January at 65 DAS. Then, decline in aphid population. Correlation coefficient (r) showed a positive effect with minimum, maximum and average temperature. Whereas mean relative humidity showed significantly negative effect.

Key Words: Mustard aphid, *Lipaphis erysimi* kalt., Weather parameters.

ASSESSING APHID INFESTATION IN INDIAN MUSTARD (*BRASSICA JUNCEA* L.) UNDER PRESENT AND FUTURE CLIMATE SCENARIOS

VISHVENDRA AND SANDEEP KUMAR

Mustard (*Brassica juncea* L.) production in India suffers from aphid, *Lipaphis erysimi* (Kaltenbach), infestation considerably. Role of weather on the incidence and development of mustard aphids was assessed from experimental data from six north Indian locations.

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Aphid appearance and population build up was found to be regulated by temperature and time to attain peak population was relatively short in warm humid climates than in cool climates. Aphids appeared generally when the accumulated thermal time ranged between 790-827 and diurnal temperature range had a key role on the pest build up. Functional relations developed from the present study between aphid incidence and peak population using previous weeks weather and pest data for majority of the locations could be used for taking of any prophylactic/control measures. Projections on aphid population in future climates using generated weather variables indicated that warming may not increase aphid population at all locations uniformly.

Keywords- Indian mustard, aphids, climate change, forewarning models.

ROLE OF INSECT VECTORS IN TRANSMISSION OF DISEASES IN CROP PLANTS AND THEIR MANAGEMENT VISVASH VAIBHAV¹, RAJAT DESHWAL², ANKIT KUMAR³, GAJE SINGH⁴, UMESH KUMAR⁵ AND SATY SARAN⁶

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Arthropod-borne plant viruses are among the most important complex and extensively distributed plant disease agents. The vectors of any plant virus are always restricted to one of the major taxa, such as aphids, leafhoppers, whiteflies, thrips, mealy bugs, beetles, mites, or nematodes. The first vectors recognized as being associated with a plant virus disease were insects, *i.e.*, leafhoppers (*Deltocephalis dorsalis* Motschulsky) transmitting rice stunt virus disease. Different terms or categories used for describing the relationship between vectors and viruses give some indication of the behavior of the virus in the vector during transmission or mechanism of virus transmission by vector. Vector transmission processes are usually complex, even for the seemingly simple mechanical transfer of plant viruses to plants on the tips of vectors' stylet-like mouthparts (similar to a hypodermic needle) during feeding. The nonpersistent transmission of viruses by aphids illustrates the importance of how vector transmission characteristics contribute to the spread of plant disease and why some control strategies for these viruses differ from those for other aphid-transmitted viruses. The most threatening property of the insect vector is its wide host range. The knowledge of virus-vector relationship is essential to devise suitable measures against vector-borne diseases. Some viruses have mealy bug vectors (*Pseudococcidae*), and various other hemipteran families have virus vector species. Only a few viruses are transmitted by thrips (Order Thysanoptera), but their economic impact is internationally important. Most approaches to control the vectors of virus diseases are aimed at eradicating or altering one or more of the primary participants in the transmission process (vector, virus, and host plant) or at preventing their coming together. Some of our most important plant diseases require mobile vectors. Broadly, the management of vectors of viral diseases can be done by adopting methods of cultural control, biological control, and chemical control, *e.g.*, an integrated management strategy consisting of appropriate transplanting time, use of barrier crops, and periodical application of synthetic and botanical chemicals for management of aphid vectors of papaya ring spot virus (PRSV) on papaya has been successfully developed.

Keywords: Insect vector, Transmission of diseases, Management of Insect vectors

SUSTAINABLE INTENSIFICATION OF AGRICULTURE: SECOND GREEN REVOLUTION!

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With the world's population expected to grow from 7.63 billion today to 9.77 billion by 2050. Food and Agriculture Organization (FAO) of the United Nations, assigned the task of feeding the world's population in 2050 in itself seems "easily possible". Easy, that is, if the world brings into play swathes of extra land, spreads still more fertilizers and pesticides, and further depletes already scarce groundwater supplies, thereby, increasing today's brand of resource-intensive, environmentally destructive agriculture which is a poor option. Therein lies the real challenge in the coming decades: how to expand agricultural output massively without increasing by much the amount of land used. Despite great recent progress, hunger and poverty remain widespread and agriculturally driven environmental damage is widely prevalent. The idea of Sustainable intensification (SI) can be defined as a process or system where agricultural yields are increased without adverse environmental impact and without the conversion of additional non-agricultural land. The combination of the terms 'sustainable' and 'intensification' is an attempt to indicate that desirable outcomes around both more food and improved environmental goods and services that could be achieved by better fertilizer and water use efficiency, ecologically based management practices, judicious use of pesticides and antibiotics, and major changes in some livestock production practices. Advances in the fundamental understanding of agroecology, biogeochemistry and biotechnology that are linked directly to breeding programmes can contribute greatly to sustainability. Agriculturalists are the principal managers of global useable lands and will shape, perhaps irreversibly, the surface of the Earth in the coming decades. Ultimately, sustainable agriculture must be a broadly based effort that helps assure equitable, secure, sufficient and stable flows of both food and ecosystem services for the 9,000 million or so people likely to inhabit the Earth.

Keywords: Agriculture, Environment, Sustainable intensification, Non-agricultural land.

**ANTIOXIDANT POTENTIAL OF 'CALAMUS ERECTUS': AN UNDERUTILIZED FRUITS FROM SIKKIM HIMALAYA
YAMUNA PANDEY¹, S. UPADHYAY¹ AND S.S. BHATT²**¹Department of Horticulture, Sikkim University, India

Calamus erectus is one of the wild edible fruit found growing wild in Sikkim Himalayan region. A large cane having armed, erect, stout and tufted stem. Leaves alternate, pinnatisect; segments acuminate; leaflets almost equidistant, their margins and midrib beneath remotely ciliolate. Petioles and rachis of the leaf are also armed below with flat, straight and pale spines. Sheath armed, produce into a ligule or ochrea. It is locally known as 'Phakrey'. The fruits are mainly preferred by diabetic patient and it is believed that this fruit can control the blood sugar level. Keeping the view of medicinal potential of this fruit, present study had conducted at laboratory of Department of Horticulture, Sikkim University to access the antioxidant potential like total phenols, flavonoid, Flavonols, ascorbic acid, anthocyanin and total carotenoids. The results of present study revealed that fruit of *Calamus erectus* was found be antioxidant potential and the data revealed as it contains 39.00 ± 1.32 mg GAE/G, 52.72 ± 0.21 mg QE/g, 88.55 ± 0.88 QE/g, 2.20 ± 0.11 mg/100 g, 1.55 ± 0.04 % and 4.55 ± 0.23 % of total phenol, total flavonoid and flavonols, ascorbic acid, anthocyanin and carotenoids, respectively.

ANTIPATHIC COMPOUNDS IN PLANT DISEASE MANAGEMENT**YAMUNA. CHANDS. L. BHATTIPROLU**

Department of Plant Pathology, Agricultural college, Bapatla, ANGRAU, Regional Agricultural Research Station, Lam, Guntur.

Antipathic compounds are the non fungitoxic chemicals. They do not act directly on the pathogen but control the disease by inducing the host defense system. These compounds show little effect on the rate of growth of the pathogen *in vitro* but show more effect *in vivo*. These compounds are less likely to encounter problem of development of resistant strains than conventional systemic fungicides because they act by inducing general defense mechanism of host through production of phenols, peroxidases and phenylalanine ammonia-lyases. Non-conventional chemicals, viz., Salicylic Acid (SA), Acetyl Salicylic Acid (ASA), DL- β - amino-n-butyric acid (BABA), gamma-amino-n-butyric acid (GABA), Amino-iso-butyric acid (AIBA), Indole-3pyruvic acid (IPA), Indole-3acetic acid (IAA), Nicotinic acid (NA), Isonicotinic Acid (INA), DL-Norvaline, Benzoic Acid and Cycloheximide, when applied as foliar sprays prior to *Fusarium* inoculations, mortality was reduced in chickpea. Soaking of soybean seeds in benzothiadiazole (BTH) @ 0.25g/l a.i. humic acid (HA) @ 4g/l a.i and their combination induced systemic resistance against *Fusarium oxysporum* under greenhouse conditions and protected soybean plants against damping-off and wilt diseases. 2, 6 dichloro isonicotinic acid (INA) @ 100mg/l and -Amino butyric acid (BABA) @ 0.5g/l reduced the incidence and severity of purple blotch disease in onion and increased the bulb yield significantly over control. Similarly, application of silicon compounds protected cucumber against damping off, bell pepper from *Phytophthora* blight and rice from blast. However, these chemicals do not have broad spectrum activity and cause phytotoxicity at higher concentrations. They have to be applied prior to fungal infections for better control of diseases. They need to be evaluated against similar fungi in other crops and may be included in integrated disease management along with fungicides.

FLUIDIZED BED DRYING OF BEETROOTS AND DETERMINATION OF EFFECT ON DRYING PARAMETERS**¹YASHWANT KUMAR PATEL*, ²M.A. KHAN AND ³SOUMITRA TIWARI**¹Assistant Professor, Department of FPT, Bilaspur University, Bilaspur, Chhattisgarh, India, ²Deptt. of PHET, Aligarh Muslim University, Aligarh, Uttar Pradesh, India

As we know the drying is very effective unit operation for food preservation. It also overcome the drawback of natural drying in terms of drying time, temperature and qualities of the final products. Experiments were conducted to study the effect of drying time on moisture content of beetroots in fluidized bed drying system. The drying parameters likewise inlet air temperature, inlet air velocity and outlet air humidity were observed. Drying of beetroots was carried out in a fluidized bed drying at 60 °C, 67.50 °C and 75 °C temperature.

Key-words: Drying, moisture content, fluidized bed drying, beetroot and effect on drying time.

ASSAY OF GENETIC ARCHITECTURE AND MOLECULAR DIVERSITY ANALYSIS AS AN IMPROVEMENT TOOLS FOR IDENTIFICATION OF WATERLOGGING TOLERANT PIGEONPEA GERMPLASM**YASHWANT K. YADAVA^{1,2*}, RAJESH KUMAR SINGH^{1,3}, PAWAN KUMAR¹, M.K. YADAV¹**¹Department of Agricultural Biotechnology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, U.P -250110, India, ²ICAR-National Research Centre on Plant Biotechnology, Pusa Campus, New Delhi-110012 India, ³Division of Genetics, Indian Institute of Agricultural Sciences, Pusa, New Delhi-110012, India.

In the present study an initial investigation was carried out to identify the waterlogging stress tolerant pigeonpea germplasms. Waterlogging treatment was given to the plants at vegetative stage after treatment the survival rate was assessed. Out of 128 germplasm pool, 38 survived. A set of qualitative and quantitative characters known as descriptors was used for identification of desirable genotypes and description. But, in this method of assessment, there are limitations like dependence on environment time consuming and subjectivity. DNA based methods offer better alternative to screening for abiotic stress and overcome the limitations posed by natural environment. However the main requirement in this approach is the appropriate marker which can clearly distinguish the tolerant and susceptible genotypes. The experiment was carried out to develop the molecular markers for assessing the tolerant genotypes. During the investigation, DNA isolated from germplasm lines and were analysed using SSR and EST-SSR primers. The bulk DNA of the pigeonpea

germplasm were screened with total 82 SSR primers among which 22 EST SSR were from different plant species which shows waterlogging stress tolerance to check cross transferability. A total of 57 SSRs loci were analyzed using 82 microsatellite (SSR) markers covering various bin locations on different linkage groups with an average 2.59 alleles per locus. Out of 82 primers 22 primers gave polymorphism with PIC value range 0.24 to 0.86, including 3 polymorphic markers from 22 EST-SSR. These primers were validated using the DNA from individual plants. Thus it could be established that EST-SSR markers could be used for assessing the desirable genotypes in pigeonpea.

SEASONAL INCIDENCE OF CABBAGE *DIAMOND BACK MOTH PLUTELLA XYLOSTELLA* (L.) (LEPIDOPTERA : PLUTTELLIDAE) IN MEERUT REGION, UTTAR PRADESH.

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After China, India is the second largest producer of vegetable with annual production of 81.00 mt from 5.12 million hectares of land. *Diamond back moth Plutella xylostella* (L.) is major pest of cabbage crop is infesting throughout the growth stages of crop. The experiment was carried out during rabi season, Oct-2012-Feb 2013 at crop research center Sardar Vallabhbhai patel university of Agriculture and technology Modipuram, meerut. *Diamond back moth* appeared during on third week of November 46 standard week and its population reached at maximum level on 50 standard week 8.3 larvae/plant and higher level of was found on 50 standard week. during the maximum level of incidence, the weather parameters like temperature and relative humidity and mean ranged from 20.57°C to 11.21°C mean 15.89°C and 73.71 to 37.42 per cent (55.56%) The population of DBM *P. xylostella* (L.) decreased very fast during 5th and 6th standard weeks. High population numbers of DBM *P. xylostella* (L.) were observed from mid-January to the end of March. DBM *P. xylostella* (L.) appeared from the 3rd week of January and reached its maximum 8.2 larvae per plant on the first week of March when the temperature and relative humidity were 12.4-29.4 degrees C and 29.8-79.4%, respectively. The coefficient of correlation studies showed that the larval population with the temperature and relative humidity indicated negative ($t = -363$) and positive ($r = +0.033$) during crop season.

Key Words: Cabbage, *Diamond Back Moth*, Temperature & relative humidity.

EFFICACY OF FOLIAR APPLICATION OF ZINC AT DIFFERENT GROWTH STAGE ON GROWTH YIELD AND ECONOMIC OF PADDY CROP (*ORYZA SATIVA*)

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The present study entitled Impact of Efficacy of foliar application of zinc at different growth stage on growth yield and Economic of paddy crop. These carried out at School of Agricultural Sciences and Engineering, IFTM University, Moradabad in 2017-2018. Zinc is essential for the normal healthy growth and reproduction of plants, animals and humans, and when the supply of plant available Zinc is inadequate, crop yields are reduced and the quality of crop products is frequently impaired. There is T_1 control, T_2 RDF+1 Zn spray at 30(DAT), T_3 +2 Zn spray 30,45 (DAT), T_4 RDF +2 Zn spray 30,60 (DAT), T_5 RDF +2 Zn spray 45,60 (DAT), T_6 RDF+3 Zn spray (DAT), T_7 RDF +3 Zn spray 45, 60,75 (DAT), T_8 RDF +4 Zn spray 30,45,60,75(DAT) and three replication. In plants, Zinc plays a key role as a structural constituent or regulatory co-factor of a wide range of different enzymes in many important biochemical pathways and these are mainly concerned with, carbohydrate metabolism (both in photosynthesis and in the conversion of sugars to starch), protein metabolism, axing (growth regulator) metabolism, pollen formation, the maintenance of the integrity of biological membranes, and the resistance to infection by certain pathogens.

NANOTECHNOLOGY: A RISING TECHNOLOGY IN AGRICULTURE SCIENCE

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Nanotechnology has greatly impacted the modern world. Due to their small size, nanoparticles act as good catalysts in many chemical reactions taking Place in industries. Their small size also allows them to penetrate into the soil and through the plants more readily making them extremely viable in the field of Soil Science. Synthesis of Nanoparticles depends on various factors as, the medium, method etc. It's synthesis is differentiated in four ways, physical, chemical, physico-chemical and biological methods. The characterization of Nanoparticles is also a crucial task to perform. It determines the shape, size, chemical bonds, functional groups, electron alignment etc. Of Nanoparticles allowing us to replicate the Nanoparticles and also provide it with some modifications to make it more efficient, as nanoparticles are coated with different substances to prevent their decay or agglomeration in the soil. Nanotechnology is the understanding and control of matter of sizes roughly in the range of 1 to 100 nanometers. If one of the dimensions is in this range, it is considered nanoparticles. Bulk materials when reduced to the nanoscale show some properties (melting point, physical strength, surface area, penetration power, electric conductance, optical effect, magnetism etc.) which are different from what they exhibit on a macro scale enabling unique applications. These materials can be either natural or engineered. Nanoscience has brought about a revolution in

different fields by helping develop processes and products that are hardly possible to evolve through conventional methods. The nanotechnology-aided application as nano-nutrients, nano-pesticides & repellants, nano-sensors & magnets, nano-films & filters etc. have the potential to change agricultural production by allowing better management and conservation of inputs.

DEVELOPING NOVEL CMS LINES IN CAULIFLOWER WITH GOOD FLORAL AND AGRONOMICAL TRAITS UNDER NORTH-WESTERN HIMALAYAN CONDITIONS OF INDIA

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Seed is the basic input in agriculture. It plays an important role in elevating the economic status of farmers'. Good quality seed along with its availability at genuine prices could pave the way to strengthen the backbone of the farming community as well as of the nation. In the case of cole crops particularly cauliflower, majority of the seed in the market is of private sector hybrids. Public sector is not able to compete with private sector in terms of hybrid seed due to less resource availability. Tedious, labour-intensive and time consuming methods of hand emasculation and pollination for hybrid seed production are the major constraints and to overcome such constraints, scientists at CSK HPKV, Palampur and Regional Research Station, IARI, Katrain have made attempts to develop cytoplasmic male sterile (CMS) lines in cauliflower to facilitate the hybrid seed production at low cost and efficient resource use. Besides being advantageous, CMS system has some limitations. Floral deformities in CMS lines may results in poor seed set and hence lower seed yields. Keeping this in view, the present investigation was conducted to develop novel CMS lines with good floral as well as agronomic traits. Eight CMS lines were developed through the repeated backcrossing over the decade. Among the developed lines, five belonged to mid- late group and three were placed in late group on the basis of maturity. Besides having high agronomic potential (yield ranges from 222-335 q/ ha), all these lines posses desirable floral characteristics similar to that of their maintainers. The utilization of these CMS lines to develop indigenous hybrids besides increasing the turnover may contribute towards higher yield, uniformity and quality of produce. Furthermore, the farmers could be benefitted through the technology transfer of this genetic mechanism.

Keywords: cauliflower, cole crops, CMS, hybrid, technology transfer

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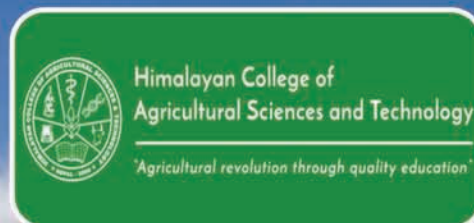


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ABSTRACTS

THEME-2

ENVIRONMENTAL AND LIVELIHOOD SECURITY FOR SUSTAINABLE DEVELOPMENT

ADVANCED IN BIOMASS AND BIOGAS ENERGY**ABDEEN MUSTAFA OMER***Energy Research Institute, Forest Road West, Nottingham, UK*

There is strong scientific evidence that the average temperature of the earth's surface is rising and this may be attribute to increased concentration of carbon dioxide (CO₂), and other greenhouse gases (GHGs) in the atmosphere as released by burning fossil fuels. One of the chief sources of greenhouse gases is burning of fossil fuels. Biogas from biomass appears to have potential as an alternative energy source, which is potentially rich in biomass resources. In the present study, current literature is reviewed regarding the ecological, social, cultural and economic impacts of biogas technology. In this communication an attempt has been made to give an overview of present and future use of biomass as an industrial feedstock for production of fuels, chemicals and other materials. However, to be truly competitive in an open market situation, higher value products are required.

Keywords: Biomass resources; biogas application; sustainable development; environment

POTENTIAL ADAPTATION MEASURES TO TACKLE CLIMATE CHANGE IMPACTS ON THE WATER AND AGRICULTURAL SECTORS IN ARID CLIMATE: LESSONS FROM OMAN**MUSHTAQUE AHMED AND AHMED AL-BUSAIDI***Dept. of Soils, Water & Agricultural Engineering, College of Agricultural & Marine Sciences, Sultan Qaboos University, PO Box 34 Al-Khod 123 OMAN*

The water problems have always remained an issue of concern to the governments in arid countries especially in the GCC (Gulf Cooperation Council) countries. The climate change will make the current situation even worse. The key climate change predictions for the region are the high incidence of reduced flows, declines in rainfall and higher temperatures. These changes will make water management even more difficult than what it is today. When renewable surface and groundwater resources are not sufficient to meet the ever-increasing demands from agricultural, industrial and domestic sectors, finding alternative water resources becomes a priority. To overcome these challenges and adapt to new climate realities, besides conservation, use of unconventional supplies should be seriously looked into. By 2025, the estimated water demand in Oman will be nearly 2,500 Mm³ from current demand of 1,700 Mm³. Oman is marked with extremely high summer temperatures, low intensity of rainfall, and declining groundwater table levels due to over pumping and obviously high evapotranspiration rates. Groundwater in Oman is over-used and, therefore, continuous abstraction is lowering water table depth and in some cases deteriorates water quality due to seawater intrusion. There are encouraging examples from Oman that if implemented widely will make the water sector more environmentally sustainable and the region more water secure. Use of renewable energy in the desalination industry, wide use of treated wastewater and greywater especially in agriculture, adoption of low cost wastewater technologies, managed aquifer recharge with treated wastewater, conjunctive use of treated wastewater and groundwater in agriculture, biosaline agriculture, controlled environment agriculture using small desalination plants with solar energy, deficit irrigation, water conservation at domestic level will lead to significantly better management of water and agricultural sectors. Lessons learnt in Oman have the potential to be applied in similar environment in other parts of the world.

Keywords: climate change, Oman, temperature, controlled environment

CLIMATE CHANGE: A BREEDER'S PERSPECTIVE**A. LOKESHWAR REDDY* G. CHANDRAMOHAN REDDY AND SUSMITA DEY*****Department of Genetics and plant breeding, Department of Horticulture, College of Agriculture, CCS Haryana Agricultural University, Hisar-125001*

The risk of climate change is sound evident by the fact of increasing temperature and more frequent drought and floods in recent times and higher incidence of insect –pests and diseases impacting agriculture production. To mitigate the ill effect of climate change, developing climate resilient varieties for heat, cold, drought and flood stress is one of the potions, where breeders can play major role. This will require a much better understanding of our genetic recourses, the underlying mechanism of gene interaction and pyramiding multi-stress related genes for developing new variety or improving already cultivated variety. The most suited approaches like double haploidy, marker assisted selection, phenotyping and bioinformatics to hasten the crop improvement. For breeders, ample opportunity lies in developing climate resilient high yielding varieties, resistant/tolerant to biotic and abiotic stress that help increasing food production and productivity, thus easy the cultivation under climate change regime. In India, various ICAR institute and state agricultural university, under national innovation on climate resilient agriculture (NICRA) program, made the concerted effort to develop different high yielding varieties with enhanced tolerance to heat, drought, flooding, chilling and salinity stress for different agro-climatic

zones. Thus, effect of climate change can be with stand to a greater extent with a suitable genetic blue print in our cultivar and that need more focused research and development from breeder's side.

Keyword: Climate change, Plant Breeding, Genetic resources, Climate resilient varieties

EFFECT OF CLIMATE CHANGE ON AGRICULTURE AND SUSTAINABLE DEVELOPMENT

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For most developing countries, adaptation to climate change takes priority over mitigation as they are more vulnerable to climate change and less carbon dependent. These countries are unique in a sense that they may be hurt by development paths that reduce the demand for fossil fuels. Improved access to energy can lead to increasing GHG emissions, for example, where kerosene and propane use is more appropriate than biomass renewables. However, in absolute terms this is a minor increase in global GHG emissions. For most Small Island States, the key issue to sustainable development is the adoption of a comprehensive adaptation and vulnerability assessment and implementing framework with several priorities: sea level rise (high percentage of the population located in coastal areas); coastal zone management (including specially coral reefs and mangroves); water supply (including fresh water catchments); management of upland forest ecosystem; and food and energy security. The impact of climate change on production and opportunities for emissions reductions should be reviewed with a focus on developing countries, including the implications for food security and livelihoods for the poor. Many studies of climate change have focused on the next 100 years. Climate change-induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events are adding to pressure on the global agriculture system – which is already struggling to respond to rising demands for food and renewable energy. Economic activity is a key driver of CO₂ emissions. How economic growth translates into new emissions, however, is ambiguous. On one hand, as the economy expands, demand for and supply of energy and of energy-intensive goods also increases, pushing up CO₂ emissions.

Keywords: Climate change, development, GHGs, livelihood.

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT

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Increase concentration of greenhouse gases in the atmosphere through anthropogenic Interventions has led to serious concerns. Climate change is induced by human influences, which contribute the most. These activities not only enhanced the process of climate change, increasing the mean global temperature by 0.60°C during last 100 years. There is still considerable uncertainty about the rates of change. Climate change required information about present situations, what is happening and why is happening. Planned adaptation needs an assessment for natural variability. It means energy is rearranged or changed within the climate system. To address this problem, we need scientific methods like mitigating the effects of climate change, we will need to manage our natural resources and ecosystem. Some of the possible priorities implies research on climate change would be given preference to cope up with the climate change. Scientists have explored research area as that would reduce uncertainty and improve knowledge to face the impacts of climate change and provide improve planning. Finally, climate change needs to be treated as a major economic and social risk to nation not just as along term environmental problem.

CLIMATE CHANGE AND ENSURING FOOD SECURITY

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Human beings can coexist only with the abundance and diversity of nature. Living things are interdependent, intricately linked in birth, death and renewal. Human beings are just one small part of this voluminous and vibrant mosaic, yet they inflict increasing pressure and pain on species and the environment. As a result, many plants and animals are at risk and under threat of extinction. They deserve our conservation. India is one of the World's richest countries in terms of its vast array of biodiversity. Biodiversity forms the foundation for sustainable development. It is the basis for the environmental health of our planet and the source of economic and ecological security for future generations Biodiversity Conservation emerges more important due to the globalize process of the world economy and also for survival of the world as a balance habitat. Biodiversity of an ecosystem is a vital issue of an economy. Soil, water, climatic condition, forest cover and biodiversity are crucial in determining the renewable resource flow of an economy .Sustainable development stresses on

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economic development alone with the object of conservation of environment. Biodiversity is a part of the biosphere supported by biological processes and organic evolution. Extinctions in the past have been the result of many cataclysmic changes on the Earth. However, the causes for the present perturbations arise from human activities. Biodiversity is being depleted by the loss of habitat, fragmentation of habitat, over exploitation of resources, human sponsored ecosystems, climatic changes, pollution invasive exotic species, diseases, shifting cultivation, poaching of wild life etc.

Keywords: Biodiversity, conservation, threats and sustainable development.

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT

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Climate change is real. Global warming is the root cause of Climate Change. The Earth temperatures are rising. According to the WHO, air pollution is responsible for the premature deaths of over 7 million people worldwide per year. Every year we're seeing new and undeniable climate events, droughts, global warming, extreme weather events intensifying, Greenland ice sheets melting at unprecedented rate and oceans are acidifying with methane plumes rising up from the ocean floor. Climate change is our single greatest security threat. Pollution control should be the top priority. The answers to climate change are that we need to create a future powered by renewable energy. Renewable energy (especially solar and wind) is a game-changer for most countries in the world. It has the potential to re-energize the world by creating millions of new jobs, achieve energy independence, and combating climate change. Climate Change and Global Warming can be managed by introducing a Carbon Tax; by exponentially increasing the deployment of renewable energy; by developing national renewable energy (RE) policy; by electrifying transportation, by utility-scale projects, by renewable innovative financing solution, decentralized energy, microgrids, solar roadways and by developing energy storage. In order to effectively address global warming, we must significantly reduce the amount of heat-trapping emissions we are putting into the atmosphere. Expand the use of renewable energy and transform our energy system to one that is cleaner and less dependent on coal and other fossil fuels. Increase vehicle fuel efficiency and support other solutions that reduce oil use. Reduce tropical deforestation and its associated global warming emissions. Until now, power plants have been allowed to dump unlimited amounts of carbon pollution into the atmosphere. Now, for the first time, the EPA has finalized new rules, or standards, that will reduce carbon emissions from power plants by preparing Clean Power Plans.

ZINC DYNAMICS IN GANGA DIARA LAND SOIL

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The state of Bihar is located between 21°.58'.10" to 27°.31'.15" North latitude and 83°. 19'. 50" to 88°.17'.40" East longitude. *Diara* is the piece of land that has got created in the middle of the river Ganges as results of deposition of sands over the decades. The Ganga *diara* land soil belongs to Entisols order and lies between 25° and 26° N latitude and 84° and 88°E longitude. There are distributed in both north and south Bihar. These soils are derived from recent to young alluvium and are stratified with no appreciable development of diagnostic horizons. Considering the distance of the *diara* land from the main stream, these can be classified as lower *diara* lands, middle *diara* land and upper *diara* land. The *diara* land soils with their undulating landscapes are generally very light to medium heavy textured. The pH and electrical conductivity varies from 6.29 to 8.40 and 0.12 to 0.50 dsm⁻¹, respectively. The soils are poor to moderate in nitrogen, and poor to moderately rich in available phosphorus and potash. The extent of Zinc deficiency in this soil was 81 percent. Widespread occurrence of Zinc deficiency in these soil suggest that both native and applied form of Zinc react with the inorganic and organic phases in soil and thereby affects its availability. Zinc is known to occur in soil in a number of discrete chemical forms differing in their solubility and thus, availability to plants. The availability of this nutrient element to plant is governed by dynamic equilibria involving these different forms and the extent to which the Zinc in solution phase is buffered.

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT

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Global climate change, judging from the debate on the subject, is one of the major concerns of the world today. However, the concern of those closely following the debate is that it has created more panic than concrete strategies to abate and adapt to the global change. The situation seems to present a crisis where the uncertainties of predicted global change scenarios combine with the risk averse nature of decision makers to obstruct concrete action and encourage the "wait and see"

approach. However, the cumulative nature of warming may not permit the luxury of "wait and see". Hence, there is a need for action, despite the uncertainties of predicted changes; but action requires concrete contexts to facilitate anticipatory measures by the decision makers. In order to resolve the problem, one should look for certainty components in the complex of uncertainties that characterize the whole problem. Taking the lead from recent conceptual work on "cumulative change," as against "systemic change," to properly understand global environmental change. Though not a substitute for direct action against global warming, but this approach can help insofar as the problem is accentuated by cumulative types of changes such as deforestation and desertification. Its strong point is that it helps to integrate the concerns of current problems with those of the future impacts of global warming, and advocates dual purpose strategies to treat the two without being unduly obstructed by the uncertainties of global change-scenarios.

Keywords: Global climate change, wait and see, anticipatory measures, deforestation, desertification.

SUSTAINABLE LIVELIHOOD SECURITY IN UTTAR PRADESH

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Sustainable livelihoods is a way of thinking about the objectives, scope and priorities for development, in order to enhance progress in poverty elimination. Swaminathan (1991) has defined SLS as livelihood options that are ecologically secure, economically efficient, and socially equitable. Present paper focuses on sustainable livelihood security (SLS). The study was conducted in Uttar Pradesh state of India. Secondary data was collected for all the districts of the state from various published sources of government authorities and other related sources for the year 2015-16. Cross sectional data pertaining to area, production, productivity of different crops or crop groups, ecological, economic & social indicators and number of different livestock for the districts were collected. The Sustainable Livelihood Security Index (SLSI) proposed by Swaminathan (1991) was constructed for districts with the help of following three components: Ecological security index, Economic efficiency index and Social security index. Ecological security was highest in Maharajganj and was minimum in Ghaziabad. Economic efficiency index was maximum for Meerut and was minimum for Balrampur. Social equity index was highest for Allahabad district and was lowest for Shravasti district. Overall Sustainable Livelihood Security Index was maximum for Meerut and was minimum for Shravasti district. If the Ecological security index (ESI) of a given district has a lower value than those of other two indices, then projects focused on afforestation, agro-forestry, cultivated area and productivity enhancement, and livestock development should be accorded higher priority over the economic and social orientation programme. If Social equity index (SEI) of a certain district has a lower value as compared to ESI and EEI (Economic efficiency index) values, attention towards equity enhancing for better education, health facilities, sanitary living environment, and rural infrastructure for both road connectivity and electrification should be given a higher priority.

NATURAL RESOURCE MANAGEMENT

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Natural resource management refers to the management of natural assets such as land, water, soil, plant, sand animals, with a particular focus on how management affects the quality of life for both present and future generations. Natural resource management is the way in which people and natural landscapes interact. It brings together land use planning, with water management, biodiversity conservation, and the future sustainability of industries like agriculture resources, mining, tourism, and forestry. It recognises that people and their livelihoods depend on the health and productivity of our landscapes, and their actions as stewards of the land play an important role in maintaining the health and productivity. It could include the efforts of a number of organizations to preserve water availability and quality all over the world. Management of water is becoming especially important as regions of the globe become warmer and drier under the influence of global warming. Natural resources are especially vulnerable to over exploitation include forests, fisheries, and the agricultural capability of land. The term "natural resource management" encompasses a broad spectrum of activities and projects. This information bulletin is focused on those activities that specifically require the participation of local communities for their sustainable management. Examples of these kinds of projects include: micro-watershed management, irrigation water management, soil and water conservation, community forestry, community-based coastal zone fisheries management, and conservation of biodiversity. Experiences have shown that centralized "top-down" conservation is only effective with large expenditures on enforcement or under undemocratic circumstances. As an alternative, participation of different types of stakeholders is now considered to be essential for effective and sustainable management and conservation

of natural resource systems. It is generally accepted that participation by local communities can be fostered by a significant degree of decentralization.

Key word: Biodiversity conservation, global warming, Natural resource, Sustainable management

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION FOR SUSTAINABLE DEVELOPMENT IN ENVIRONMENT AND LIVELIHOOD

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A natural resource is not manmade but is already on the Earth. Natural resources are available to sustain the very complex interaction between living and non-living things. Humans also benefit immensely from this interaction. All over the world, people consume resources directly or indirectly. Developed countries consume resources more than under- developed countries. In what form do people consume natural resources? The three major forms include Food and drinks, Housing and infrastructure and Mobility. These three make up more than 60 % of resource use. Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals with a particular focus on how management affects the quality of life for both present and future generations. Natural resources management deals brings together land use planning, water management, biodiversity conservation and the future sustainability of industries like agriculture, mining, fishing, etc. The insight into sustainability provided by mainstream economics are taken much further by environmental and ecological economists. Sustainability view to assumptions about the conservation of natural resources, extending the analysis of externalities to provide a basis for designing antipollution policies and deciding on the resources it is desirable to devote to avoiding pollution, arrange of methodologies for evaluating the services provided by environmental assets and social capital to extend the inclusiveness of Cost Benefit Analysis. Model for projecting the pricing and depletion of finite resources and assessments of the implications of various access regimes governing the harvesting of renewable resources.

Keywords- Environment, Ecological economists, Natural resource management, sustainability.

METEOROLOGICAL DROUGHT ASSESSMENT USING STANDARDIZED PRECIPITATION INDEX AT ALMORA DISTRICT, INDIA

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Meteorological drought is a natural hazard characterized by the periods of occurrences of less than normal precipitation in a region and indicates a temporary reduction in the availability of water resource for a specific period. This study was conducted to assess the occurrence of meteorological drought and wet conditions using Standardized Precipitation Index (SPI) at Almora district located in Himalayan state of Uttarakhand, India. The SPI was calculated on 1-, 3-, 6-, 9-, 12- and 24-month time scales using monthly rainfall data of 115 years (1901-2015). The results of analysis revealed that the probability of occurrence of moderate, severe and extreme drought events was 0.66, 0.20 and 0.14 for SPI-1; 0.55, 0.24 and 0.21 for SPI-3; 0.58, 0.27 and 0.15 for SPI-6; 0.45, 0.37 and 0.18 for SPI-9; 0.44, 0.33 and 0.23 for SPI-12; and 0.47, 0.20 and 0.33 for SPI-24, respectively. Similarly, the probability of occurrence of moderate, severe and extreme wet events was 0.58, 0.28 and 0.13 for SPI-1; 0.64, 0.25 and 0.11 for SPI-3; 0.63, 0.28 and 0.09 for SPI-6; 0.66, 0.24 and 0.10 for SPI-9; 0.67, 0.26 and 0.07 for SPI-12; and 0.54, 0.38 and 0.08 for SPI-24, respectively. It is evident from the analysis that there are more chances (68%) of normal condition, and the occurrence of severe and extreme drought or wet events is unlikely at Almora district. There are relatively more chances of occurrence of moderate drought and wet conditions, which may be taken care of by adopting appropriate water/moisture conservation measures such as *in-situ* rainwater harvesting, mulching etc. for enhancing agricultural productivity in the region.

Keywords: Meteorological drought, Rainfall, SPI, Almora, Uttarakhand

ENVIRONMENTAL POLLUTION AND DISASTER MANAGMENT

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Environment pollution is a wide reaching problem and it is likely to influence the health of human populations is great study finds that these kinds of are not only seriously affecting the human by diseases and problems but also the animal ,trees and plants .According to author , still time left in the hands of global institutions, governments , local bodies to use the advance resources to balance the environment for living and initiates the breathed intellectuals to live friendly with environment .As we know India is one of the most disaster prone country of the world. It has had some of the world's most severe droughts ,

famines , cyclones , earthquakes , chemical disaster , mid-air head-on air collision , rail accidents and road accidents .In simple terms we can define disaster as a hazard causing heavy loss to life , property and livelihood .This paper deals with types of environmental pollution , disaster hazards and risk reduction are the main key points involved in environmental pollution and disaster .This paper also deals with role of GIS (GEOGRAPHIC INFORMATION SYSTEM) in it and awareness programs required for public , to save themselves from pollution and disaster.

Keywords: Environmental pollution, Disaster management , Geographic information system.

CONSERVATION OF NATURAL RESOURCE MANAGEMENT

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Natural resource management is the management of natural resource linked to human activities and monitor their usage and depletion and take necessary action to meet desired outcome. The main objectives of environmental resource management are environmental stability. It refers to the management of natural resource such as land, soil, plant and animals. And the conservation of the natural resource to stop rapid extension of natural resource. For this management issues are inherently complex. They involve complex ecological cycles like hydrological cycle climate and plants. All this are inter related and dynamic. Now a day it is very important to manage our resource. For this various approaches applied to natural resource management include: community- based natural management, adaptive management and integrated natural resource management. In (NRM) specific policy and action challenges directly impacting sustainability and productivity of natural resources are: technology fatigue, huge technology transfer/adoption gaps, collapse of extension system and serious knowledge deflection and gaps, collapse of extension system and serious poor institutional credit and insurance. Management is one of the major key factor of conservation of resource. Basically conservation is an ethic of resource use, allocation and protection. Its primary focus is upon maintaining the health of the natural world, habituated and biological diversity. Also focus on material conservation including non-renewable resources like metal, fossil fuels and energy conservation. We can't survive without natural resource so it is important to conserve our natural resources. simultaneously we have to manage our natural resource use. The goal and convictions of individuals and communities, appear fundamental to the adaption of human system because it is human who will, in the end, make the right and wrong decisions influencing the future.

CATASTROPHIC EVENT OF ENVIRONMENT

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An environment disaster or ecological disaster is a catastrophic event regarding the environment due to human activity. This distinguishes it from the concept of a natural disaster. It is also distinct from international act of war such as nuclear bombings. In this case, the impact of human's alteration of ecosystem has led to widespread and /or long lasting consequences. It can include the deaths of animals (including human) and plants, or serve disruption of human life, possibly requiring migration. Environmental disasters can have an effect on agriculture, biodiversity, the economy and human health. The cause include pollution, depletion of natural resources, custom industrial activity or agriculture. Seveso disaster- 1976 release of dioxin Amoco Cadiz oil spill- 1978, the vessel broke in two, releasing entire cargo of 1.6 million barrels (250,000 m³) of oil Ok tedi environmental disaster- 1948, as of 2006, mine operators have discharged about 2 billion tons of tailings, overburden and mine-induced erosion into the OK tedi river system. About 1,588 square kilometre of forest has died or is under stress. Bhopal disaster- 1984, release of methyl isocyanide gas and other chemicals some estimate 8,000 people died within two weeks, a government affidavit in 2006 stated the leak caused 558,125 injuries including 38,478 temporary partial. Chernobyl disaster- 1986, the official soviet count of 31 deaths has been disputed. An UNSCEAR report places the total confirmed deaths from radiation at 64 as of 2008. The eventual death toll could reach 4,000. Hanford nuclear-1986, the US government declassifies 19,000 pages of documents indicating that between 1946 and 1986, the Hanford site near Richland, Washington, released thousands of US gallons of radioactive liquids. Radioactive waste was both released into the air and flowed into the Columbia River. Fukushima daiichi nuclear disaster- 2011, was an energy accident, initiated primarily by tsunami following the Tohoku earthquake on 11 March 2011. Immediately after the earthquake, the active reactors automatically shut down their sustained fission reactions. The insufficient cooling led to three nuclear meltdown, hydrogen-air explosions and the release of radioactive materials. Level 7 event classification of the international nuclear event scale.

Keywords- Catastrophic, Disaster, Nuclear Disaster

THE EFFECT OF EROSION IN SOIL DEGRADATION IN DRYLANDS**ARCHANA VERMA^A, AKANSHA SINGH^B**^a*M.Sc. Deptt. Of Soil Science and Agricultural Chemistry, SVPUAT Meerut-250110, (U.P.)*^b*Ph.D. Deptt. Of Soil Science and Agricultural Chemistry, SVPUAT Meerut-250110,(U.P.)*

The effect of degradation of soil and lands as a result of high temperature and low rainfall in Dry lands have been seen as soil erosion and high losses of crops. The low amount of soil Water and increased soil temperature in dry lands resulted in low soil organic matter (SOM) Decomposition and by that increased soil organic carbon (SOC) accumulation and soil deficits Decreases the decomposition rate of SOM. The soil degradation involves erosion and Contamination which leads to low above ground net primary production (NPP). Damages by Wind erosion and deposition are also much accelerated by over exploitation of mearge Vegetation cover of dry lands. In poor irrigated lands the salinization affects highly productive lands and it is also one of a form of dry land degradation which causes particularly High loss of potential crops. So, the low NPP and high level of soil erosion is caused by soil Degradation in dry lands which is the result of low water table and high temperature of both Soil and climate.

CLIMATE SMART AGRICULTURE: NEED OF HOUR**¹ASHAQ AHMAD, ¹ROHEELA AHMAD, ²UMER BIN FAROOK, ²DANISHTA AZIZ, ²SHAFIYA RASHID**¹*Division of Soil Science and Agricultural Chemistry, SKUAST, Kashmir* ²*Division of Entomology, SKUAST, Kashmir*

Multiple climate changes have occurred over the past several decades across the world, including increasing temperatures, changes in water availability and precipitation, and increasing instances of floods. These changing climatic conditions, especially over the last twenty years, have presented multiple risks to the country's agricultural sector, affecting the productivity and quality of crops. Marked changes in rainfall dynamics, with more frequent and intense precipitation events, and more frequent and pronounced drought events that disrupt farming and other economic activities, have presented new challenges for farmers. Farmers are now forced to respond to these adverse changes that affect the way they are familiar to farming and threaten to destabilize the economic viability of many farming communities. These changes, along with increasing climate variability, have influenced soil fertility, crop selection, and harvesting times. The emerging challenges have prompted a need for change in agricultural practices and technologies on the islands. Innovators in the community of farmers in world have realized that to tackle these issues, both mitigation and adaptation measures need to be implemented, and have thus committed to working towards creating more resilient agricultural systems.

Keywords: Climate, Smart, Agriculture, Floods, rainfall, soil fertility**BIODYNAMIC FARMING: A WAY OF SUSTAINABLE AGRICULTURE****ASHEESH CHAURASIYA, DURGESH SINGH, AND SWARAJ KUMAR DUTTA, SHAMBHU PRASAD***Department of Agronomy, BAU, Sabour, Bhagalpur- 813210*

Biodynamic agricultural is an innovative and potentially sustainable method of farming developed in the 1920's by Dr Rudolph Steiner. It was developed in order to tackle the growing problem of soil erosion that was occurring at the time. Biodynamic farming not allowing the use of chemical pesticides and fertilisers and instead opt to use something very unique preparations. These preparations are made up of totally natural substances which are usually sourced from the farm itself. The research found in terms of sustainability biodynamic agriculture is one of the most sustainable agricultural practices in modern day farming. It has no adverse effects on the environment, produces no waste, as everything that would typically be deemed as waste, is recycled to other parts of the farm. The study found that preparations 500-507 do have beneficial effects on the soil and its quality. The main findings were that compost treated with biodynamic preparations contained 10% less Carbon Dioxide (CO₂), had a higher ratio of dehydrongenase enzyme to CO₂ production and had increased microbiological movement. Additionally it was also found that the treated composts were typically of a higher average temperature and increased organic matter content. The Biodynamic farming systems generally have better soil quality, improved biological soil properties, lower yields than their conventional counterparts. All of these findings are factors which enable decomposition to occur faster, which produces a greater quality of soil. If soil is of good quality then the quality of crops grown in the soil will also be better. In sereral studies was found that we still need to rely on conventional agriculture to meet our global food demand. This is because currently, our alternative options are just not sustainable enough yet and need more time to develop. overall, biodynamic farming could be a feasible option for the future. However in order for this to happen, additional measures must be taken in order to make biodynamic agriculture more sustainable.

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT

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Climate change is one of the most pressing challenges the world faces today. It involves many dimensions –science, economics, society, politics, moral and ethical questions and is a global problem, felt on local scales that will be around for decades and centuries to come. The earth is warming mainly due to greenhouse gas emissions generated by humans, with potentially damaging consequences. The challenge is take effective action to address the issue. Climate change has always been a Plan A priority. In 2007, Plan A was launched with 29 targets to tackle climate change. In 2017, a bold and approved science-based target was made to foster the efficiency of our own operations as well as cutting 13.3m tones of CO₂ e from our wider value chain. It's clear that our climate is already changing, and our business needs to be able to cope with extreme weather events. Responding to climate change involves two-pronged approach. Firstly, reducing emissions of and stabilizing the levels of heat-trapping greenhouse gases in the atmosphere (Mitigation) and secondly adapting to the climate change already in the pipeline (Adaptation). According to the 2014 report on Climate Change Impacts, Adaptation and Vulnerability from the United Nations Intergovernmental Panel on Climate Change, governments at various levels are also getting better at adaptation. Climate change is started to be factored into a variety of development plans: how to manage the increasingly extreme disasters we are seeing and their associated risks, how to protect coastlines and deal with sea-level encroachment, how to best manage land and forests, how to deal with and plan for reduced water availability, how to develop resilient crop varieties and how to protect energy and public infrastructure.

Keywords: Adaptation, mitigation, vulnerability, disasters, encroachment

SOIL QUALITY AND SUSTAINABLE AGRICULTURE

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Soil is the world's most vital component for food and fiber production: preservation of this critical natural resource is paramount for protecting the environment, and ensuring that current and future populations are healthy and well-fed. Soil quality is the critical component of sustainable agriculture. Soil quality can be conceptualized as a three-legged stool, the function and balance of which requires an integration of three major components — sustained biological productivity, environmental quality, and plant and animal health. The concept attempts to balance multiple soil uses (e.g., for agricultural production, remediation of wastes, urban development, forest, range, or recreation) with goals for environmental quality. Many decades of research have consistently shown that the best means of improving and restoring soil quality and productivity is by proper and regular additions of organic materials mainly through the use of crop rotations, cover crops, crop residues, animal manures, composts, and reduced tillage. Soil organic carbon (SOC) is the most often reported as the most important indicator of soil quality and agronomic sustainability because of its impact on other physical, chemical and biological indicators of soil quality. Often the topsoil is lost at a rate that far exceeds the capacity of natural processes to regenerate it. With soil degradation, there is a concomitant decline in soil quality, i.e., the soil's capacity to produce healthy and nutritious crops, resist erosion, and reduce the impact of environmental stresses on plants. Society is demanding solutions from science. Simply measuring and reporting the response of an individual soil parameter to a given perturbation or management practice is no longer sufficient. The soil resource must be recognized as a dynamic living system that emerges through a unique balance and interaction of its biological, chemical, and physical components.

Keywords: Agricultural sustainability, soil organic carbon, environment quality.

RAINFALL - RUNOFF MODELLING FOR ASSESSMENT OF CLIMATE CHANGE

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Water is one of the most important natural resource and a key element in the socio-economic development of a state and country. Water influences every sphere of the environment supporting life on earth. Its varying availability in time and space is a matter of concern to the mankind since fresh water is not an ever-present resource. Rainfall generated runoff is very important in various activities of water resources development and management, such as flood control and its management, irrigation scheduling, design of irrigation and drainage works, design of hydraulic structures, hydropower generation, and so on. The method of transformation of rainfall to runoff is highly complex, dynamic, nonlinear and exhibits temporal and spatial variability. A model is a simplified representation of a real world system, and consists of a set of simultaneous equations or a logical set of operations contained within a computer program. Runoff is one of the most important hydrologic

variables used in most of the water resources applications. A rainfall- runoff model is a mathematical model describing the rainfall - runoff relations of a catchment area, drainage basin or watershed. The Rainfall Runoff Library (RRL) is designed to simulate catchment runoff by using daily rainfall and evapotranspiration data. The incremental scenarios – also called synthetic or arbitrary scenarios – are the easiest scenarios one can develop and apply, and so the first one ever implemented. In those scenarios, one climatic parameter mean temperature, precipitation amount, etc is changed incrementally, perturbed from its historical records. This can provide quickly information on a wide range of possible changes, by allowing the test of a lot of different parameters, to generate different future climate and it is applicable in any area of study.

Keywords: RRL AWBM Model, Evapotranspiration, Climate Change, Irrigation scheduling, Incremental scenarios.

THE SPATIO DISTRIBUTION AND INVESTIGATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN ROAD DUST OF MEERUT CITY

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The spatio concentration of polycyclic aromatic hydrocarbons (PAHs) in the road dust of Meerut area is described. Total 10 samples from three sites: Traffic, Industrial and Residential were collected for the investigation. Among them, 8 samples were taken from the traffic site for the investigation. The most toxic twelve PAHs i.e. phenanthrene, anthracene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno [1,2,3-cd]pyrene were chosen for the study in the present work. The concentration of Σ PAHs in the road dusts (n = 8) of traffic site was ranged from 8.69 – 21.69 mg/kg with mean value of 12.74 $\pm$ 2.81 mg/kg. The toxicities, sources, correlation, variations and comparison with other sites are discussed.

Keywords: Spatio; PAHs; Road Dust; Toxicity; Source; Traffic

THE DISTRIBUTION, TOXICITIES AND SOURCES OF PCBS CONCENTRATION IN THE ROAD DUST OF MEERUT

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The spatio concentration of **Polychlorinated Biphenyl** (PCBs) in the road dust of Meerut area is described. Total 10 samples from three sites: Traffic, Industrial and Residential were collected for the investigation. Among them, 8 samples were taken from the traffic site for the investigation. At least 96 PCB congeners out of 209 were detected in the road dusts. The concentration of Σ PCBs in the road dusts (n = 8) of traffic site was ranged from 98 – 548 μ g/kg with mean value of 248 $\pm$ 201 μ g/kg. The toxicities, sources, correlation, variations and comparison with other sites are discussed.

Keywords: Spatio; PCB; Road Dust; Toxicity; Source; Traffic

GIS AND REMOTE SENSING APPLICATIONS IN NATURAL RESOURCE MANAGEMENT

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Natural resources are essential to the economy of a nation since they play a critical role in the provision of employment, they are a source of raw materials for various industries, acts as a source of food and income, medicine as well as energy. The aesthetic beauty that relates to natural resources is always regarded as the cultural representation of nations. Remote sensing (RS) and Geographical Information System (GIS) offers an abundant opportunity to monitor and manage natural resources at multi-temporal, multi-spectral and multi-spatial resolution. World's ecosystems are in a state of constant change at various spatial and temporal scales by a variety of socio-economic and environmental factors. We can compile the various applications of remote sensing and GIS tools that can be used for natural resource management such as-agriculture, water, forest, soil and natural hazards. With the rising pressure on natural resources due to the increasing human population and climate change, remote sensing and GIS can be used to manage these precious limited resources (renewable and non-renewable) in an effective and efficient manner. In natural resource management, remote sensing and GIS is mainly used in the mapping process. These technologies can be used to develop a variety of maps such as-land cover maps, vegetation maps, soil maps and geology maps. Geospatial information are quite useful in the identification and analysis of factors that affect the utilization of these resources in the nature. Reduced agricultural and livestock production, declining revenue, as well as increased conflict from resource competition between farmers and pastoralists are expected for the future. Hence, with the

detailed understanding of these factors sound decisions can be arrived at that will ensure the sustainable use of natural resources to meet the needs of the current as well as future generations.

Keywords: GIS, Remote sensing, Natural Resources, Affecting factors and Management.

DROUGHTS: CAUSES, IMPACTS AND MITIGATION STRATEGIES

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Drought is a protracted period of deficient precipitation. It is also related to the timing of precipitation. Further, climatic features which are often associated with drought are high temperature, high wind speed, and low relative humidity. This dearth results in a water shortage and has a very high impact on food production. It also reduces life expectancy and the economic performance of affected areas. Droughts can reduce water quality because lower water-flows reduce dilution of pollutants and intensify contamination of water sources. The definitions of drought are region, occurrence and impact specifically. Different drought forms like meteorological (deficiency of precipitation), hydrological (diminishing water resources), agricultural (dearth of soil moisture), socio-economic (surplus demand for economic commodities due to a shortfall in water supply) are obsessed by different variables/phenomena. Owing to reduced precipitation, when the principal productivity of natural ecosystem declines significantly then ecological drought occurs. The major impacts of drought are classified under three categories i.e. social, environmental and economical. Thus, to cope with the harmful effects of drought, planning for its mitigation is necessary. Mitigation strategies include, monitoring of the coming drought and its early warning, soil and water conservation techniques, afforestation, management of watershed, waste management, energy management etc.

Keywords: Meteorological droughts, Hydrological droughts, Agricultural droughts, Socio-economic droughts, and Ecological droughts

GLOBAL WARMING – A MANMADE CLOUD OF DESTRUCTION

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Global warming is the present burning issue for the world nations. Global warming mainly caused due to increase in the levels of CO₂, N₂O, CH₄, Chlorofluorocarbons which are emitted from the various industries causing the so called greenhouse effect. The rapid urbanization and industrialization during post world war II without considering the effects of that work led to the situation called global warming, which is considered the major constraint for life on earth as this resulted in the increase of earth's temperature at a range between 0.4-0.8°C. Scientists calculate about 1.5°C rise will be by 2100 which eventually leads to the complete melting of polar ice caps. Due to global warming polar ice caps and glaciers started melting as a result there is rapid increase in the sea levels which is posing a great threat to the coastal countries and with that climate has become unstable without able to get predicted by the scientists. These changes are causing excessive heavy rainfall at one place and drought in other places. According to NASA the average rise in sea level is 3.5mm/year and CO₂ levels are raising beyond 409ppm while the polar ice is decreasing by 13.2% which is about 413 gig tons per year. Scientists from intergovernmental panel are raising alarm about the depleting situation and urging the governments to form strict policies regarding the emission of these gases. Due to global warming one of the most affected field is that of agriculture. There is a steep decline in the global food production as the instability in the rainfall and high temperatures and also the decrease in the ground water are all collectively responsible for this decrease. Global warming is the reason behind the fluctuation in atmospheric activity which causes the change in the seasons for the crop setting, vegetative and reproductive phases of different crops. The positive side of global warming on agriculture is that the increase in CO₂ concentration could boost the photosynthesis rate (called CO₂ fertilization effect) that too till a certain extent but this global warming has a lot of deleterious effects than positivity. So, efforts should be done by the scientists to release such varieties of crops that can withstand the atmospheric fluctuations without decreasing the present global food productivity and on the other side, aware the world population about the harmful effects of global warming and minimize the emissions of harmful gases from industries.

WATER AND WATER-SAVING OUTLINES FOR SUSTAINABLE CROP PRODUCTION IN FUTURE CHALLENGES**SARVAJEET¹, P. K. SHARMA¹ AND SHUBHAM KUMAR MAURYA²¹***Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences**Banaras Hindu University Varanasi, U P -221005² College of Agriculture CSAUA&T Kanpur, U P*

Water is a limited resource worldwide and irrigated agriculture remains one of the biggest and most inefficient users of this resource. Growing world population and the uncertain risks that accompany climate change put an increasing pressure on the management and sustainability of scarce environmental resources, particularly water. In spite of its water scarcity, the use of water for agricultural production in water scarcity regions requires pioneering and sustainable research programme and an appropriate transfer of technologies. The water-saving agricultural systems and approaches to improve agricultural water use efficiency in the arid and semi-arid regions. The biological mechanisms of water-saving agriculture and water-saving irrigation technologies, including low pressure irrigation, furrow irrigation, plastic mulches, drip irrigation under plastic, rainfall harvesting and terracing. The need to integrate green and blue water management is emphasized in a future scenario of water availability under climate change and population growth. World-wide there is an enormous challenge to produce almost 50% more food up to 2030, and double production by 2050. For 2050, the scenario indicates that 59% of the world population will face blue water shortage, and 36% will face green and blue water shortage. Based on input-output techniques, we simulate the scenarios aiming at saving 19% of the water available, a figure set by the first of them based on improving the efficiency of the current irrigation management system. In order to ensure the sustainable development of agriculture, especially food security, the future water-resources strategy must focus on changes in agricultural water-saving technology to increase the efficiency of use of precipitation and irrigation water.

CLIMATE RESILIENT TECHNOLOGY TO SMALL FARM COMPLEXITIES FOR SUSTAINABLE ECONOMIC DEVELOPMENT UNDER NICRA PROJECT IN DISTRICT MORENA (M.P.)**DEBESH SINGH, DHARVENDRA SINGH, S.P. SINGH, S.V.S. CHAUHAN, AJAY BHADAURIA**

Farming in environmentally fragile ecosystems always portrays a distressed picture with sustenance production level often leading to poor nutrition, aggravated vulnerability to climate related constraints ultimately resulting in low farm income and poor economic status of the farmers. Farming in said –Atta village adopted under NIRA project was not an exception to the farming in most of the rain fed area as it strictly represents every feature of a rain fed ecology viz., rugged and undulated topography, and water scarcity during most of the cropping seasons and proneness to weather aberrations. More frequent prolonged dry spells or drought during crop growth stages, excessive moisture condition during rainy season, nutrient mining and low response of nutrients ultimately adds to the low production and productivity of the crops in the village. Small size of land holding of the farmers is a major factor squeezing their cushion to face the climate related environmental latencies in agriculture and making them more prone by limiting their capacity to take initiative for technology adoption aims to provide resilience in agriculture. In NICRA village technologies were demonstrated under four modules viz., natural resource management (NRM), crop production, livestock and fisheries, institutional interventions (capacity building and extension activities). The objective of these technological interventions was to enhance the production and productivity of crops and livestock while organising the rural folk under the ambit of rural institutions and building the capacity of the farmers to understand.

STRATEGIES FOR SOIL MOISTURE CONSERVATION UNDER CHANGING CLIMATIC CONDITION FOR HIGHER CROP PRODUCTION IN RAINFED AGRICULTURE**DHARMENDRA GAUR^{*1}, KALPANA SHARMA¹, RAHUL KUMAR¹, HEMLATA DHAKAD¹ AND ANJU SHARMA²**¹ Ph. D. Scholar, College of agriculture, RVSKVV, Gwalior, MP, 474002² M. Sc. (Ag) Horticulture, College of agriculture, RVSKVV, Gwalior, MP, 474002

Rain fed agriculture is the farming practices that rely on rainfall for water (IWM, 2010). Rainfed agro-ecosystems occupy a considerable place in Indian agriculture, covering 80 M ha in arid, semi arid and sub humid climate zones; constituting nearly 57 % of the net cultivated area. Rainfed agriculture supports 40 % of human population and 60 % of livestock population. Much of acreage under coarse cereals (85 %), pulses (83 %), oilseeds (70 %), substantial area under rice (42 %) and nearly 65 % of cotton area are Rainfed. Rainfed agriculture is likely to be more vulnerable in view of its high dependency on monsoon and the likelihood of increased extreme weather (Rao et al., 2016). Hence, directly effect on soil moisture depletion. Therefore, agronomical, mechanical, forestry and agrostological measures are to be adopted for conserving the soil moisture so that higher crop production in rainfed agriculture could be achieved. Under agronomic practices conservational tillage coupling with optimum crop geometry at optimum soil moisture would be remunerative. Among mulches; organic

mulch followed by inorganic mulch are the good means for moisture conservation when coupled with drip and sprinkler irrigation. Application of superabsorbent also would be remunerative under water scarcity. Among mechanical practices water harvesting and ridge and furrow are the appropriate way to conserve moisture in Rainfed agriculture Watershed development, agroforestry and alternate land use system are the way to conserve moisture in non cropped area of Rainfed agriculture.

RUMINANT ANIMALS PRODUCING DETRIMENTAL GREEN HOUSE GASES IN THE ENVIRONMENT

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Livestock contributes in climate change through the emission of GHGs such as methane (CH₄) via enteric fermentation and manure management, nitrous oxide (N₂O) via manure management, application and deposition of manure and indirect N₂O emissions from fertilizers used for feed and fodder production and from leguminous feed crops and carbon dioxide (CO₂) emission related to fossil fuel burning. These three GHGs together contribute 18% of global GHG emissions which includes 9% of global CO₂, 37% CH₄ and 65% N₂O anthropogenic emissions. At global level GHGs emissions by livestock sector consist of enteric fermentation (39%), manure management (26%), feed (21%), land-use change (9%), energy and post-farm activities (5%) respectively. Methane is emitted from a variety of anthropogenic and natural sources. More than 70 percent of global CH₄ emissions are related to anthropogenic activities. Anthropogenic sources include fossil fuel production and use, animal husbandry (enteric fermentation in livestock and manure management), paddy rice cultivation, biomass burning, and waste management. Emissions from enteric fermentation of the domestic livestock contribute significantly to GHGs inventories. Emissions from animal facilities primarily consist of animal respiration and enteric fermentation. In addition, emissions from manure storage are also believed to be a potential source of CH₄.

Keywords: Livestock, Green House gases, fertilizers, fermentation

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT

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Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions. Factors that can shape climate are called climate forcing. These include processes such as variations in solar radiation, variation in the earth's orbit, variation in the albedo or reflectivity of the continent, changes in greenhouse gas concentrations. Certain gases in the atmosphere, known as 'green house' gases like CO₂, CO, CH₄ are able to absorb and emit heat. When sunlight strikes the earth's surface it warms up, emit heat, some into space and some back down to earth, which results in heating up of the earth atmosphere, also known as Global warming. Management of climate change and global warming possible by adaptations of mitigation strategies like Carbon reduction which includes rationalization of coal use, reduction of gas- flaring, installation of waste heat-recovery system, use of gas, hydropower, renewable, Solar, Wind energy, Biogas, Afforestations and land restoration. Carbon Sequestration also known as "carbon capture and storage", It is a geo-engineering technique for the long-term storage of carbon dioxide (or other forms of carbon) and Carbon trading is an exchange of credits between nations designed to reduce emissions of carbon-dioxide. The carbon trade allows countries that have higher carbon emissions to purchase the right to release more carbon dioxide into the atmosphere from countries that have lower carbon emissions.

EFFICIENT UTILIZATION OF SOIL AND WATER RESOURCES FOR SUSTAINABLE CROP PRODUCTION

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With the burgeoning human population, pressure to meet the requirement of global crop production is increasing. To meet the instant production, faulty agricultural management practices are being followed which lead to poor soil fertility and resource use efficiency. However, agricultural production is mostly based on seasonal rainfall in India. Therefore, it is necessary to have better management of primary agricultural resources especially soil and water for sustainable crop production. Among the soil resource management, crop selection, tillage and nutrient management are most important practices. Crop selection based on the soil properties may ensure higher yield and maintains soil fertility. Conservation tillage (zero and minimum tillage) practices reduces the cost of cultivation due to savings in fuel and labours, reduced weed density, saving of irrigation water by 15-20% and build up in soil organic carbon owing to reduced crop residue burnings. Site specific nutrient management may reduce soil as well as environment pollution and will also improve the resource input efficiency which leads to reduce cost of cultivation. Inadequate water management may decline crop yield. Both excess as well as deficit water

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is harmful for better crop production. Micro-irrigation is a vibrant option for water supply for sustainable crop production. Drip and sprinkler irrigation are the well-known example of micro-irrigation. They reduce the water loss and increase crop yield. On the other hands, water quality also affects the crop production. Conjunctive use of canal as well as well/saline water in rotation may also help in reducing the ill effects of poor quality water. Hence, the judicious utilization of soil and water management practices may leads to better crop production in a sustainable manner.

Keywords: Soil, Water, Sustainable Crop Production, Micro-irrigation

DEVELOPMENT OF BETTER HAZARDOUS WASTE MANAGEMENT STRATEGIES IN INDIA

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Management of hazardous wastes including their disposal in environment friendly and economically viable way is very important and therefore suggestions are made for developing better strategies. The present paper outlines the steps towards planning, designing and development of models for effective hazardous waste management.

NATURAL RESOURCES MANAGEMENT & THEIR CONSERVATION

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Natural resources Management focuses on the need of sustainable management of the Earth's depleting natural resources such as clean water. Energy, minerals and biological resources in relation to the growth of the human population. Natural resources are usually either renewable or non renewable. The former refer to those resources that can renew themselves in the time. These include living resources like forests or non living once like wind, water solar energy. To have an environmentally sustainable future where we can still enjoy natural resources we urgently need to transform the way we use resources by completely changing the way we produce and consume goods & Service. Natural resources especially water and soil are essential for the function and structure of Agricultural production systems and for the overall social and environment sustainability. Natural resources management requires integrative thinking and problem solving that synthesizes both ecological and social components. The United Nations conference for the environment and development held in Rio De Janeiro in 1992, most nations subscribed to new principles for the integrated management of Land, water and forest. These days natural resources management projects include studies of. Community- based conservation, Ecotourism and sustainable development, Human responses to global environmental, Human wildlife interactions, Local environmental resources governance.

ENVIRONMENTAL EFFECTS OF PESTICIDES

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Pesticides present the only group of chemicals that are purposely applied to the environment with aim to suppress plant and animal pests and to protect agricultural and industrial products. However, the majority of pesticides is not specifically targeting the pest only and during their application they also affect non-target plants and animals. Repeated application leads to loss of biodiversity. Many pesticides are not easily degradable, they persist in soil, leach to groundwater and surface water and contaminate wide environment. Pesticides enter the soil via spray drift during foliage treatment, wash-off from treated foliage, release from granulates or from treated seeds in soil. Some pesticides such as soil fumigants and nematocides are applied directly into soil to control pests and plant diseases presented in soil. The transport, persistence or degradation of pesticides in soil depend on their chemical properties as well as physical, chemical and biological properties of the soil. All these factors affect sorption/ desorption, volatilisation, degradation, uptake by plants, run-off, and leaching of pesticides. Water contamination depends mainly on nature of pesticides (water solubility, hydrophobicity), soil properties, weather conditions, landscape and also on the distance from an application site to a water source. Depending on their chemical properties they can enter the organism, bioaccumulate in food chains and consequently influence also human health. Overall, intensive pesticide application results in several negative effects in the environment that cannot be ignored.

Keywords: pesticide, soil and water contamination, human health

PLANNING & MANAGEMENT FOR FREE AIR POLLUTANT ENVIRONMENT

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It has become a very important topic in today's time for the growing population and its future. We can give a good environment and a good air for inhale with industrialization and modernization under it, a good milieu from pollutant air, along with this many diseases like asthma, sterile diseases can be relieved because many diseases Carrier found in air to get rid of them can be found. It is useless to imagine good health without good environment. The most polluting factor of the air is industrialization included sugar industries chemical industries, firecracker factories etc. The second factor is modernization included changing milieu and increasing numbers of vehicles and more uses of A.C and the gases emitted from the dump of waste, so we cannot stop modernization and industrialization so along with to reduce air pollution. We have to make some plans like roof gardening, plantation of more oxygen producing plants, indoor gardening, develop forestry, spekboom revolution. We need some adoption of managements like air purifier, decomposers of waste, avoid of rice cultivation, should be adopt fuel free vehicles, plantation of leguminosae plants, etc. Some schemes going on successfully but some management systems will need to develop and adopt.

Keywords: Industrialization, Modernization, Roof gardening, Milieu.

TECHNIQUES OF SOIL AND WATER CONSERVATION FOR SUSTAINABILITY

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Soil and water conservation its most important for sustainability of agriculture and environment. Forthcoming increasing demand for healthy food & environment. Green environment & natural food for precious health only possibility based on Agriculture sustainability, Sustainability depends on soil and water conservation. Water is one most important for living things without water we cant imagine any life ,life needs food ,food we cant produce without conservation of soil with nutrient value. Soil and water resources are being deteriorated due to different anthropogenic and natural factors. Soil erosion several major deteriorative process which is removal of soil due to movement of water and air , Deforestation, overgrazing mismanagement of cultivated soils these agencies which are responsible of soil erosion. Application of fertilizer is the second pollutant factor which promote to barren land and deterioration of soil moisture, humus, organisms and soil productivity. For sustainability our first necessity conservation resources of soil & water and develop techniques & systems against erosion or diminution. Concept of soil conservation cannot be putted into effective without conserving and efficient use of water resources. Its pre-requisite should be adopted water conservation practices: water harvest techniques, check dams, terraces, contour bunding. Soil conservation practices: soil management, farming systems , agronomical practices, range management and forestry operation.

Keywords: Green environment, sustainability, conservation, Farming system.

CARBON SEQUESTRATION FOR CLIMATE CHANGE MITIGATION

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Anthropogenic activities have led to an increase in atmospheric concentration of CO₂ and the resultant global warming, leading to the reduction in arctic snow cover, rise in sea level, decline in crop yield, change in biodiversity and increase in food insecurity. There is a strong link between food insecurity, soil degradation, and climate change. Yet, the twin crisis of climate change and food insecurity, which may define the future, can be addressed through restoration of the soil organic carbon (SOC) pool and improvement in soil quality. Among several solutions to mitigate climate change, an important option is sequestration of carbon in agro ecosystems, especially in agricultural soils. 'Carbon sequestration' is commonly used to describe any increase in SOC content caused by a change in land management that increased soil carbon storage and mitigates climate change. This is only true if the management practice causes an additional net transfer of C from the atmosphere to land. Converting the wastelands to forest, grassland or perennial crops will remove C from atmospheric CO₂ and genuinely contribute to climate change mitigation. The climate change benefit of increased SOC from enhanced crop growth must be balanced against greenhouse gas emissions. Carbon sequestration for climate change mitigation includes following constraints: (i) the quantity of C stored in soil is finite, (ii) the process is reversible and (iii) even if SOC is increased there may be changes in the fluxes of other greenhouse gases, especially N₂O and methane. An over-emphasis on the benefits of soil C sequestration may be done by slowing deforestation, breeding plants with deeper root systems so that additional C is directly deposited at depth and increasing efficiency of N use in order to decrease N₂O emissions.

Keywords: Carbon Sequestration, Climate Change, SOC

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION**FARAH FAROOQ*¹, SHAH AAMIR², TABASUM MANZOOR³, HEENA ALTAF⁴**¹*Division of Agriculture Extension and Communication, FOA, Wadura, SKUAST-K*

Natural Resource Management (NRM) refers to the sustainable utilization of major natural resources as land, water, air, minerals, forests and wild flora and fauna. These resources together provide the ecosystem services which provide better quality to human life. Natural resources provide fundamental life support in the form of consumption and public good services. Ecological processes maintain soil productivity, nutrient recycling, cleansing of air and water and climatic cycles. A sustainable management of natural resources is necessary because it helps in the conservation of a replenishable resource which otherwise may get depleted soon and the depletion of one resource may affect other resources too. This will also prevent pollution and maintain our ecosystem. Conservation of natural resources needs to be viewed as proper utilization of natural resources. Absolute conservation encompasses the quality and quantity of natural resources. Re-use, recycling and minimum use of non-renewable resources like fuel, coal and minerals help in their conservation.

Keywords: Management, Conservation, Re-use, Recycling, Natural resource.

UPTAKE AND PARTITIONING OF CD, CR, NI AND PB IN VARYING ORGANS OF *LUFFA AEGYPTIACA* TREATED WITH THESE HEAVY METALS IN CONCENTRATIONS EQUIVALENT TO THAT IN GANGA RIVER SEDIMENTS AT ALLAHABAD.**FAUZIA NAUSHIN AND FAREED AHMAD KHAN***Department of Botany, Section of Ecology and Environmental Botany, Aligarh Muslim University, Aligarh*

The pot experiment was conducted to determine the uptake of Cd, Cr, Ni and Pb in *Luffa aegyptiaca* treated with these heavy metals singly and in combination of all four in quantities as determined on AAS in the Ganga river bank sediment samples collected from Allahabad. The seed of *Luffa aegyptiaca* were sown in 25 cm pots filled with acid washed sand and kept in polyvinyl trays. Ten days after germination, the aqueous solution of Cd, Cr, Ni and Pb (Cd 37.93 µg g⁻¹, Cr 105.7 µg g⁻¹, Ni 230.9 µg g⁻¹, Pb 7.7 µg g⁻¹, respectively as determined in the sediment samples) were added singly and in combination of all four. The accumulation of these heavy metals was determined (on AAS) in root, stem, leaves, unwashed fruit, washed fruit and fruit peel in 75 days old plants. The accumulation of all four heavy metals was higher in all plant organs when each of the heavy metal was applied singly than when applied in combination of all four heavy metals. The combination of all four heavy metals in quantities occurring in soil sediments of Ganga river bank at Allahabad thus had antagonistic impacts on uptake and their subsequent partitioning in various organs of *Luffa aegyptiaca*.

Keywords: Ganga River, *Luffa aegyptiaca*, Heavy metals, Partitioning

POSSIBLE EFFECT OF CLIMATE CHANGE ON INSECT-PESTS DISTRIBUTION**GAURAV SINGH***Division of Entomology, Indian Agricultural Research Institute, New Delhi*

In India, Agriculture is the major economic sector which includes nearly 62 per cent of the country's total population and occupies 42 per cent of its total geographical area. India is major producer of crops such as rice, wheat, cotton, maize, sorghum, sugarcane, pulses, tea, coffee etc. There are several constraints in production of crops. Among them, one is the infestation of insect-pests during crop cultivation and level of infestation of insect largely depends upon prevailing environmental conditions of that region. Therefore, it is highly expected that climate change may serve as major driver for accelerating the multiplication rate of insect-pests. It also can substantially affects the development and distribution of insects. In future it may stimulate major changes in insect-pests diversity, their geographical distribution, population dynamics, abundance, evolution of biotypes and extinction of species etc. It may also have affect on efficacy of crop protection technologies. Major insect-pests of economically important agricultural crops, such as cereal stem borers (*Chilo partellus*, *Sesamia inferens*, and *Scirpophaga incertulas*), pod borers (*Helicoverpa armigera*, *Maruca testulalis* and *Spodoptera litura*) and sucking pests like aphids, whiteflies may move to temperate regions at higher altitudes, leading to greater damage in cereals, grain legumes, vegetables, and fruit crops. There will be increased risk of invasion by migrant insect- pests species which may proliferate in absence of effective pest control strategies. By 2050, it may leads to 2.4 to 2.7-fold elevation in global pesticide use. Global warming has resulted in increased overwintering survival of *Helicoverpa* sp. which may put forth major constraint in production of maize in different countries. Diapause period of insect may be reduced (due to depletion of major stored nutrients) that provide more time for insect-pests to feed and develop on crops. There are chances that climate change would affect insect survival due to increased population and decreased winter mortality which may result in more crop damage by insect-pests under global warming scenario.

Key words: Infestation, Climate change, Distribution, Abundance

A VIEW ON WASTE WATER MANAGMENT AND USE OF SUPER ABSORBANTS POLYMERS

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Water resources play a vital role in the development of human civilization. Expanding of urban and industrial setting in the developing countries lead to increase waste water production which need to be safely disposed. Thus, there is a need to increase water use efficiency to meet the increasing demand. However, waste water is known to be a source of contaminations such as heavy metals, acids which are harmful to environments as well as human health. Use of Super absorbents polymer (SAP) is an water conservation technique in agriculture and is also used in all the different parts of the world. It is hypothesized that the use of SAP and SAP biochar mixture would ensure safe use of waste water in agriculture because of SAP's ability to absorb and biochar's ability to absorb contamination.

Keywords- Waste water management, SAP

FLOOD -A DISASTER AND ITS MANAGEMENT

HARITHA ENUMULA

Disaster is the widespread destruction of life and property. Flood means the submergence of an area due to heavy rains, cyclones, tsunamis, melting of snow etc. It affects the ecosystem of the area and it also avails the favourable environment for spread of cholera, diarrhoea like diseases. Food scarcity also avails as various standing crops will be damaged and houses, huts, roads, bridges, railway tracks, cables, electric poles, powerlines, etc., are also badly affected. The main objective is to have advance knowledge on flood regimes [past and future] & provide guidelines for infrastructure design and also advance knowledge is necessary on flood forecasting systems & enhanced understanding of direct and indirect flood impacts at local and regional scales is essential for flood risk management, planning future development, for sound Science based policy making. Managing present day & future risk from flooding involves a combination of risk avoidance and risk reduction activities. Flood risk assessments incorporate an understanding of impacts of climatic change on flood hazards. Government of India commissioned a national flood commission in 1976. Management practices include defences such as levees, bunds, reservoirs, & weirs are used to prevent rivers from bursting their banks. When these defences fail, emergency measures such as sandbags or portable inflatable tubes are used. They also include removal of unwanted silt from river, reforestation etc. Flood cannot be absolutely controlled, it can only managed to reduce losses. However, floods have claimed so many lives in the last few years but we have to live with it because it is the part of nature's cycle the only thing we can do is stay clear of the flood if it occurs and always be ready for it.

SUSTAINABLE DYEING TECHNIQUE USED IN TEXTILE MANUFACTURE: A TRADITION OF BHOTIA TRIBE

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Bhotias are the one of the tribal community, residing in the high Himalayan region of Uttarakhand state that shares the border with Tibet. *Bhotias* are subdivided into three main areas (location) i.e., the *Jadhs* of Uttarkashi, the *Marchas* and *Tolchas* of Chamoli, and the *Shaukas* and *Rung* of Pithoragarh. Trade has been the backbone of the *Bhotia* economy. This community was also known as the 'international traders' community in the past who used to perform trade between China (Tibet) and India. The spinning of woollen yarn and making woollen stuff either by weaving or knitting and construction of their traditional costumes have been the specialty of the *Bhotias*. This art was handed over to the daughter by her mother. In the present study, a descriptive research was conducted in three districts in the five villages of Uttarakhand for exploring the information from different sub-groups of *Bhotia* tribe about plants used by them for extracting dyes and their use in textile colouration during past and present times. The rich flora of Himalayan region in Uttarakhand has been abode to varieties of plant species in wild which were used by the *Bhotia* tribe for dyeing their woollen products. Plant dyes used by *Bhotia* tribe were *Jangli palak* (*Rumex nepalensis*), *Bagmaru* (*Eupatorium*), *Kilmora* (*Berberis asiatica*), *Akhrot* (*Juglans regia*), *Dholu* (*Rheum aysrale*), tea leaves, *Tantri* (*Rheum moorcroftianum*), *Kaphal* (*Myrica esculenta*), *Darim* (*Punica grantum*), *Burans* (*Rhodendron araborium*) and *Harda* (*myrobalan*). Today only *Shauka* and *Jad* tribes are using natural dyes for dyeing woollen yarn. Reasons for the reduction in usage of natural dyes among *Bhotia* tribal groups were the extinction of plant species, change in land use, natural disasters, government restriction on plucking certain plant species, the prevalence of synthetic dyes at low cost and colored yarn availability in the market.

Keywords- Natural dyes, sustainable, textile dyeing, and traditional tribal textiles.

SCRUTINIZING THE CLIMATE CHANGE THROUGH BOX PLOT METHOD IN EASTERN UTTAR PRADESH**HARSHIKA CHOUDHARY*, P.S. BADAL***Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi*

Eastern U.P. has faced severe floods, while Bundelkhand region has faced one of worst famines of last decade. Thus, the impact of climate change has adversely effect the agricultural Production resulting in huge loss of paddy, corn and regional crops in eastern districts. The objectives were to examine the pattern of change of rainfall and temperature in eastern Uttar Pradesh. To examine the pattern of change of rainfall and temperature of India, Box plot method is used as a tool to study the change. Many extreme temperature and rainfall conditions are becoming more common. The Indian monsoon is changing, with less rainfall overall in more intense bursts, and more frequent dry spells in between. Gorakhpur, Siddharthnagar and Maharajganj were highly climatic vulnerable than other districts.

Keywords Climate Change, Eastern U.P., Box-plot method, Monsoon extremes

PRECISION AGRICULTURE, SOIL AND WATER CONSERVATION FOR SUSTAINABLE**HEMRAJ JAT¹, PIYUSH CHOUDHARY²**¹*Department of Agricultural Chemistry & soil science,*²*Department of Agronomy Rajasthan College of Agriculture, MPUAT (Udaipur), Rajasthan.*

Precision Agriculture (PA) can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other conditions. PA substitutes information and knowledge for physical inputs. A literature review indicates PA can contribute in many ways to long-term sustainability of production agriculture, confirming the intuitive idea that PA should reduce environmental loading by applying fertilizers and pesticides only where they are needed, and when they are needed. Precision agriculture benefits to the environment come from more targeted use of inputs that reduce losses from excess applications and from reduction of losses due to nutrient imbalances, weed escapes, insect damage, etc. Conservation practices have clearly shown advantages in improving soil, water and air quality as well as reducing costs of operations. Conservation of natural resources is the base for a long-term sustainability of agricultural and natural ecosystems. Conservation Agriculture is not just conservation tillage, but a series of land management practices that include crop residues retention, cover crops, appropriate cropping system rotation, integrated pest management able to minimize land degradation. Because of the complexity associated with natural and agricultural ecosystems, a land management practice found to be sustainable at one site might not be equally sustainable at another site. Agricultural production systems are inherently variable due to spatial variation in soil properties, topography, and climate. To achieve the ultimate goal of sustainable cropping systems, variability must be considered both in space and time because the factors influencing crop yield have different spatial and temporal behavior. Advances in technologies such as Global Positioning Systems (GPS), Geographic Information Systems (GIS), remote sensing and simulation modeling have created the possibility to assess the spatial and temporal variability present in the field and manage it with appropriate site-specific practices. Such approach is commonly called Precision Agriculture or site-specific crop and soil management.

CLIMATE CHANGE AND IT'S IMPACT ON AGRICULTURE**ISABELLA JOB*, SHANTHA BALAGOND***Department of Agricultural Meteorology, College of Agriculture, Pune – 5 MPKV, Rahuri – 413722*

Climate change is the fluctuation in the long term weather patterns that characterize the regions of the world. Higher temperature, increased CO₂ concentration and variability in precipitations are the scenarios included in climate change. Anthropogenic activities without considering the environmental nature becomes the main reason behind climate change. Flood, drought and the rise in mean sea level can also be the after effects. Apart from the other sectors, agriculture sector is mostly affected due to its direct relation with climate. The climate change imposes profound impact on crop plants by varying growth rate, yield, photosynthesis and transpiration rate. As per the recent studies, for every 75 ppm increase in CO₂ concentration rice yields will increase by 0.5 t/ha and decreases by 0.6 t/ha for every 1⁰C rise in temperature. Likewise each crop behaves in its own way which can't be predicted. The productivity of major food crops are predominantly affected and the other crop productions are also imbalanced. This unexpected change in the crop productivity leads to food insecurity. A severe impact on developing countries rather than developed ones can be seen as the former possess an average temperature almost near to crop tolerance levels. Agriculture sector which stands as a backbone of the economy of a country may get disrupted as an impact of climate change. The time has come to enforce different control measures for the sustainable development of agriculture and thereby strengthening the economic conditions of a country. A developing country like India, should adopt mitigation measures in order to combat with the conditions.

Keywords: Climate change, Sustainable development, Mitigation

EFFECT OF CLIMATIC CHANGE ON CROP PRODUCTION

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Agriculture and climate both are linked with each other with climate having a significant impact on agriculture. Agriculture is basically science, art of cultivating the soil, producing crops and raising livestock to fulfill the demands of increasing population. A change in global or regional climate patterns in particular a change apparent from the mid and late 20th century onwards and attributed largely to the increased levels of carbon dioxide in atmosphere is termed as Climate change. Climatic factors which are affecting the crop production are quite difficult to determine because there is no single factor that is affecting agriculture these days. Climatic factors viz. rainfall, temperature, etc. affect the crop production varying from region to region. These factors have their more significant impact towards plant growth at immature as well as critical growth stages. The impacts of climate change on agriculture may add significantly to the development challenges of ensuring food security and reducing poverty. One major concern of the agriculturists when regarding climate change involves the effects on pest populations. Climatic change may allow pest migration or population expansions which may adversely effect the agricultural productivity and ultimately profitability. Global climate change, to the extent it occurs, will strongly impact all soil processes. At this time, the main task of soil management should be to enhance the soil structure and fertility and to help counter the atmospheric greenhouse effect. Thus, impact on crop production can be observed significantly.

EFFECT OF PHYSICO CHEMICAL PROPERTIES ON SOME SOIL ENZYMES

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A study was conducted in the year 2014, to have a basic understanding of the activity of enzymes in the heterogeneous soil matrix, and to determine their involvement in soil nutrient transformation. Ten soil samples were collected from College farm and Student farm of the College of Agriculture Rajendranagar of present Professor Jayashankar Telangana State Agricultural University. Soil enzymes play an important role in mineralization of nitrogen, phosphorus and sulfur their by contributing to soil health. In the present study soil enzymes urease, phosphatases activity were assayed to study their distribution, soil urease enzyme activity ranged from 6.9 to 11.8 ($\mu\text{g of NH}_4^+ \text{ g}^{-1} \text{ soil h}^{-1}$) and the activity of acid phosphatases ranged from 20.65 to 40.16 ($\mu\text{g of 4-nitrophenol g}^{-1} \text{ soil h}^{-1}$) and the range of alkaline phosphatases activity was 38.65 to 74.4 ($\mu\text{g of 4-nitrophenol g}^{-1} \text{ soil h}^{-1}$). Enzyme activity is influenced by several factors such as soil moisture content, soil temperature, pH, C/N ratio etc: The amount of available organic substrates and inorganic nutrient elements may stimulate or inhibit certain enzymes. Vegetation, soil type, land use history and soil management strategy affect soil enzyme activity which in turn effect the transformation of nutrients. Hydrolytic enzymes make nutrients available to plants by acting on wide range of complex substrates and they are influenced by soil properties viz., pH, organic carbon and texture, and also by crop management and anthropogenic impacts. Hence these soil enzymes are one of the most important and most precise indicators of biological activity.

Keywords: Acid Phosphatases, alkaline phosphatases, Soil health and Ureases

NATURAL RESOURCE MANAGEMENT FOR SUSTAINABLE AGRICULTURE IN DIVERSE ENVIRONMENT CONDITIONS

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Sustainable agriculture can be understood as an ecosystem approach to agriculture. Sustainable agriculture is “an integrated system of plant and animals production practices having site-specific application that will last over the long term”, for example to satisfy human food and fiber needs, to enhance environmental quality and the natural resource base upon which the agriculture economy depends, to make the most efficient use of non-renewable and on-farm resources and integrate natural biological cycles and controls, to sustain the economic viability of farm operations, and to enhance quality of life for farmers and society as a whole. Throughout the developing world, Resource-poor farmers (about 1.4 billion people) located at risk prone, diverse environments; remain untouched by modern agriculture technology. A new approach to natural resource management must be developed so that new management systems can be tailored and adapted in a site-specific way to highly variable and diverse farm conditions typical of resource-poor farmers. The latest advances of natural resource management are reviewed in order to better sustainable agriculture which is compatible with needs and aspirants of peasants

Keywords: Sustainable agriculture, Natural resource management, Diverse environment, Resource poor-farmers

SAVE WATER TO SECURE YOUR FUTURE - WATER CONSERVATION**JALENDRA BAIRWA*, RAJA RAM BUNKER**, DEEPAK SARAN*****

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Water conservation includes all the policies, strategies and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere, and to meet the current and future human demand. Population, household size, and growth and affluence all affect how much water is used. Factors such as climate change have increased pressures on natural water resources especially in manufacturing and agricultural irrigation. Many US cities have already implemented policies aimed at water conservation, with much success. The goals of water conservation efforts include:- Ensuring availability of water for future generations where the withdrawal of freshwater from an ecosystem does not exceed its natural replacement rate. The key activities that benefit water conservation (save water) are as follows:- Any beneficial reduction in water loss, Avoiding any damage to water quality. One strategy in water conservation is rain water harvesting. Digging ponds, lakes, canals, expanding the water reservoir, and installing rain water catching ducts and filtration systems on homes are different methods of harvesting rain water. Harvested and filtered rain water could be used for toilets, home gardening, lawn irrigation, and small scale agriculture. Another strategy in water conservation is protecting groundwater resources. When precipitation occurs, some infiltrates the soil and goes underground. Water in this saturation zone is called groundwater.

Keyword: water conservation, harvesting rain water, filtration systems etc.

GLOBAL WARMING AND ITS IMPACT ON CROP PRODUCTION**KISHAN KUMAR¹, ROHIT², PANKAJ KUMAR SINGH³ AND SHUBHENDRA KUMAR PANDEY⁴**

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Agriculture is the backbone of Indian economy which in turn relies on the monsoon season. Rising global temperature is not only causing climate change but also contributing to the irregular rainfall patterns. Uneven rainfall patterns, increased temperature, elevated CO₂ content in the atmosphere are important climatic parameters which affects the crop production. Research studies indicate that weathering parameters influence strongly (67%) compared to other factors like soil and nutrient management (33%) during the cropping season. The Intergovernmental Panel on Climate Change (IPCC) projected that the global mean surface temperature will likely rise and may result into uneven climatic changes. This rising temperature may affect crop yield at large scale. It has been reported over 20th century that rising temperature plays an important role towards global warming as compared to precipitation. Researchers have confirmed that crop yield falls by 3-5% for every 1°F increase in the temperature. Global warming has become a major scientific and political issue during the last decade. The global temperature had risen by 40C over the last years because of rapid industrialization, it has increase about 0.5-1.00C in last century. If this trend continues, global warming of approximately 0.50C by 1995-2005, 1.50C by 2015-2050 and 30C 2050-2100, with greater increased taking place at higher latitudes, has been predicated.

Keywords: Global warming, Atmosphere, Nutrient Management, Precipitation, IPCC, etc.

SOIL AND WATER CONSERVATION**KRISHNAPRIYA M.K*, GOVIND KUMAR YADAV*, G.D.PATIL**B.D.TAMBOLI****

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Soil and water are the two basic resources important to human civilization. These resources are under intense pressure from increased population and degradation has already set in many fragile watershed ecosystems. Soil and water conservation is an integral part of watershed management. Conservation activities maintain or enhance the productive capacity of land including soil, water by reducing soil erosion, compaction, salinity etc. An unscientific way of farming in sloppy lands may cause large scale loss by soil erosion. Major objective of conservation is to keep everything in the soil in its place. Soil erosion, the displacement of soil particles from the soil surfaces is a serious problem in our country. This process ultimately losses the productivity of soil as a whole causing several environmental issues. Many nutrients and organic matter is lost by erosion. The loss of topsoil certainly affects the production of crops. Soil fertility is to be restored to have a sustainable and satisfactory production. It has been observed that the people are having less knowledge for improving the agronomic and

biological measures to reduce soil loss and to increase productivity. Contour bunds can be used to conserve the soil and water by increasing infiltration and percolation. People participation is must in soil conservation activities. Indigenous technical knowledge of the farmers in soil conservation should also be encouraged. We all must invest in soil conservation practices not just for farmers and people but for the whole life on earth.

Keywords: Erosion, Production, Contour bunds, Watershed management

THE ROLE OF HONEY BEES IN POLLINATION

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The pollinators and flowering plants form an interdependent compatible system, where the former derive their nourishment in the form of pollen and nectar and later in the process receive the benefits of cross pollination. Out of 95 per cent of the flowers which are cross pollinated, more than 85 per cent depend on insect for pollination and amongst 300 commercial crops about 84 per cent are insect pollinated. Amongst 80,000 species of insect pollinators, 17,533 species of bees are identified as pollinators worldwide. Pollination done by honey bees is called melittophily. Of the 160 million hectares of the cropped area, more than 55 million is under bee dependent crops. At present four or more species of honeybees are found in the Indian sub-continent viz. *Apis cerana*, *Apis dorsata*, *Apis florea* and *Apis mellifera*. They can enhance 11-79 per cent yield in different crops through pollination and improve quality of fruits and seeds. Increase in yield under open pollination depends upon natural densities of bees in the local context and as such cannot be used as a yard-stick for comparison of yield. Moreover, a worldwide decline of pollinator densities has been noticed due to indiscriminate use of pesticides, deforestation and monoculture. Here arises need of planned honey bee pollination. The requirement of honey bee colonies varies from crop to crop. At blooming period, requirement of *A. cerana* and *A. mellifera* colonies vary from 2-25 and 1-15 colonies in different fruit crops, respectively. However, in oilseeds, the requirement varies from 4-10 and 3-5 colonies of respective honey bee species. Apple growers of Himachal Pradesh during the bloom period, a minimum of 2-3 strong colonies per hectare being recommended in mature orchards having sufficient level of pollinizer level (33%). The number must increase to eight colonies per hectare if pollinizer level is low. Besides recommended number of colonies, the planned honey bee pollination also has some other prerequisites like they must be placed in apple orchards when the flowering has started (5%), avoiding further short distance shifting of colonies, avoiding insecticidal sprays during blooming period and need based use of pollen dispenser. The conservation of natural pollinators by using selective and reduced risk insecticides and creating awareness amongst farmers and growers can also solve the problem of declining pollinators.

AGRI-PRENEURIAL INTERVENTIONS FOR FOOD, LIVELIHOOD AND NUTRITIONAL SECURITY

KUSUM KUMARI SAW

MCAT, SELAQUI, DEHRADUN

The issue of food security and sustainable livelihood is central to all development interventions. It is founded on the premise that sufficient and nutritious food is a pre-requisite to the dealing with development issues. Food insecurity is a dynamic, complex issue associated with health, education and economic factors. The ultimate goal of food security interventions is individual's food utilization for which not only food access is required but also food quality, safe drinking water and hygiene. Interventions increasing agricultural production scored generally positive. Creating markets for small holder farmers, particularly for nutritious food can promote their production thereby, increasing nutritional security for the vulnerable while contributing to their gainful employment or livelihood. Cash crops schemes can be more effective when accompanied by nutritional interventions programmes such as nutritional education. Global cooperation is necessary to improve food security. By improving agricultural business, health and nutritional education and the environment we help to improve food security.

IMPACT OF PLASTIC POLLUTION ON OCEAN BIOTA AND ECOSYSTEMS

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Plastic pollution is pervasive in world oceans. It is well known that for decades plastic products have been widespread and specifically chosen for their long shelf-life. Due to our ability to produce durable, lightweight, and corrosion resistant material there is an abundance of consumer plastics being improperly discarded into the world's oceans on a daily basis. The deep ocean acts as a sink for plastic pollution. Plastics break down due to physical and chemical forces to overcome their initial buoyancy in the water. Water movement and certain geologic features also help distribute plastic to the deep ocean. Plastics also have the potential to alter the composition of the sea floor from that of a soft-bottom surface to more of a hard-bottom surface with very little oxygen and opportunity for gas exchange, affecting many sessile and infaunal organisms.

These factors have the potential to decrease species populations and biodiversity. The increasing quantity of plastic in the ocean poses many potential risks to humans and marine organisms, ranging from toxic chemicals to harmful organism that attach to drifting plastic and can cause diseases. Plastic pollution's effects on the deep ocean biota can include ingestion, inhalation, smothering, introduction of toxins, bacteria, viruses, and potentially diseases into organisms, the spread of invasive species to new ecosystems, and much more. We tend to be most concerned about risks to humans, but we are just one species that may be negatively impacted by the increasing amount of environmental plastic. The more scientists search, the more marine species we realize are interacting with and potentially impacted by plastic marine debris. We know that plastic in the ocean impacts hundreds of species; many of these are of direct importance as food and especially protein sources, while others such as corals and other invertebrates provide important ecosystem functions that maintain balance and indirectly benefit society. Because of the lack of information about the impact of environmental plastic on environmental and human health, an important priority should be to assess the plastic-associated risk for environmental and human health.

Keywords: Infaunal, Invertebrate, Ocean biota, Plastic pollution, Sessile.

IMPROVING SOIL HEALTH AND CANE PRODUCTIVITY THROUGH APPLICATION OF BIOFERTILIZERS LALAN SHARMA¹, S.K.SHUKLA², V.P. JAISWAL³, ASHA GAUR⁴ AND A.D.PATHAK⁵

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Sugarcane is commercial *cum* industrial crop and being cultivated in the country. The crop requires 10 -12 months for maturity. Agricultural inputs like inorganic fertilizers, agro-chemicals and water are non-judicious applied by the sugarcane growers while cultivating sugarcane. Due to consistent and non-judicious application of inorganic fertilizers, soil fertility and quality is deteriorating day by day. It also increases cost of crop of production in addition to affecting our soil environment. A study is conducted to isolate, characterize and identify promising microbial isolates for sugarcane crop and developing suitable microbial formulation so that application of inorganic fertilizers could be minimized. For this, soil and plant samples were collected from ICAR-IISR Lucknow farm. The soil samples analyzed for physico-chemical properties and soil enzymes production activities. A total of 343 beneficial soil bacteria isolated and screened for nutrient fixation, solubilising and mobilizing activities. The bacterial isolates were also screened for the plant growth promoting activities viz., siderophore production, IAA production, antagonism assay, phosphatase enzyme production, salt tolerance and seed vigour assay. The antagonism assay was also performed with test pathogen *Colletotrichum falcatum* and *Fusarium moniliformae*. The shelf life of bacterial isolates is being estimated in well defined liquid culture media and modified media. The field experiments have been conducted with different combinations of recommended dose of chemical fertilizers to record the response on the sugarcane crop. The data are being recorded at different growth stages for improving soil health and cane productivity.

IMPORTANCE OF ORGANIC FARMING FOR HUMAN AND ENVIRONMENT HEALTH

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"Organic agriculture is a production system that sustains the health of soil, ecosystem and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved" IFOAM. The relatively high success of organic farming in some countries is due to the high awareness about the health problems caused by the consumption of chemically contaminated food product and appropriate support from the governments. The conventional farming had helped India not only to produce enough food for own consumption but also produces surplus for exports. Now it's a need of the hour to grow crops organically. Since, most vegetables are consumed fresh, so it should be chemical free. In addition to this, export of organic vegetables would also provide higher profit to the farmers. Today India has total area of 1.4 mha under organic farming which produces 24339.49 tonnes vegetables and exported 497.06 tonnes in 2016-17. The insect pests inflict crop losses to tune of 40 per cent in vegetable production and may exceed up to 100 per cent due to viral diseases. Hence organic farming adoption may decrease its number. By using proper organic nutrient, weed, pest and disease management techniques the farmers may shift to organic agriculture as it is gaining momentum as an alternative method to the modern system to get premium prices in the markets. With ever increasing population pure organic farming may not be possible in India, rather some specific areas can be diverted to organic farming for export of high quality vegetable crops. Thus, as a whole under Indian condition, partial switching to organic farming of export oriented vegetable crops can be possible in recent times.

PROBLEM OF ENVIRONMENTAL POLLUTION AND WASTE MANAGEMENT

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Everything that surrounds us is directly or indirectly connected to the environment. Not only the man, but also other living beings as well as the nature (volcanic eruptions, earthquakes) have effects on environmental pollution. Environmental pollution is present from the very beginning of life, but today it is a serious problem that threatens the survival of mankind. Today we can say that we live in a world of waste; because of population growth and production increasing amounts of waste that makes landfill are becoming more numerous and increasingly degrade the environment. Every day a huge amount of waste, equally as in the villages and in agricultural areas is produced. Every year, about 10 million tons of oil products reaches rivers and oceans and has more than 500 billion tons of industrial waste. During the preparation of scientific research, we noticed a problem: "What is the influence of the waste management on the environment?" Today, every person living on planet earth is worried about environmental pollution because the consequences faced every day, through the air we breathe, the food and water we consume, through pollution and radiation we are exposed to. In the middle ages, food waste was dumped on the streets, so the rodents and insects transmitted many infectious diseases and dangerous epidemics. Today, because of inadequate treatment of waste could be a higher number of infectious diseases. Also, the consequences of environmental problems are manifested through the lack of natural resources, extinction of plant and animal species, as well as the problems in the global ecosystems and biochemical processes. Based on the research problem we can hypothesize: Yes, waste management has a great impact on the environment.

Key words: environment, waste management, environmental pollution, recycling, ecology, natural resources and ecosystems.

SUSTAINABLE INTENSIFICATION: WHAT IS ITS ROLE IN CLIMATE SMART AGRICULTURE

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The 'sustainable intensification' (SI) approach and 'climate-smart agriculture' (CSA) are highly complementary. SI is an essential means of adapting to climate change, also resulting in lower emissions per unit of output. With its emphasis on improving risk management, information flows and local institutions to support adaptive capacity, CSA provides the foundations for incentivizing and enabling intensification. To meet the food demand burgeoning population under changing climatic condition like aberrant weather, rising CO₂ level, rising temperature, rising sea level is needed to "Climate-Smart Agriculture" (CSA) approach, which is presented in 2010 at The Hague Conference on Agriculture, Food Security and Climate Change. FAO defines CSA as "Agriculture that sustainably increases productivity enhances resilience (adaptation), reduces GHGs and enhances achievement of national food security and development goals" Many agricultural practices, soil and water management is much more important issues in CSA. Soil degradation along with soil erosion, micronutrient imbalance, poor water and nutrient use efficiency needed potential efforts for managing soil productivity same times water management also need to be improve practices like rain water harvesting and its utilization through micro-irrigation, and ground water recharge have significant roles and much emphasis given to participatory integrated watershed management, the bio-engineering measures, canopy management, mulching, crop rotation, conservatory tillage practices GIS, remote sensing technique hydrological footprint for hydrological characterization of water resources, congruent planning of surface and ground water (COP-SAG) and use of Climate Smart Agriculture is found a promising tools to mitigate climate change adverse effect on soil and water and helps to meet out the food demands for future generation by reducing the impact of climatic variability thus maintaining the proficiency and sustainability of environment.

Keywords: Climate smart agriculture, resilience, remote sensing, sustainability.

CONJUNCTIVE USE STUDY OF SURFACE AND GROUND WATERS USING NON-LINEAR OPTIMIZATION IN THE TUMARIA CANAL COMMAND OF UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND

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This study presents the development and application of two Non-linear Programming (NLP) models/plans for the seasonal optimal allocation of resources to maximize the annual return of the Tumaria canal command of Udhham Singh Nagar district of Uttarakhand. This area comes under Tumaria Extension Main canal which originates from Tumaria dam. There are two distributaries and fourteen minors. The length of the main canal, branch canal, and total length of canals of the study area are 10713, 25214 and 35927 meters respectively. The CCA of canal command is 14070 ha. Total 11 crops were included in the optimization plan. Plan1, the proposed area of all crops of the command were less than equal to existing area of command

except fodder crops which was equal to existing area of command. Plan 2, the proposed area of major crops of command greater than equal to minimum consumption area of command, the proposed area of fodder and vegetable crops equal to existing area of command and proposed area of minor crops less than equal to minimum consumption area of command. Total permissible annual ground water draft was taken equal to average net draft of five years (2010-14) through minor irrigation structures at existing development stage and 25%, 50%, 75% and 100% additional groundwater available corresponding to semi-critical stage in the canal command. The plans results show the net annual return for existing crops area, Plan 1 and Plan 2 were obtained as Rs. 912577405, Rs. 635980200 and Rs.708364300 respectively. In existing crop plan no restrictions imposed on availability of canal water supply and groundwater, more crop production, implied more return. The proposed crop plan included wheat, masur, pea, mustard, potato for *Rabi* and paddy, maize, urad, soyabean for *Kharif* and Zaid summer rice, and sugarcane. The study concluded that nonlinear optimization model gives the high production per unit area of crops but development of production function is difficult task which is experimentally developed. There were also time saving, wages saving in nonlinear optimization because area of land remains fallow. Fallow lands may be utilized for other purposes.

Keywords: Conjunctive use planning; Nonlinear programming; Production functions; Canal command area.

THE EFFECT OF CLIMATE AND OTHER PROPERTIES ON SOIL

MAMTA

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The present investigation was carried out that the soil form through the legion interaction of a no of forces, consolation, parent material, acting all over time. It takes many years for a soil to form and many soils are still developing changes like in soil forming factors, particularly climate and vegetation, etc. Climate that is the most prime factor which affect in the formation of soil with important intimation for their development, use and management perspective with reference to soil structure, stability, topsoil water holding capacity, nutrient availability and erosion. As there are a lot indirect effects corresponds to changes in growth rates or water-use regulation, through sea-level rise, through climate-induced decrease or increase in vegetative cover or anthropogenic intervention. We are assuming constant quantity of carbon in soils from vegetation, different estimate predict that expected changes in temperature, precipitation and evaporation will cause significant change in organic matter turnover and CO₂ dynamics. In the end we find the increased productivity would generally guide for greater quantity of carbon to soil, that will increase the organics.

Key word: soil, carbon, climate effect, sea level, erosion

SEASONAL TRENDS OF TEMPERATURE AND RAINFALL EXTREMES IN HARYANA (INDIA)

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This study analyzed climate extreme indices over five stations viz., Ambala, Bawal, Hisar, Karnal and Sirsa in the state of Haryana (India) using meteorological data for daily maximum and minimum temperatures and total daily rainfall for the 30 year period (1985-2014). Statistical trend analysis techniques, namely the Mann-Kendall test at different level of significance and the Sen's slope estimator were used to examine trends. The seasonal trend and slope values of temperature related climate change indicators for five locations in the state of Haryana indicated a decrease in the cold extreme event (TXn & TN10p). Further, the value of Mann-Kendall test statistic Z and Sen's slope test revealed minimum temperature extremes (TNn and TN10p) have stronger trend and a steeper slope. The hot extreme events (TN90p) evidenced an increasing order in sirsa resulting in the decrease of day-night temperature variation as demonstrated by constricting diurnal temperature range (DTR). TX90p and TXx did not showed any significant trend for each station in all seasons. A strong significant positive trend and steeper slope was noted for warm nights (TN90p) during all season of the year in the Sirsa. The minimum temperature has enhanced in terms of its maximum value as indicated by a significant increase in number of the warm nights. The results also showed that there had been no substantial change with respect to maximum temperature values at all five selected stations. Thus, this has led to significant decrease in DTR. The DTR have decreased significantly at Sirsa during all four season, however, for rest four stations decrease during winter was significant. No significant trend was observed in pre-monsoon and post-monsoon seasons except Sirsa. However, the trend analysis of rainfall related climate indicators (RX1day & RX5day) based on seasonal values revealed no significant trend except at Bawal & Hisar stations.

Keywords: RCLimdex, temperature, Haryana, ETCCDI, climate extremes indices, DTR & Sirsa

CUMULATIVE EFFECT OF ORGANIC AND INORGANIC NUTRIENTS ON HEAVY METALS (CD, CR, NI AND PB) CONTENT UNDER RICE–WHEAT SYSTEM IN AN INCEPTISOL OF VARANASI**MANEESH KUMAR*, S. K. SINGH AND A.K. CHANCHAL***Department of Soil Science & Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, (U.P.), India*

Field experiments were conducted for two years in sandy loam soil to study the direct effect of organic manures i.e. sewage sludge (SS), vermicompos (VC) and sesbania (SB) with chemical fertilizers on rice (*Oryza sativa*) and their residual effect on wheat (*Triticum aestivum*) grown in sequence in winter (*Rabi*) and summer (*Kharif*) season during 2015-16 and 2016-17 at Agriculture Research Farm, BHU, Varanasi, Uttar Pradesh. Twenty five percent nitrogen through supplement organic sources with 75% recommended dose of fertilizers, customized fertilizer, 100% RDF with S, Zn, B applied to rice and their effects were compared with the recommended dose of fertilizers i.e., 150, 60 and 60 kg N, P₂O₅ and K₂O ha⁻¹ and absolute control, respectively. There was significant increase the concentration of Cd, Cr and Pb (grain) of rice with application of 75% RDF + 25% N through sewage sludge whereas, in wheat grain and straw was also recorded significantly increase over 100% RDF (T₂). The maximum Cr content in grain of I rice (T₄), I wheat (T₅), II rice (T₅) and II wheat (T₃) was 4.32, 2.11, 4.03 and 0.68 mg kg⁻¹, respectively. The maximum Cr content in straw of I rice (T₇), I wheat (T₅), II rice (T₆), II wheat (T₅) was 7.93, 3.95, 7.93 and 3.18 mg kg⁻¹, respectively. The maximum Ni content in grain of I rice (4.72 mg kg⁻¹), I wheat (22.58 mg kg⁻¹) and II rice (4.49 mg kg⁻¹) was observed in treatment T₄ (customized fertilizer), whereas, in II wheat, it was found in T₅ (75% RDF along with 25% N through sewage sludge). The maximum Ni content in straw of I rice, II rice and II wheat was recorded in treatment T₇ (75% RDF along with 25% N through sesbania), whereas, in I wheat, it was found in treatment T₃ (100% RDF with S, Zn, B). The maximum Pb content in grain and straw of all the four crops was noticed in T₅ (75% RDF along with 25% N through sewage sludge).

Keywords: Organic and inorganic sources of nutrients, chemical fertilizers, customized fertilizers, sewage sludge, vermicompost, sesbania, rice- wheat

TACTICS OF NANOPARTICLES IN WASTE WATER TREATMENT**MANOJ KUMAR CHITARA*, SADHNA CHAUHAN, RAJESH PRATAP SINGH***Dept of Plant Pathology, CoA, GBPUA&T, Pantnagar (Uttarakhand) 263145*

Water is the basic need of in our lives for this to improve and preserve its quality in a better way. The global population is increasing day by day but the availability of fresh water decreases so, the world may experience great freshwater scarcity and the main cause of the deterioration of drinking water quality is the industrial, chemical domestic and agricultural waste and others. Our natural water resources are not available for a long time or limited, so conservation of natural resources by means of the remediation of contaminated water the treatment and recycling methods are the alternative way of receiving fresh water in the coming periods. There are certain advanced technology use for waste water treatment such as advanced oxidation technology (AOT) in which including chemical oxidation, Fenton and photo processes, ultraviolet (UV)-based processes, photocatalytic redox processes, supercritical water oxidation, sonolysis, and electron beams and γ -ray irradiation. One more effective and extraordinary advanced technology includes the nanotechnology provide an opportunity of an effective exclusion of contaminants and offers opportunities to develop next-generation water supply systems therefore, in which included several types of nanoparticles, nanomembrane and nano-powder used for treatment of surface water, groundwater detection and removal of chemical substances such as toxic heavy metals, biological substances such as certain germs, organic and inorganic solutes, and microorganisms. Basically four classes of nanoscale materials that are being evaluated as functional materials for water purification e.g. metal-containing nanoparticles, carbonaceous nanomaterials, zeolites and dendrimers. Carbon nanotubes and nanofibers also show some positive result. Nanomaterials reveal good result than other techniques used in water treatment because of its extremely small size (nm), high surface area to volume ratio, surface modifiability, biocompatibility and amazing properties of nanomaterials such as photosensitivity, catalytic and antimicrobial action, electrochemical, optical, and magnetic properties.

FARM POND TO MITIGATE THE CLIMATE CHANGE IN RAINFED AGRICULTURE : A BRIEF REVIEW**¹MD MAJEED PASHA, ¹K. S RAJASHEKARAPPA AND ²K. DEVARAJ***¹Department of Agricultural Engineering ³AICRP on Dry land Agriculture College of Agriculture, UAS, GKVK, Bengaluru*

According to some estimates out of 370 million, ha meters of rainwater which falls on 329 million ha of land in 2 to 5 months in a year, 170 million ha meters runs off in rivers and streams and hardly 80 million ha meters seems to be entering the soil system. One hundred and twenty million ha meters is lost in evaporation. It is only a fraction of the runoff water which is being used for irrigation. Rainfed agriculture constitutes 55% of net sown area in the country. The annual average rainfall of the country varies from 400 to more than 2000mm varying in both space and time. In low to medium rainfall rainfed regions,

the occurrence of high intense rainfall events with the short duration are very common causing the soil erosion. Hence, the efficient rainwater management is necessary to improve water productivity and protect the natural resource base in rainfed regions. Water harvesting is one of the key components of successful rainfed farming in semi-arid regions. Harvesting surplus runoff in dug out or embankment types ponds and recycling the same for providing supplemental irrigation to kharif crops or pre-sowing irrigation to rabi crops has proved to be the most successful technologies for adoption. Water harvesting becomes all the more relevant now in view of the recent increase in the extreme events where in heavy rainfall is occurring in few days followed by long dry spells. Under such circumstances, the only answer is harvesting the surplus runoff during high rainfall events and using the same during dry spells for critical irrigation by using the farm ponds water.

Keywords: Rainwater, farm pond, irrigation and runoff

CARBON SEQUESTRATION AS A PROCESS OF CARBON CAPTURE AND STORAGE: TECHNIQUE TO MITIGATE THE EFFECTS OF GLOBAL WARMING

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From the beginning of the Industrial Revolution there has been a large increase in human activities which increase the atmospheric carbon dioxide concentration such as fossil fuel burning, slash and burn, deforestation etc. Carbon dioxide is a greenhouse gas which cause global warming. Global warming is the most challenging environmental problem in the world which refers to the increase in global average temperature near Earth's surface. To decrease the concentration of carbon dioxide and its consequences, CO₂ reducing techniques are required. Carbon sequestration is one of the most important technologies around the world that is considered as one of the potential option for reducing CO₂ gas. Carbon sequestration is the process of carbon capture and long term storage of atmospheric carbon dioxide. This can capture up to 90% of the CO₂ emissions produced from the use of fossil fuels in electricity generation and industrial processes and prevents the carbon dioxide from entering into the atmosphere. Carbon Capture and Storage (CCS) consists of three parts; capturing the carbon dioxide, transporting the carbon dioxide, and storing the carbon dioxide emissions. First, capture technologies allow the separation of carbon dioxide from gases produced in electricity generation and industrial processes. Carbon dioxide is then transported by pipeline or by ship for safe storage. Then carbon dioxide is stored in carefully selected geological rock formation that is typically located several kilometers below the earth's surface. Thus Carbon sequestering is one of the most effective and promising ways to mitigate the effects of global warming.

WATER MANAGEMENT IN SMART AGRICULTURE

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Due to irregularity of rainfall and decreasing water level, it has become very necessary now that due to the intervention of water management, the excess consumption of water consumed in agriculture should be fulfilled in such a way that only the small amount of water in the tab to get the full water of their needs, first we have to collect rain water. Use the water on the collection as follows: Use water to reduce the amount of water used Waste so that we can use the rest of the water in other works. Interventions in water management Smart Agriculture: Interference with natural water (1) Land collation by laser: The technique of colloquialization by laser is a new technology in which the role of tractor driver is zero, the action of collagenation is done by laser itself. Studies have shown that 10% of the paddy fields coated in laser and 10 in the field of wheat 20 percent water can be saved. (2) Use of crop change or drip: The profitability of the paddy wheat crop cycle is decreasing day by day, along with the cultivation of vegetables and fruits, if drip irrigation is also provided, then more water can be saved, one big benefit of drip irrigation it is also possible that underground saline water found in dry or semi-arid areas can be used. (3) Groundwater recharge: Excessive emphasis should be given on the use of ground water recharge rather than draining the water into the drains, the following measures can be taken. Excavation and renewal of old ponds: Recharged on the roof by cultivating water or roof water, Use of surface and underground drainage, Construction of potholes on the banks of fields and construction of pits for water harvesting on the shore.

Keywords: Irregular rainfall, Ground water recharge, water harvesting

CONSERVATION OF BIODIVERSITY FOR SUSTAINABLE DEVELOPMENT**¹MOHIT HUSAIN, ¹S. N. GEELANI, ¹AZEEM RAJA, ¹AFSHAN ANJUM BABA AND ¹ISHRAT SALEEM**¹*Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Benhama, Ganderbal, J&K India.*

Human beings can coexist only with the abundance and diversity of nature. Living things are interdependent, intricately linked in birth, death and renewal. Human beings are just one small part of this voluminous and vibrant mosaic, yet they inflict increasing pressure and pain on species and the environment. As a result, many plants and animals are at risk and under threat of extinction. They deserve our conservation. India is one of the World's richest countries in terms of its vast array of biodiversity. Biodiversity forms the foundation for sustainable development. It is the basis for the environmental health of our planet and the source of economic and ecological security for future generations. Biodiversity Conservation emerges more important due to the globalize process of the world economy and also for survival of the world as a balance habitat. Biodiversity of an ecosystem is a vital issue of an economy. Soil, water, climatic condition, forest cover and biodiversity are crucial in determining the renewable resource flow of an economy. Sustainable development stresses on economic development alone with the object of conservation of environment. Biodiversity is a part of the biosphere supported by biological processes and organic evolution. Extinctions in the past have been the result of many cataclysmic changes on the Earth. However, the causes for the present perturbations arise from human activities. Biodiversity is being depleted by the loss of habitat, fragmentation of habitat, over exploitation of resources, human sponsored ecosystems, climatic changes, pollution invasive exotic species, diseases, shifting cultivation, poaching of wild life etc.

Keywords: Biodiversity, conservation, threats and sustainable development.**TO STUDY THE RAINFALL AND TEMPERATURE PATTERN UNDER HARYANA CONDITIONS.****MOHIT KAMBOJ***Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, U.P.*

The prediction of rainfall and temperature is extremely important for droughts, environmental flows, and water demand by different sectors, maintaining reservoir levels, and disasters. Many attempts have been made in the recent decades to model and forecast rainfall and temperature using various techniques with the use of time series techniques proving to be the most common. The present investigation was carried out in Department of Environmental Science & NRM under College of Forestry in Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh during 2018. The ARIMA model developed for forecasting of temperature and rainfall were developed using SPSS software. The experiment was conducted for diagnostic, calibration and forecasting of temperature and rainfall for Hisar and Bhiwani. This data indicates that the models chosen for temperature series are the best fitted once for the data sets. Evaluation of forecasting data from 1985-2016 revealed that both the forecasted and observed monthly rainfall data were fitted on the same plot and indicates the model accuracy/adequacy for performance purpose. Monthly precipitation from 2017-2025 were predicted using Seasonal ARIMA model. The predicted values are well-fitted through the original data with the lower and upper limits containing majorities of the temperature original data. The identified models are therefore adequate to be used for forecasting monthly temperature in Hisar and Bhiwani.

IMPACT OF POLLUTED HINDON RIVER WATER IRRIGATION ON SOIL HEALTH AND ASSESSING RISK IN RELATION TO TRANSFER OF METALS TO HUMAN FOOD CHAIN**MANJUNATH DALI¹, RAJENDRA SINGH^{2*}, DEBASIS GOLUI², MAN SINGH¹ AND DHARA SINGH GURJAR¹**¹*Water Technology Center, ICAR-Indian Agricultural Research Institute (ICAR-IARI), New Delhi, India*²*Division of Soil Science and Agricultural Chemistry, ICAR-Indian Agricultural Research Institute (ICAR-IARI), New Delhi,*

The present study was carried out with the objective of assessing the impact of polluted river water irrigation on soil health and assessing risk in relation to transfer of metals to human food chain. In all, 45 paired soil and plant samples (Mustard, Rice, Pumpkin, Cucumber, Spinach, Turmeric, Brinjal, Marigold, Pearl millet, Mung bean, Carrot and Pigeon pea) were collected from river irrigated soils covering Makreda, Rewari, Nithari, Kinauni, Barnawa, Parsi villages of Western U.P. As per the geo-accumulation indices (I_{geo}), PI, IPI and PLI, all the river water irrigated soils were loaded with high level of metals (Zn, Cu, Ni, Pb and Cd) and required immediate intervention to ameliorate metal contamination. Among the river water irrigated soils, least value of soil quality index (SQI) was recorded in Nithari and Barnawa (PCA-SQI = 0.28). Based on PCA-SQI, the extent of soil health deterioration due to metal contamination follows the order: Nithari (0.28) = Barnawa (0.28) > Makreda (0.30) > Rewari (0.38) > Parsi (0.39) > Kinauni (0.44). All the plants grown on river water irrigated soils accumulated much higher amount of Zn, Cu, Ni, Pb and Cd compared to plants grown on tubewell-irrigated soils. Taking all the crops together, relative orders of transfer of metals from soil to plants grown on river water irrigated soils were Zn > Cu >

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Ni > Cd > Pb. The values of hazard quotient (HQ) for intake of trace toxic elements by humans through consumption of rice grain, vegetables (spinach, carrot, cucumber, pumpkin) and mustard grown on river water irrigated soils were well within the safe limit.

HEALTH HAZARDS DUE TO HOUSEHOLD (KITCHEN) AIR POLLUTION AND ITS PREVENTIVE MEASURES

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Firewood fuels are the dominant source of energy for cooking and heating purposes. Utilization of biomass fuels under poorly designed cook stove is the main factor responsible for increase of indoor air pollutants and health hazards. It is increasingly apparent that traditional cooking and heating technologies and fuels have a range of negative health effects on household well-being. Worldwide, more than three billion people are dependent on the burning of solid fuel for cooking and heating of their houses. Incomplete combustion products emitted into the indoor air form a health threat, especially for women, young children and senior citizens. Air quality is also influenced on a local and global scale and the unsustainable harvesting of fuel wood leads to deforestation. Household (Kitchen) environmental quality has a significant impact on public health and well-being. These hazards cause and exacerbate a variety of adverse health effects in humans, ranging from acute and chronic respiratory symptoms etc. We review the effects of kitchen allergen exposure and focusing on household (kitchen) pollutants such as carbon monoxide and particulate matter (PM_{2.5}) due to combustion of solid fuel. Additionally, Preventive measures are described and improvement of such harmful environmental conditions should be undertaken.

Key words: indoor air pollutants, environmental pollution, health effects, prevention.

DRINKING WATER TREATMENT

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The rural population of sparsely populated over various hydrological / hydro geological regions. Provision of safe drinking water sources to a large population having different physical, socio-cultural and economic background is a difficult task. Rural India largely depends upon ground water to meet its water demand. Now a day's water quality is emerging a major concern in India. Because of rapid industrialization, urbanization and excessive irrigation the quality of water gets affected. There is an urgent need to provide access to safe sources of drinking water who are at a significant health risk. Use of sustainable technologies for communities and household water treatment and storage with proper awareness and capacity building including hygiene education is likely to have various direct beneficial health effects.

Key word- Hydrological, health risk, water demand, quality of water and etc

IMPACT OF CLIMATE CHANGE AND GLOBAL WARMING ON CROP PRODUCTIVITY IN INDIA : ITS PLANNING AND MANAGEMENT

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Climate change and global warming is grave environmental concern adversely affecting crop production and productivity. Climate change has severely threatened the food security of the increasing population while sustaining the stressed environment. The climate change projection for Indian subcontinent by 2100 indicate an increase in temperature of 2-3 °C, with different regions expected to experience differential changes in amount and distribution of rainfall. The temperature increase by 1.5-5 °C will result a 10 percent increase in annual mean rainfall intensity and a 15 percent in year to year variability during the monsoon precipitation causing extreme events like drought, flood and cyclones, instability in crop production and productivity in India. The total annual crop losses in many are due to direct weather and climatic effects such as frost, dew, storms, hail, cold and heat waves. Agricultural productivity can be affected by climate change directly due to changes in temperature, CO₂ level and precipitation by affecting primarily soil health, emergence of new insect / pest and diseases. The probabilities of occurrence of extreme and episodic event have increased over the last three decades. There is need to sustain crop production and safeguard to enhance resilience of agriculture to climate change through planning and management such as altering the timing or location of cropping activities, provision of value-added weather services to farmers. Agronomic as well as crop contingency planning such as planting dates, choosing varieties with different growth duration, crop rotations, participatory and formal plant breeding to develop climate-resilient crop varieties that can tolerate

higher temperatures, drought and salinity tolerance, developing a long-term land use plan for ensuring food security and climatic resilience, providence of more funds to strengthen research can serve as suitable adaptation strategies.

Keywords: Climate change, Green House Gases (GHGs), food security, Planning, Adaptation strategies

BIOREMEDIATION IS AN INNOVATIVE AND PROMISING TECHNIQUE AVAILABLE FOR REMOVAL OF HEAVY METALS

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Our earth provides us a variety of essential goods and services for everyday life. But today we see that the abundance of heavy metals is found in the soil surrounding the industrial areas that the plant that is growing in them becomes contaminated. Its main reason, nowadays, with the development of industrialization and extraction of natural resources, the discharge of industrial waste for the environment has increased significantly, mainly due to soil and water, which has given rise to the accumulation ion of heavy metals. Metal activities such as metallurgy mining and smelting, agricultural, waste disposal, or industry discharge such as metals (AG), arsenic (AS), gold (AU), cadmium (cd), cobalt (co), chromium (cr), copper, Mercury (Hg), which can cause harmful effects on human health. On the other hand, biological methods are likely to solve these defects as they are easy to operate, do not produce secondary pollution it's called as Bioremediation. Bioremediation is an innovative and promising technique available for removal of heavy by beneficial microbes. The process of participation of microorganisms to reduce pollutant concentration, which is a natural process and the importance of bio-diversity, is considered to be rapidly for cleaning the contaminated and polluted ecosystem.

Key words: bioremediation, heavy metal, environment pollution,

NITRATE MEASUREMENT IN HARVESTED LEAFS USING HYPERSPECTRAL IMAGING

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Nitrate is found naturally in the environment and it is an important plant nutrient. Crop with sufficient available nitrogen develops a healthy green colour; otherwise, it will be of a poor quality. There are several factors affecting nitrate accumulation in vegetables, such as genetic, environmental and agricultural factors, the most important factor is soil nitrogen content according to as nitrogen fertilization. In the human body, nitrite can be formed by the microbial reduction of nitrate which is one of the constituents in vegetables. Nitrates may be considered as the index or precursor to the amount of nitrite which may be formed. Nitrites can lead to methemoglobinemia and the formation of N-nitroso compounds, which are carcinogenic. If foods contain high levels of nitrate, the potential hazard may be increased if conditions during storage or processing are conducive to conversion to nitrite. Vegetables (including potatoes) are one of the major sources of dietary exposure to nitrate, being responsible for 85% of intake. The WHO set an acceptable daily intake for nitrate of 0-3.7 mg/kg body weight per day. The nitrogen concentration in plant materials can be quantified by expensive and time consuming process laboratory analysis. Two popular methods to quantify N nutritional state in plants are SPAD and SAP test. The performance of the SPAD and SAP is variable, being affected by several factors such as cultivar, environmental conditions, plant growth stage, disease, and pests. Another non-destructive method to quantify the N concentration is visible-near infrared (VIS-NIR) portable spectrophotometer, it is a rapid, non-destructive, cost effective technique, but the spectra measurements do not resolve the spatial distributions of constituents within a sample. Hyperspectral imaging is an effective tool to measure a spectrum at each pixel in digital images three dimensionally. NIR hyperspectral imaging system is a potential technique for non-destructive prediction of quality attributes, thus facilitating nitrate identification in the simplest and faster manner. Since NIR is a rapid method, it is considered as a suitable tool to implement frequent quality control in food management chain.

HIGH-DENSITY PLANTING SYSTEM: A MITIGATION STRATEGY FOR CLIMATE CHANGE

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HDPS is high-density planting system where planting is done very closely per unit area so as to exploit the resource of soil moisture, nutrient and better weed management by narrow spacing and shorten their life cycle and subject themselves to mechanical harvest. this system already successfully adopted in Countries like Australia, Brazil, and China. Nowadays in India, the HDPS has been busting up to harvest more yield and overcome the labor shortage and to sustain production under changing the climatic condition for sustainable development. In HDPS, cotton crop is raised with population density ranging

between 1.0 to 3.0 lakh plants (45-60 cm between rows and 10 cm between plants) per hectare as against the normal plant population of 0.18 to 0.20 lakh plants (90-120 cm between rows and 60-90 cm between plants) per hectare. The dry matter production at harvest is almost doubled ranging between 1.1 to 1.5 tones/ha while yield gain is almost 60 – 65 % above normal crop depending upon the density of planting with the same level of inputs utilization. Even by assuming that 10 tonnes of biomass is produced by HDPS then about 3.9 tonnes of carbon has been sequestered and stored as biomass. HDPS has the advantage of better moisture and nutrients use efficiency and HDPS crop is characterized with synchronized flowering and uniform boll bursting with early cutoff. As row to row distance is wider, intercropping with the short duration crop like coriander, beetroot, greens gram etc will not only give additional income but also sequester carbon from the atmosphere during the cropping period. It is highly suitable for mechanical harvest and the tender stalks and leaves can be ploughed back into the soil to enrich the soil carbon. It has also proved to be a sustainable technology for both dryland and irrigated ecosystem. In this way, HDPS helps in mitigating climate change.

Keywords: High-density planting system, climate change, sustainable development.

TACKLING ENVIRONMENTAL HAZARDS FOR ACHIEVING SUSTAINABLE DEVELOPMENT

NEHA GOSWAMI

Sustainability is the foundation for today's leading global framework for international cooperation – the 2030 Agenda for Sustainable Development. Apart from the 17 SDGs mentioned by United Nation one goal is to make environment sustainable. Environmental sustainability concerns the natural environment and how it endures and remains diverse and productive. But, the world is facing an increasing frequency and intensity of environmental pollution - natural and man-made - that has had devastating impacts. As reported by the secretariat of the International Strategy for Disaster Reduction (ISDR), the last ten years have seen 478,100 people killed, more than 2.5 billion people affected and about US\$ 690 billion in economic losses. Environmental pollution is 'deadlier' than wars, natural disasters, AIDS, hunger or any other deadly events or disease, according to a study released in The Lancet medical journal. Environmental pollution costs trillions of dollars every year and it warns that the crisis "threatens the continuing survival of human societies". Environmental pollution produces a number of negative effects, including ocean acidification, global warming, acid rain, and habitat loss for plant and animal species. There is a paramount need to meditate upon the existing policies related to Environment Impact Assessment. Present review paper will focus on the factors and impact of pollution on environment, strategies to overcome the problem and current challenges faced in implementing the policies. The paper will also highlight the possible course of action for making favourable environment so that the sustainable goal can be achieved by 2030.

KEY WORDS: Environment, Sustainable Development, Pollution, Livelihood Security

CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURAL PRODUCTIVITY AND FARMER'S INCOME IN INDIA

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Climate change is natural phenomenon and has been occurring since the earth came into being. A change in the average weather of a given area or region (or the whole Earth) over a significant period of time is termed as Climate Change. This includes higher temperature, change in wind patterns, and change in precipitation and higher atmospheric CO₂ concentrations. From ancient time India's agriculture has been dependent on monsoons. Any change in monsoon leads to drastically affects on agriculture. Climate change has a serious impact on India's agricultural productivity—and farmers' incomes (The economic survey 2018). The impact of climate change is more adverse in unirrigated lands compared with irrigated areas. The change in agricultural productivity patterns as a result of climate change could reduce annual agricultural incomes by between 15% and 18% on average, and between 20% and 25% particularly for unirrigated areas. Intergovernmental Panel on Climate Change (IPCC), predict that temperatures in India are likely to rise by between 3 degrees Celsius and 4 degrees Celsius by the end of the 21st century. The Indian government, therefore, intends to focus on water scarcity and inefficiency of existing irrigation schemes, technologies of drip irrigation, sprinkle, and water management (realizing "more crop for every drop"-campaign). Climate change is already affecting agriculture, that will probably increase farmer uncertainty, so there is need to build crop insurance program and weather-based models and technology (for example drones) to determine and compensate losses caused by uncertainty to protect farmers from bad yields within a week and replacing un-targeted subsidies in power and fertilizer by direct income support.

Keywords: climate, insurance, productivity, uncertainty

PHYTOREMEDIATION OF POLLUTED SOILS: PERSPECTIVES AND ADVANCEMENTS"

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The agricultural activities involve addition of nutrients, pesticides and sediments to soil. Also industry and urbanization pollute the soil with solid wastes, heavy metals, solvents and several other organic and inorganic substances. Many efforts have been made in the last two decades in order to control the pollution sources and counteract the polluted soil. Phytoremediation, being more cost-effective, plant based technique with proven qualities to naturally reduce, degrade or remove contaminants from soil along with minimal side effects as compared to other chemical and physical approaches, has gained popularity both among researchers and farmers. More than 400 plant species have been identified having potential for polluted soil remediation. Among them the most common are - Indian mustard (*Brassica juncea* L.), Willow (*Salix* species) (White Willow), Poplar tree (*Populus deltoides*), Indian grass (*Sorghastrum nutans*), Sunflower (*Helianthus Annuus* L.) etc. Through this paper, attempt has been made on providing review of the research and application of phytoremediation of polluted soil.

MANAGING SOIL ORGANIC CARBON

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By the end of every year, concerns about air and water quality became as important as concerns about agricultural productivity. To address these environmental goals and maintain the land's productive potential, we must now go beyond erosion control and manage for soil health. The most practical way to enhance soil health today is to promote better management of soil organic matter or carbon (C). Soil carbon levels are ultimately the result of a balance between processes and inputs that add carbon to soil and those that remove it. To increase soil carbon you need to reduce processes that lead to loss of soil carbon carbon loss and increase processes that lead to carbon gain. The easiest way to increase your soil carbon levels is to incorporate more organic matter into and onto your soils, such as by maximising ground cover and mulching. A new cropping technique - 'pasture cropping' - which has led to dramatic increases in soil and soil minerals, including SOC. Pasture cropping involves direct-drilling crops into dormant native perennial grasses. This technique promotes ongoing groundcover and minimal soil disturbance, supporting high biological functioning and constant formation of fertile soil. Roots and root exudates play a vital role in soil carbon formation. Exudates also play an important role in helping to promote stable aggregates in the soil structure. These aggregates can range from the microscopic scale to many mm. In the right conditions these aggregates will bind to and protect root and other organic matter isolating them from further biological decay. Over grazing, bare ground, ploughing, bare fallowing, some forms and methods of fertiliser, pesticides and herbicide use, excess concentrations of nitrogen from manure and urine can all contribute to a loss of soil carbon. Top soil is even used for bricks to meet the demand for housing. Identifying alternative material for brick making if of high priority. Using top soil for brick making must be banned.

No-till agriculture with leaving crop residue in the fields seems to be beneficial. Initially more fertiliser may be required but, as SOC increases, the soil become more productive, requiring the same or even less fertiliser.

Keywords:- Soil organic carbon, Pasture cropping, No-till agriculture, Mulching, Root exudates etc.

CLIMATE CHANGE AND LIVESTOCK : THE ANTAGONISTIC RELATIONSHIP

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Climate change has become a cause of concern worldwide. It not only affect human but livestock, plants and nature in many more ways. In context to livestock, they affect them both directly and indirectly. The direct effect include the heat waves that are projected towards the earth which increase the temperature drastically and in return cause increased escapades of heat shock in livestock. Heat shock increase vulnerability to disease, reduced fertility, and reduced milk production. In heat stress conditions, animals can adapt to hot climates, however the response mechanisms that are helpful for survival may be detrimental to performance. The indirect impact include the change in climate conditions, increased floods and droughts, increased pest and disease occurrences etc. Drought may threaten pasture and feed supplies. Drought reduces the amount of quality forage available to grazing livestock. Some dry and arid areas could experience longer, more intense droughts, resulting from higher summer temperatures and reduced precipitation. This directly affect the crop production and for

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animals that rely on grain, these changes due to drought could also become problematic. Climate change can also result in a higher intensity precipitation that leads to greater peak run-offs and less groundwater recharge. The deprivation of water affects animal physiological homeostasis leading to loss of body weight, low reproductive rates and a decreased resistance to diseases. Climate change may increase the prevalence of parasites and diseases that affect livestock. The earlier onset of spring and warmer winters could allow some parasites and pathogens to survive more easily. In areas with increased rainfall, moisture-reliant pathogens could thrive. Increase in carbon dioxide (CO₂) may increase the productivity of pastures, but may also decrease their quality. As a result, cattle would need to eat more to get the same nutritional benefits which could become a burden on the pocket of owners.

Key words: climate change, livestock, heat shock, drought, parasites

MARINE POLLUTION AND USE OF OIL SPILL DISPERSANT

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Keywords: Marine Pollution, impact on flora and fauna, oil dispersant, effective but toxic

Marine pollution can be defined as the infiltration of elements to the marine environment directly or indirectly by humans. It can be through Ships fleet operating at sea, Offshore exploration, municipal and agricultural pesticide waste directly routing into the sea. The major chances which can cause oil spills at sea is collision at sea or grounding of vessel and offshore explorations. The oil spill has severe impact on flora and fauna and indirectly to humans. If the oil spill takes place at sea, the most effective method to treat is use of dispersant. Oil dispersants are the chemical mixture of surface-active substances added to colloid, to accelerate, and to improve the separation of particles and to prevent them from clumping with each other. Chemical surfactants are amphiphilic compounds, which can reduce surface and interfacial tension by accumulating at the interface of immiscible fluids, and increase the solubility and mobility of hydrophobic or insoluble organic compound. The main aim of oil dispersant is to suppress the oil spill effect by reducing the amount of oil coming ashore by water waves and by converting the spilt oil into small particles and droplets so that they can be dispersed beneath the water column. There are various dispersant available in market, however, there are various factors needs to be catered to use the appropriate one. There are many advantages of dispersant but being not-environment friendly, they can be equally dangerous and toxic.

ADAPTATION STRATEGIES OF FRUIT CROPS TO MINIMIZE CLIMATE CHANGE IMPACTS

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Climate change is the biggest environmental issue in the current situation affecting all forms of life. Under climate change scenario with increase in temperature there would be change in growing degree days, which has direct impact on phenology of fruit crops. Rise in temperature results in increasing respiration rate, loss of vigour, reducing fruit bearing ability, fruit size, juice content, shelf life, hastening fruit ripening, maturity and senescence and increasing disease and pest attack. It will also alter phenology particularly flowering, fruiting and partitioning of photosynthates to economic product. Indeterminate fruit crops are less sensitive to heat stress as compared to determinate crops because the time of flowering is extended. The temperate fruit crops which possess an optimum thermal range may suffer greatly as compared to tropical fruit crops. Higher temperature causes different physiological disorders in fruit crops eg. Spongy tissue of mango, fruit cracking of litchi, flower and fruit abscission of solanaceous crops, sunburn and cracking in apples, apricot and cherries. Good simulation models for fruit crops like mango, grapes, apple, orange, litchi etc. need to be developed for prediction of vulnerability of existing areas under changing climate conditions. Adaptation strategies like changing sowing or planting dates, modifying fertiliser application, providing irrigation at critical stages of crop growth and conserving soil moisture through crop management practices like mulching are need to be adopted. In addition to these, stress tolerant and resistant varieties should be developed basing upon their suitability to different agro-ecological regions. Integration of all available options along with hi-tech horticulture and judicious management of natural resources will be the main strategy to sustain productivity under this climate change scenario.

Key words – climate change, fruit crops, adaption strategies

ROLES OF ANTITRANSPIRANTS IN IMPROVING GROWTH AND WATER RELATIONS OF TOMATO GROWN UNDER IRRIGATION INTERVALS

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Climate change is affecting weather in many ways. In subtropical region, it is found responsible for drought prone condition as well as temperature rise in coming future. This will drastically bring down the production, if we will not start looking for other possibility to increase WUE (water use efficiency) to cope up with water stress conditions. This research is based on application of Antitranspirants on plant growth and shows the method or way for saving water and to make easy for plant survival under less water availability or dry condition with eight treatments and three replications were laid out in complete randomized Design. Different Concentration of chitosan (50, 150, 250, 350 ppm) shows different result on crop productivity under two irrigation systems, 250ppm concentration show best result in all the growth and yield parameters in comparison to control. MgCO₃ is also used with different concentration (300, 400, 500, 600 ppm) and 500ppm of MgCO₃ showed better response under the both irrigation conditions in all parameters.

Keywords: Antitranspirants (AT), Irrigation intervals, Chitosan, MgCO₃ (magnesium carbonate), SOD (superoxide dismutase).

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION

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Natural Resources Management refers to the sustainable utilization of major natural resources, such as land, water, air, minerals, forests, fisheries and wild flora and fauna. Together, these resources provide the ecosystem services that provide better quality to human life. Natural resources provide fundamental life support, in the form of both consumptive and public-good services. Ecological processes maintain soil productivity, nutrient recycling, cleansing of air and water, and climate cycles. Biological diversity (biodiversity) is the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to different climates, and environments along with their interaction processes. Biodiversity encompasses the variety of all life on earth India is one of the 17 mega-biodiversity countries of the world. Although India has only 2.5% of land area, it has a large pool and diverse pool of plants and microbes which accounts for 7.8% of recorded species in the world. Genetic diversity describes the variation in the number and type of genes as well as chromosomes present in different species. The magnitude of variation in genes of a species increases with increase in size and environmental parameters of the habitat. Species diversity describes the variety in the number of the species with in a region. Ecosystem diversity describes the assemblage and interaction of species living together and the physical environment in a given area.

ROLE OF PESTICIDES IN ENVIRONMENTAL POLLUTION: A REVIEW

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Pesticides and agrochemicals became an important component to ensure the food safety of a rapid growing human population in worldwide agriculture systems during the last century. At the same time, during the last decades we realized that agrochemical residues did spread in the environment, causing significant contamination of terrestrial and aquatic ecosystems and poisoning human foods. Studies are uncovering diverse sublethal effects of pesticides on natural pollinators which result in decreased production of crops. The consequences of contamination appeared because of indiscriminate and unplanned use of pesticides. According to Pimental a minute percentage (0.1-2%) of applied chemicals reaches to the target organisms and rest remains in air, soil or water and create adverse effects all around. Improper storage, man handling, spill and other practices, pesticides are posing serious environmental threats including human health. The residual effects of pesticides include carcinogenicity, mutagenicity, reproductive disorder, neurological and various other health problems. In addition, the misuse of pesticides could also result into low crop yield, destruction of flora and fauna, undesirable residue accumulation in food crops. According to Miller the use of pesticides has increased 50 folds since 1950 and 2.3 million tons of industrial pesticides are now used every year. The physico-chemical treatment methods for pesticides contaminated sites are highly expensive and not eco-friendly. In this regard, the bioremediation approach can be a suitable alternative over the conventional treatment methods for the treatment of pesticides-contaminated sites. Bioremediation is the use of microorganisms, fungi or their enzymes to degrade and detoxify the pollutants from the environment. Bioremediation is a cheap and environmental friendly approach for the degradation and detoxification of pesticides.

TOWARDS AN INTEGRATED SCREENING SYSTEM FOR DROUGHT STRESS USING ABOVE AND BELOW GROUND PLANT TRAITS**PARVAZE A. SOFI***USDA NORMAN BORLAUG FELLOW**SR. SCIENTIST DRYLAND AGRICULTURAL RESEARCH STATION, SKUAST-KASHMIR*

The practical difficulty in creating managed stress conditions for screening large germplasm sets for drought tolerance reduces the efficiency of the selection program for drought tolerance on account of confounding effects of other factors. Breeding for drought tolerance is further complicated as the stress conditions created in experimental set ups and actual field conditions have poor correspondence. The implication of target above and below ground traits have been studied in isolation and focus has been on survival and parametric approach rather than productivity under stress. Despite the growing evidence for importance of root traits, little work has been done to include drought-adaptive root traits in breeding for drought-tolerant varieties and most breeding programs have concentrated on above-ground components, mainly because of the difficulties associated with root recovery and evaluating root traits *in situ*. An understanding of the relationship of root traits (resource acquisition) to the above-ground traits (resource acquisition, utilisation and mobilisation) that contribute to better grain yield under stress is highly essential to achieve improvements in productivity under moisture stress conditions. While designing an optimum selection criterion, we need to understand synergism between below and above-ground traits to identify a set of traits that can be effectively used to screen for drought resilience. The above ground traits especially the biomass and its partitioning into various components as well as various physiological parameters are easy to measure and quantify, but there is still a huge shopping list of traits that are unranked. There is a need to identify and link effective traits from the hidden half of the plant to the visible part that usually expresses the response to stresses. This paper discusses some of the work in creating an integrated framework of screening for drought stress in light of available evidences.

Key Words: Drought Stress, Root Architecture, Physiological Traits**DESERTIFICATION: CHALLENGES IN OUR ECOSYSTEM****PAWAN KUMAR PAREEK*, RAVINDRA KUMAR MEENA**, SHYAM SINGH******* Department of Horticulture , College of Agriculture, SKRAU, Bikaner (Raj.) India**** Department of Horticulture(Fruit science)College of horticulture and forestry, Jhalawar- (AU- Kota)***** Department of Horticulture(Vegetable science) College of horticulture and forestry, Jhalawar- (AU- Kota)*

Desertification is a term that has been in use since at least 1949. It is the process of deterioration in these ecosystems that can be measured by reduced productivity of desirable plants, undesirable alterations in the biomass and the diversity of the micro and macro fauna and flora, accelerated soil deterioration, and increased hazards for human occupancy. Desertification as the changing of productive land into a desert as the result of ruination of land by man-induced soil erosion. He associated it with the humid and sub-humid tropics where he worked. The causes of land destruction were tree cutting, indiscriminate use of fire, and cultivation, which exposed the soil to water and wind erosion. Desertification was not the result of the Sahara spreading outward but of localized activity that could begin anywhere. Desertification occurs in tropical Africa was due to man's activity, and that there had been no significant climatic change during the past thousand or more years. Most of that destructive activity has occurred within recent historic time by the action of agricultural populations. Desertification is the impoverishment of terrestrial ecosystems under the impact of man.

Keyword- Deterioration, Desertification, ecosystem etc.**APPLICATION OF GREEN TECHNOLOGY****PAWAN KUMAR SAINI***Department of Genetics and Plant Breeding Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, , UP, India*

Green Technology is the development and application of products, equipment and systems used to conserve the natural environment and resources, which minimize and reduces the negative impact of human activities. Green technologies sometime also known as 'Clean Technologies' such as wind technology, solar technology, small hydropower, biomass and waste to Energy technologies is considered in this category. Green growth in agriculture is achieved through a shift to practices that take into account the regional environmental capacity, by promoting low-carbon production and carbon sequestration capacities. What is needed is a low-carbon life cycle, not only in terms of production but also encompassing distribution, processing and consumption. Solar power is the conversion of sunlight into electricity, either directly using photovoltaic, or indirectly using concentrated solar power. Wind turbines convert the kinetic energy in the wind into mechanical power that runs a generator to produce clean electricity. Hydroelectricity uses the energy of running water to

make electrical energy. Biofuel made from biological sources like straw, wood, wood waste, sugarcane and by products from agriculture industry. Green information technology starts with manufacturers producing environmentally friendly products and encouraging information technology departments to consider more friendly options like virtualization, power management and proper recycling habits. Green nanotechnology refers to the use of nanotechnology to enhance the environmental sustainability of processes producing negative externalities. Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment or built environment, into the atmosphere. One of the important factors for environmental pollution is the disposal of waste. Green technology is an important concept that every individual should be well acquainted with. Understanding the past of technology in addition to green technology is crucial to understand the potential future of green technology. Solving environmental problems can move us toward health, longevity, peace and prosperity.

Keywords: Green technology, Environmental, Solar power, Sustainability and Hydroelectricity.

EFFECT OF PESTICIDE IN ENVIRONMENTAL POLLUTION

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The pesticide effect on human life, wild life, soil, air, water and food. Pesticides can contribute to air pollution. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas, potentially contaminating them. Pesticide impacts on aquatic systems are often studied using a hydrology transport model to study movement and fate of chemicals in rivers and streams. The quantitative analysis of pesticide runoff was conducted in order to predict amounts of pesticide that would reach surface water. The most pesticide such as organochlorine insecticides, which may lose about 1% regardless of weather pattern because of their long persistence; and soil surface-applied, wettable-powder formulations of herbicides, which may lose up to 5%, depending on weather and slope, because of the ease of wash off of the powder. Pesticides with solubilities of 10 ppm or higher are lost mainly in the water phase of runoff, and erosion control practices will have little effect on such losses. Organochlorine pesticides, paraquat, and arsenical pesticides, however, are important cases of pesticides which are strongly adsorbed by sediments, and erosion control can be important in controlling losses of these compounds. The disruption in wildlife, humans, and experimental animals and focuses on the most studied chemicals: the pesticides DDT, amitrole, and the thiocarbamate family, including ethylenethiourea, and the industrial chemicals polyhalogenated hydrocarbons, phenol derivatives, and phthalates. Wildlife observations in polluted areas clearly demonstrate a significant incidence of goiter and/or thyroid imbalance in several species. Experimental evidence in rodents, fish, and primates confirms the potentiality for thyroid disruption of several chemicals and illustrates the mechanisms involved. In adult humans, however, exposure to background levels of chemicals does not seem to have a significant negative effect on thyroid function, while exposure at higher levels, occupational or accidental, may produce mild thyroid change

Keyword: Pollution , Pesticide

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT

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Climate change is a shift in 'Climate'. Global warming refers only to the Earth's rising surface temperature, while *climate change* includes warming and the "side effects" of warming like melting glaciers, heavier rainstorms or more frequent drought. Another way, global warming is one symptom of the much larger problem of human-caused climate change such as global temperature is expected to rise from 1.8 to 4 °C by the end of 21st century, sea levels to rise 7 to 23 inches by the year 2100, carbon dioxide expected to be 100% higher in 2100. Photosynthesis activity increases by 25 to 75% for doubling atmospheric CO₂ concentration, inadequate chilling shows a negative impact on growth and development. With changing climate the occurrence of pests and diseases will be more pronounced. Higher temperature in spring results in faster reproduction rate, thus increase in pest population will be rapid. Number of generation /fruiting season will be more with an increase of 2°C in temperature. Climate change have some positive impact in which increase the productivity from enhancing temperature and CO₂ level, possibility of growing new crops, accelerated maturation rate etc. Planning and management of climate change: escape of unfavorable climate and identify new regions, develop climate specific forecasting tools, adoption of specific orchard management practices, exploring the wild genotypes of fruit crops having resistance to various biotic and abiotic stresses and developing the cultivars resistant to heat and drought.

Key words – Climate change, Global warming, CO₂ level, Temperature, Biotic, Abiotic.

CLIMATE CHANGE AND GLOBAL WARMING: PLANNING AND MANAGEMENT**PRASHANSA TAYAL***Department of Biotechnology and Microbiology, Meerut Institute of Engineering and Technology. Meerut.*

Climate change, also called global warming refers to the rise in average surface temperature on Earth. Climate change is basically the major environmental challenge to the world today, with remarkable threats to ecosystems, food security, water resources, and economic stability overall. The global warming utilization is dramatically increasing due to our quest for a higher living standard and increasing world population. In many developing nations, the cause of air pollution are grouped as, aggravated bush burning, combustion, gas flaring, improper disposal of domestic and industrial wastes; pollution through oil spillage; car exhausts, unsanitary and unsafe housing, quarrying etc. Most of our energy comes from fossil fuel and burning of these fossil fuels causes environmental problems and in particular global warming. Changing environmental conditions, including rising temperatures caused by climate change, causes high levels of ozone that can affect the respiratory system and increases morbidity and mortality, particularly in sensitive groups of the population. More than 4.6 million people die every year due to air pollution and most is attributed to indoor pollution. Studies released in the past few years clearly demonstrates that poor indoor air quality not only increases asthma symptoms but can also be responsible for headaches, fatigue, nausea, allergic reactions, hormone imbalances and liver, kidney or central nervous system damage. Ozone concentrations are highly dependent on environmental conditions, including temperature and it is thought to be likely that long-term changes in climate will affect levels of future ozone pollution. Instead of tackling these problems of climate change separately, there are technological solutions that address both concerns at the same time: for example, switching from fossil fuels to renewable forms of energy cuts down on air pollution emissions, (eg particulate matter (PM), sulphur dioxide and nitrous oxides), whilst simultaneously reducing emissions of the greenhouse gas, carbon dioxide (CO₂).

Keywords: Air pollution, oil spillage, ozone concentration, green house gas.

A VIEW ON SUSTAINING SOIL HEALTH AND SOIL QUALITY**PRASHANT DEO SINGH, ABHILASHA PATHAK, PRAMOD KUMAR, GOUTHU NAGA PANCHAVATHI***Department of Soil Science & Agricultural Chemistry, SVP University of Agri & Tech, Modipuram, Meerut, U.P.**Department of Agronomy, C.S.Azad University of Agri & Tech, Kanpur, U.P.*

Soil health is the capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health. Soil health and soil quality are defined as the capacity of soil to function as a vital living system within land use boundaries. This function which sustains biological productivity of soil also maintains the quality of surrounding environment and human health. Thus the two terms are used interchangeably although it is important to distinguish that, soil quality is related to soil function, whereas soil health presents the soil as a finite non-renewable and dynamic living resource. In this review, we deal with soil health concept which includes interactions between plant inputs and soil in creating a healthy environment. Adverse effects on soil health and soil quality arise from nutrient imbalance in soil, excessive fertilization, soil pollution and soil loss processes that are increasingly becoming common in developing countries. To evaluate sustainability of agricultural practices, assessment of soil health using various indicators of soil quality is needed. Soil organism and biotic parameters (e.g. abundance, diversity, food web structure, or community stability) meet most of the five criteria for useful indicators of soil quality. Soil organisms respond sensitively to land management practices and climate. They are well correlated with beneficial soil and ecosystem functions including water storage, decomposition and nutrient cycling, detoxification of toxicants and suppression of noxious and pathogenic organisms. Indicators must be comprehensible and useful to land managers, who are the ultimate stewards of soil quality and soil health. Visible organisms such as earthworms, insects, and molds have historically met this criterion. Finally, indicators must be easy and inexpensive to measure, but the need for knowledge of taxonomy complicates the measurement of soil organisms.

Keywords: soil health, soil quality, soil indicators

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION**PRATISTHA PRADHAN AND GAVASKAR***Department of soil science and agricultural chemistry**Sam Higginbottom University Of Agriculture, Technology And Sciences Naini Agricultural Institute, Allahabad*

Natural resources are depleting at an alarming rate because of their irrational use pattern. Although, utilization of resources is an intrinsic component of the process of development yet, overexploitation of natural resources has led to environmental degradation and change in pattern of rural economy. Rural communities, in particular, are greatly affected by the increasing use of natural resources. To many of them, development is about livelihood and survival rather than increasing productivity

and accumulation of wealth. Management of natural resources seems to be the only way forward to sustain the liveability of rural households. The objective of this paper is to discuss on how to expand the adoption of sustainable land and water management practices in different parts of the country. First component is knowledge management, governance and communication which aid in the success of this endeavour. Second component is resources management tools, technical assistance and investments that support sustainable land management practices and initiatives aiming at improving the sustainable use of biodiversity resources in the target areas; reversing reduction of forest coverage; strengthening the resilience of rural producers assets in the targeted areas to climate change challenges. The third component is the diversification of local livelihoods for expansion of production of food grains that reduces socio-economic crisis. The fourth component is the project coordination, monitoring and evaluation. Conservation of natural resources has become a necessity for conserving the earth itself by protecting its capacity of self-renewal. All the aspects are to be considered which are solid wastes, air pollution and water pollution. The various methods of conservation of natural resources is also a component of this paper.

Keywords: - biodiversity, conservation, sustainability, rural development.

CLIMATE CHANGE: A BIG THREAT TO THE WAY OF RESEARCH AND DEVELOPMENT PROGRAMS FOR IMPROVING FOOD SECURITY AND LIVELIHOOD IN THE WORLD

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Climatic changes causes potential increase of food insecurity in the world. Extreme weather conditions like drought, salinity, heat waves, cold stress, and heavy metal stresses make worse the risk of hunger through decreasing agricultural production. Climatic changes have increased the intensity of these abiotic stresses for crop plants. It has adverse effect also on livelihood and food security. The impact of these disastrous conditions causes destruction of crop, infrastructure and important community assets, thereby damaging livelihood and increasing poverty in the world. The impact is more dangerous in developing countries. The people living in coastal areas and river deltas are affected by rise in sea level because of change in climatic conditions. The increasing temperature accelerated melting of glaciers that is affecting the quality and reliability of water, in turn affecting occurrence of flooding and drought. Every aspect of food security and nutrition are affected by climate change. The changes in environmental conditions have already affected the agricultural production and staple food crops. The future climate change have threatens to aggravate agriculture and food security. The high rain fall and temperature have direct impact on yield and quality of agricultural crops. As a result of this, the prices of crops may increase and the survival becomes more difficult for peoples. Under these circumstances, for most helpless people, lower agricultural output means lower incomes. Thus, the poorest people becomes poorer by scarifying additional income on food and other assets to meet their nutritional requirements. The aim of this research talk is to bring attention of research and developments towards a different aspect that should be kept under consideration while working for betterment of agricultural crops production and food security in the world.

Keywords: Accelerated, Chronic, Deteriorating and Community.

ROLE OF GREEN CHEMISTRY IN ENVIRONMENTAL SUSTAINABILITY

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Chemistry is generally considered as the prime reason for environmental degradation and pollution. But with adoption of green methods these effects can either be reduced or minimized. Green chemistry encompasses design and synthesis of environmentally benign chemical processes, green approaches to minimize and/or remediate environmental pollution, the development of biomaterials, bio-fuel, and bio energy production, biocatalysts, and policies and ethics in green chemistry. Green chemistry is a novel philosophical technique that makes use of a set of principles that aims to reduce/eliminate the use or generation of hazardous substances in the design, manufacture and application of chemical products. It is the best example of environmentally benign chemistry having a significant role in achieving environmental sustainability. With the help of green chemistry the approaches towards the renewable resources can be made increasingly viable technologically and economically. Green chemistry plays an essential in developing alternate sources of energy generation (hydrogen cell, fuels cells, biofuels,.). Using the environment technology we can conserve the natural environment and curb the negative impacts of human involvement. Implementation of green chemistry, design of chemical products and processes that eliminate the use and generation of hazardous substances, is essential if the expanding global population is to enjoy an increased standard of living without having adverse impact on the environment health. Green chemistry provides solutions to such global challenges as climate change likewise (soil pollution, water pollution and air pollution), sustainable agriculture, energy, toxics in the environment, the depletion of natural resources. In its essence, green chemistry is a science-based non-regulatory and economically driven approach to achieving goals of sustainability, environmental and human health protection.

Keywords- Green chemistry, Eco-friendly and Sustainability etc.

ACHIEVING FOOD SECURITY THROUGH REDUCING FOOD WASTAGE**PRIYANSHU TRIPATHI*, BACHCHU SINGH**, R.K. MEENA*, B.S. MEENA*, ROOP SINGH*, SURESH BAIRWA* & S. L. KASWAN****KVK Scientist* and Programme Coordinator ** Krishi Vigyan Kendra, Hindaun (Rajasthan)*

Agriculture, along with its allied sectors, is the largest source of livelihood in India. A challenge for the Indian agricultural sector today is to feed its ever-growing population, even though India's food grain production has kept steady pace with its population. However, adequate food production is not sufficient to ensure food security. Not all food produced is consumed, as an enormous amount of food is wasted. It is estimated that saving one-fourth of the food currently lost or wasted globally would be enough to feed 870 million hungry people in the world, of which the highest number (about 194.6 million) are in India. Maximum food loss happens during transit from farm to plate, especially to urban markets. These losses not only impact producers with reduced income and consumers with increased costs, but also challenge overall food security. It has been also observed that food waste and loss occurs differently in developing and developed countries. In developing countries, food waste and loss occurs at early stages of the food value chain. This can be associated with lack of support to farmers, poor/non-scientific harvesting techniques, weak infrastructure, storage, cooling and transport facilities. The underlying cause of post-harvest loss in the country is due to the lack of infrastructure for short-term storage, particularly at the farm level, as well as the lack of intermediate processing in the production catchments. This is indicated a need for capacity building at different levels of value chain actors. It also called for investment in large storage facilities and other related infrastructure such as roads and electricity to ensure reduction in food loss and waste. This can eventually lead to enhanced food security in the country as well as globally.

Keywords: Food security, Food wastage, India

SOIL AMENDMENTS FOR IMPROVING CROP YIELD IN SALT AFFECTED SOILS***PUSHPALATHA. M., SUNIL, B. H. AND PARAMESHWARAREDDY, R.***Department of Soil Science and Agricultural Chemistry, UAS Dharwad**Division of Soil Science and Agricultural Chemistry, ICAR-Indian Agricultural Research Institute, New Delhi**Department of Agronomy, UAS Dharwad*

Soil amendment are improving the crop yield in salt affected soils. Sodic and alkali soils are characterized by the occurrence of excess sodium (Na^+) and salts of sulphate, chlorides, carbonates and bicarbonates etc., are adversely affect soil structure and disturb the availability of nutrients for plant growth. Increasing the productivity of water and making safe use of poor quality waters in agriculture will play a vital role in easing competition for scarce water resources, prevention of environmental degradation and provision of food security. Driven by the pressure to produce more, even the saline and alkali waters are being increasingly diverted to irrigated agriculture. Development of salinity, sodicity and toxicity problems in soils not only reduces crop productivity and quality but also limit the choice of crops. Major production constraints of Saline soils exit in arid and semi-arid region, such soils are poor physical properties- high ESP, dispersion of fine clay- (high Na), low permeability impeded aeration, soil water movement, poor aggregate stability, low organic matter content, reduced availability of N, K, Zn, Fe etc. this is cause reduction in crop yield mainly due high concentration of soluble salts in soil, salt toxicity, and their management strategies include leaching and drainage methods. Such a way sodic soil are contributing the same problems in crop production like hard pan formation and reduces the infiltration capacity, hydraulic conductivity etc., Management strategies of alkali/sodic soil include leaching, crop establishment, crop choice, organic and inorganic amendment. Application of gypsum based on the gypsum requirements (GR) varied from 8.5 to 15.5 t ha⁻¹ is considered as one of the most useful strategies to reclaim alkali/sodic soils. Cultivation of salt tolerant crops (barley, sugarbeet, cotton), grasses (karnal grass, para grass, bermuda grass) and tress (date palm, eucalyptus, acacia) increase the productivity but also improve the soil physico-chemical properties. These approaches help for enhancing the crop yield.

CLIMATE CHANGE AND GLOBAL WARMING - PLANNING AND MANAGEMENT**PUSHPANJALI¹ AND PRATISHTHA DIWAKER²***SKN College of Agriculture, Jobner, Agriculture University, Jobner, Rajasthan**Rajasthan College of Agriculture, Udaipur, Rajasthan*

Climate change is the one of the most complex issue facing us today. Reducing GHGs emissions, by reducing the rate and magnitude of climate change is referred to as mitigation. GHGs are primary contributor to global warming, principle GHGs are CO_2 , Methane, N_2O and fluorinated gases. Carbon di oxide, the heat trapping green House gas that has driven recent global warming. So if we not stopped emitting all GHGs gases today, global warming and climate change will continue to affects future generations. We are already committed to some level of climate change by two prolonged approach that is reducing emissions and stabilizing the level of heat trapping greenhouse gases in the atmosphere and adapting to the climate change already in the pipeline. India released its much awaited National Action Plan on Climate Change (NAPCC) to

mitigate and adapt to climate change on June 30, 2008, focus on eight missions that is (i) National Solar Mission aims to promote the development and use of solar energy for power generation, (ii) National Mission For Enhanced Energy Efficiency aims to recommends mandating specific energy consumption decrease in large energy consuming industries, (iii) National Mission On Sustainable Habitat, (iv) National Water Mission sets a goal of 20% improvement in water use efficiency to deal with water scarcity. (v) National Mission for sustaining the Himalayan ecosystem to prevent the melting of glaciers, (vi) Green India Mission aims to afforestation of degraded forest, (vii) National Mission for Sustainable Agriculture and National Mission on strategic knowledge for climate change for improve climatic modelling and international collaboration. NASA is involved with its eyes on the earth and wealth of knowledge on the earth's climate system. NASA makes detailed climate data available to global community and set the climate policy. Started in 2010, NASA's Carbon Monitoring System (CMS) is forward looking initiative established under direction by the U.S government. CMS improving the monitoring of global carbon stock (where carbon is stored around the planet) and fluxes (how carbon is cycled).

Keywords; Climate Change, Global warming, NAPCC (National action plan on climate change), NASA, Mitigation.

QUALITY OF GROUND WATER IRRIGATION AND ITS MANAGEMENT IN AGRICULTURE-A REVIEW

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Indian agriculture continues to depend heavily on its ground water reserves especially in arid and semi-arid regions. In India about 50% of ground waters are marginal and poor in quality whereas in Rajasthan their extant is still elevated to 84%. The present distribution of poor quality of water in India indicates about 37% water is sodic and 20% are saline in nature. The fresh water is also considered as good quality water, while sodic water, saline water, municipal/city waste water, industrial effluents, sewage and sludge - all are considered as poor quality water of varying degree. About 70% of our Earth's surface is covered by water, out of these about 97.3% of water on earth is salty, leaving only 2.7% as fresh water. Less than 1% of the world's fresh water (0.007% of all water on earth) is accessible for direct human uses. Groundwater is used for over 40% of global irrigation on almost 40% of irrigated land. It has become indispensable for agriculture production in many countries; it accounts for half of South Asia's irrigation and supports two-thirds of grain crops produced in China. Maximum saline and brackish ground water areas of India fall in the arid and semi-arid regions of Haryana, Punjab, Rajasthan, Gujrat.

EFFECT OF AGRONOMIC MEASURES ON ENHANCING SOIL CARBON SEQUESTRATION AND ITS IMPACT ON CLIMATE CHANGE SCENARIO

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Climate change is among the major global issues of the 21st century. Carbon sequestration is one of the strategic principles to mitigate the adverse effect of changing climate as it removes CO₂ from atmosphere and stores in soil, plant or in water bodies. It basically refers to the capture and long-term storage of carbon dioxide in forest, ocean or in deep geological formations to reduce the concentration of CO₂ in the atmosphere. Soils are the largest carbon reservoir of the terrestrial carbon cycle. It stores large amount of soil organic carbon. Agronomic practices like reduced tillage, manuring, residue incorporation, crop rotation and mulching play important roles in sequestering soil carbon. Growing crops in rotations over mono cropping and following crop rotations leads to increase in soil carbon storage. Minimum tillage and conservation tillage practices as well as incorporation of residues increases the soil carbon content significantly. Addition of organic manures and fertilisers, practising agroforestry and tree planting, revegetation of degraded land and following various land use options also lead to increase in soil carbon storage. Application of soil amendments helps in improving soil characteristics and prevent CO₂ and methane emissions. Most, if not all, of the management regimes that promote carbon sequestration also improve soil aggregation, water retention, soil fertility, and food security. Hence, soil Carbon sequestration is certainly a step in the right direction to improve soil health, increase crop yield and mitigate climate change through judicious land use and recommended management practices but decisions about soil carbon sequestration require careful consideration of priorities and trade-offs among multiple resources.

Key words – climate change, agronomic measures, soil carbon sequestration

PSOPHOCARPUS TETRAGONOLOBUS L. DC: UNDEREXPLOITED WONDER LEGUME VEGETABLE FOR ENVIRONMENT, LIVELIHOOD SECURITY AND SUSTAINABLE DEVELOPMENT**R. K. DUBEY*, J. DEVI, V. SINGH, S. PANDEY, P.M. SINGH AND B. SINGH***ICAR- Indian Institute of Vegetable Research, Varanasi - 221305, India*

Legumes represent an important component of human diet as rich source of protein, minerals and vitamins. In recent years, increasing emphasis has been placed on several under-utilized/under exploited plants of the new and the old world, for growing them in diverse agro-climatic conditions. Amongst these, winged bean has assumed considerable importance as a protein rich multipurpose crop. In India, it is grown over a wide physiographic agro-ecological range from sea level to about 1200 m elevation primarily confined to the humid sub-tropical parts of North- eastern region and parts of Western Ghats, Maharashtra southwards and central/eastern peninsular region of the country. Winged bean is climbing short-day plant, cultivated as an annual with indeterminate growth. In India, the best time for sowing is from the last week of June to the end of July. Flowering commences after 50 to 60 days of sowing. The basic pigmentation of the stem is green and purple, green being the most common. The leaves are green, trifoliate. The majority of leaves are deltoid, the rest being lanceolate. The extensive root system may help the plant to grow in nitrogen poor soils, reflecting its ability to obtain fixed nitrogen via its root nodules. The fibrous roots of certain varieties form tubers. The inflorescence is an axillary, erect raceme which bears 3-12 bluish or white flowers. Pod formation is visible 5 to 7 days after anthesis. The length of four-winged, slightly bent pod varies from 10-40 cm and the seed number 5 to 14 per pod. Wide variation can be seen in pod color, shape and the wing. The leaves contain 5 to 15% protein and high amount of vitamins and the tubers contain 10 to 12% crude protein higher than other tuber crops. The green tender pods also have high protein content (1.9- 2.9%), carbohydrates (3.1- 3.8 %), rich in calcium, iron, phosphorus and vitamins and are low in fat which accords to potential health benefits. Effective conservation and sustainable utilization of such genetic resources needs extensive attention. Considering the importance of the crop, an initiative has been taken at ICAR-IIVR, Varanasi, India by adopting winged bean as a new underutilized crop. In this regard, diverse germplasm lines were evaluated during 2016-17 and 2017-18 for their morphological and biochemical characters. Observations were recorded on different horticultural traits viz. days to anthesis, days to first pod appearance, days to edible pod maturity, pod length (cm), maximum number of pod per cluster, pod width (cm), fresh pod weight (g), number of seed per pod and tuber weight per plant and variability was seen for these different traits. Antioxidant analysis was also performed for some of the promising lines for edible pods and tubers. It was found that winged bean green pods have higher antioxidant activity than raw tubers. Hence, considering all package of practices, it may be concluded that winged bean can grow effectively with little care and management in diverse agro-ecological conditions and will not compete for available land with other cultivated crops. Popularization of its cultivation techniques and augmenting the potential of this "Wonder Legume Vegetable" can play an important role for sustaining the dietary needs as well as health benefits for a large section of population. This also holds potential to pave its way under the changing climatic conditions.

Keywords: Underexploited, legume vegetable, winged bean, environment, nutritional security.

CONSERVATION TILLAGE FOR SUSTAINABLE AGRICULTURE PRODUCTION AND ECO-SAFETY**RAGHAVENDRA NAGAR****Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat*

Traditional agriculture, based on tillage and being highly mechanized, has been accused of being responsible for soil erosion problems, surface and underground water pollution, and more water consumption, while conservation agriculture is a management system that maintains a soil cover through surface retention of crop residues with no till/zero and reduced tillage. CA is described by FAO as a concept for resource saving agricultural crop production which is based on enhancing the natural and biological processes above and below the ground. The main components of conservation tillage are zero tillage, minimum or reduced tillage, strip tillage, no-tillage, raised bed system, crop diversification and crop residue managements. The main advantage of CT are the reduced erosion and increase organic matter and ultimately increase the yield and maintain soil health. Till planting is the method of zero tillage. Crop residue can be used as mulch to cover the soil to reduce erosion, maintain soil moisture, improve soil tilth and quality, reduce nutrient runoff, and provide wildlife cover instead of burning them on field. Laser land leveling and directed seeding of rice are the resources conserving techniques.

Keyword: Traditional agriculture, water pollution, crop diversification, wildlife, Laser land leveling

WHEAT RESIDUE WITH ZERO TILLAGE MAXIMIZE THE PRODUCTIVITY AND PROFITABILITY OF KHARIF MAIZE (ZEA MAYS L.) IN INDO-GANGETIC PLAIN**RAJBIR SINGH KHEDWAL^{1*}, DHARAM BIR YADAV² AND ANKUR CHAUDHARY³**¹Department of Agronomy, Punjab Agricultural University, Ludhiana-141004, Punjab, India^{2,3}Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004, Haryana, India

Maize (*Zea mays* L.) is an alternate and viable option to replace the rice in rice-wheat system to address the issue of resource degradation and maintain soil health. The main focus is to minimize the cultivation cost through different tillage practices with the use of available resources present on farmers' field. Therefore, a field experiment was conducted at CCS Haryana Agricultural University, Regional Research Station, Karnal, Haryana during *kharif* 2015 to maximize the productivity and profitability of maize in zero tillage (ZT) with residue. Zero tillage and raised beds (RB) each with and without residues were comprised in main plot. Three maize hybrids (HQPM-1, HM-4 and HM-10) and two weed control treatments viz. Atrazine 750 g/ha pre-emergence (PRE) followed by (fb) 1 hand weeding (HW) at 30 days after sowing (DAS) and unweeded check were arranged in sub plots in a split plot design. Maize was sown in ZT with residue recorded significantly highest growth parameter (crop growth rate-19.47 g/m²/day and plant dry matter accumulation- 444.90 g/m² at 40 DAS), yield attributing parameters (length of cob- 16.79 cm and girth of cob- 13.34 cm), grain yield (7.32 t/ha), gross returns (₹112531/ha) and net returns (₹ 59958/ha) as compared to other methods. The hybrid HM-4 produced maximum yield attributing parameters, grain yield and economics than other hybrids, but the growth parameter was significantly higher with HM-10 fb HM-4 and HQPM-1. Maximum growth parameter, yield attributing parameters, grain yield and economics were observed under atrazine 750 g/ha (PRE) fb 1 HW at 30 DAS than unweeded check. It may be elucidated that ZT sowing of hybrid maize in *kharif* season with wheat residue found the most productive and profitable. Hence, it will promote sustainable cropping systems in the Indo-Gangetic Plain and maximize the farmers' income.

Keywords: Economics, growth parameter, maize, residue, yield attributes, zero tillage

DISTRIBUTION OF INSECT-PESTS UNDER CLIMATE CHANGE SCENARIO**RAJESH KUMAR¹ AND KARTIK²**¹Department of Agricultural Meteorology CCSHAU, Hisar ²Department of Agronomy CCSHAU, Hisar

Insects being poikilotherms, temperature is probably the single most important environmental factor influencing their behaviour, distribution, development, survival, and reproduction. Therefore, it is highly expected that, the major drivers of climate change i.e. elevated CO₂, increased temperature and depleted soil moisture can impact population dynamics of insect-pests. More than one-third of species in the world are at the risk of extinction and an estimated 60% of the Earth's ecosystems have been degraded in the last 50 years, with negative consequences for the ecosystem. Up to 50% of the Asia's total biodiversity is at risk due to climate change. With rise in temperature, the insect-pests are expected to extend their geographic range from tropics and subtropics to temperate regions at higher altitudes along with shifts in cultivation areas of their host plants. This may lead to increased abundance of tropical insect species and sudden outbreaks of insect-pests can wipe out certain crop species, entirely. Accelerated metabolic rates at higher temperatures shorten the duration of insect diapause due to faster depletion of stored nutrient resources. Warming in winter may cause delay in onset and early summer may lead to faster termination of diapause in insects, which can then resume their active growth and development. This gives an important implication that increase in temperature in the range of 10°C to 50°C would increase insect survival due to low winter mortality, increased population built-up, early infestations and resultant crop damage by insect-pests under global warming scenario. The amount of carbon dioxide in Earth's atmosphere rose at a record pace in 2016 to the highest level in at least three million years. The growth could ultimately lead to a 20-metre rise in sea levels and an increase of three degrees in temperature. Atmospheric concentrations of carbon dioxide (CO₂) have now reached 404.48 parts per million (ppm), up from 400.0 ppm in 2015. A larger crop canopy and denser foliage resulted from enhanced CO₂ level in the atmosphere will create more relative humidity, thereby making micro-environment more favourable to pests. Increases in food quality, i.e. increase in the nitrogen content of plants due to high temperature, can results in sudden resurgence of population of pests. Moreover under condition of stress, plant defensive systems are less effective and they become more susceptible to pest attack.

CLIMATE SMART AGRICULTURE: AN EMERGING WAY FOR SUSTAINABLE AGRICULTURE UNDER CLIMATE CHANGE SCENARIO**RAM RAJ KARWASARA^{1*} AND POONAM KUMARI²**¹*M.Sc. Agronomy, ICAR-National Dairy Research Institute, Karnal*²*M.Sc. Plant Pathology, Rajasthan College of Agriculture, MPUAT, Udaipur*

Climate change is considered as a biggest threat on food and livelihood security of millions of people in various countries of the world (IPCC, 2014). Climate change, particularly higher frequency and greater intensity of climate extremes are likely to cause negative impact on agriculture, food and livelihood security, especially in developing countries like India which are highly depend on agriculture. Changes in cropping system, agricultural biodiversity, decline factor productivity and prevalence of pest and diseases are some of the major observed causes of climate change impact on agriculture. The estimated impacts of climate changes on cereal crop yields in different places indicate that the yield loss can be 20 to 60 per cent. Most of estimates indicate that the climate change causes negative impact on productivity of agricultural crops, their production sustainability and net income in some areas which are already food insecure. So, agriculture production system require better adaptation to climate change for ensuring food security in developing countries. Thus, development of Climate Smart Agriculture (CSA) has a crucial role to achieving overall food security *via* sustainable agriculture under climate change scenario. Climate Smart Agriculture aims to improve the agricultural productivity and income from crops, livestock and fish on sustainable basis and environment sound. It also serve as to have reduced farmer risk, better resilience to climate, ecosystem protection, improved productivity, minimized greenhouse gas emissions from agriculture and allied sectors, avoid deforestation and maximise carbon sink.

Keywords: Climate change, Climate smart agriculture, Food security, Sustainable agriculture.

CLIMATE RESILIENT AGRICULTURE: A STEP TOWARDS SUSTAINABLE FUTURE**RANAJIT KUMAR MAHANTA***Agronomy, ICAR – National Dairy Research Institute, Karnal*

The world population is estimated to be increased to three billion by the end of 2050 and 90% of this will be from developing countries like India that rely on existing land, water and ecology for food and well-being of human kind. Population growth and rising incomes in much of the developing world have pushed demand for food and other agricultural products to unprecedented levels. In order to meet food demand in 2050, FAO has estimated that annual world production of crops and livestock will need to be 60% higher than it was in 2006. In developing countries, about 80% of the required increase will need to come from higher yields and increased cropping intensity and only 20% from expansion of arable land. Climate change poses a major and growing threat to global food security. The magnitude and speed of climate change; and the effectiveness of adaptation and mitigation efforts in agriculture will be critical to the future of large segments of the world's population. According to IPCC 2013 report, all four dimensions of food security are possibly affected by climate change through their effects on agricultural production and incomes of rural households, food prices and markets; and in many other parts of the food system (*e.g.*, storage, food quality, and safety). Implementations of different interventions module going to make agriculture system insensitive to climate change – including the increased incidence of extreme weather events and strengthening its adaptive capacity are therefore, important priorities to protect and improve the livelihood of the poor's and allow agriculture to fully play its role in safeguarding food security. The improved technology and adequate policy measures should be implemented to reduce vulnerability and increase the capacity of producers, particularly smallholders, to effectively adapt, so that production system be unaffected.

Keywords: Climate change, Adaption, Mitigation, Policy, Food security

FOOD SECURITY UNDER CLIMATE CHANGE: SUSTAINABLE FOOD PRODUCTION

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Current trends point to continued human population growth beside climate change increase the pressure on improving the capacity of agricultural system to produce food and fiber without further sacrificing the regional and natural resources. The foremost challenges which agriculture is going to face in coming decades will be to produce sufficient food and fiber for emergent global population by keeping in mind the environmental sustainability. Climate change has immense effects on agriculture and therefore human hunger currently and in the decades ahead. The degradation and scarcity of natural resources, pollution resulting from agricultural production, food losses and wastage, and food safety (both quantitative and qualitative), both in terms of production and post-harvest handling, are critical issues that must needs to concern to attain sustainable agricultural production globally. Recent agricultural practices that have greatly increased global food supply have had inadvertent, detrimental impacts on the environment and on ecosystem services, highlighting the need for more sustainable agricultural production.

Keyword: Food security, Climate change, Sustainable management

CROP RESIDUE WASTE OR WEALTH FOR SOIL HEALTH AND CROP PRODUCTIVITY

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Disposal of crop residues has turn out to be a huge problem in north-west Indian states; resulting farmers prefer to burn the residues in-situ. Crops residue management are of utmost important as it contains plant nutrients and improves the soil-plant-atmospheric continuum. Burning biomass not only pollutes environment and results in loss of appreciable amount of plant essential nutrients. Crop residues, usually considered a problem, when managed correctly can improve soil organic matter dynamics and nutrient cycling, thereby creating a rather favourable environment for plant growth. The intelligent management and utilization of crop residues is essential for the improvement of soil quality and crop productivity under rice-wheat/ Sugarcane based cropping systems of the sub-tropical climatic condition of western Uttar Pradesh. Viable option is to retain residue in the field; burning should be avoided. The major issue is adapting drills to sow into loose residues. This paper also discusses the possible strategies, financial and socio-economic evaluation of the crops residue management technologies and accentuates the assessment of range of potential policy instruments which would offer avenues for sustainable agriculture and environment. Timely availability of machinery is of utmost significance to manage the crops residues in-situ. The agricultural waste opens vivid options for its versatile usage and is possible if residue is collected and managed properly. It is a prerequisite for surplus residues to be used for sustainable agriculture. There is an urge to create awareness among farming communities to incline them to understand importance of crop residues in western Uttar Pradesh soils for sustainability and resilience of Indian agriculture. A part from the higher quantity of rice and wheat residue, the residue of sorghum, maize, barley, chickpea, groundnut, rapeseed and mustard, sugarcane trash, potato, soybean, sunflower and some other minor cereals also contribute substantially towards total amount of about 629 million tonnes in India in 2008-09. Three-fourth of the total residue is produced by rice, wheat and oil seed crops and remaining One-fourth are from sugarcane and sorghum. Of the available residue for incorporation 53% are available in Kharif and 47% in Rabi season. Crop residue (CR) is important components of low external input of sustainable agriculture without sacrificing productivity. Crop residue improves the physical, chemical and biological properties of soil. Crop residue increased the crop productivity. Crop Residue can be partially substituting the fertilizer nutrient but not completely replacing them. Crop residue has potential to improve fertility status of soil.

Keywords: Residue burning, Soil health, Productivity, Profitability, Soil organic carbon

WHY AND HOW CONSERVATION OF SOIL AND WATER IN OUR COUNTRY**¹RISHABH DEV, ²J P RATHORE, ²ANIL SHARMA AND ¹D KVISHWAKARMA AND ³ANKITA MANTRI**¹*College of Agricultural Engineering and Technology,*²*Division of Fruit Science, SKUAST-Kashmir, Shalimar Campus, Srinagar (J & K)*³*Department of Fruit Science, ASPEE CHF, Navsari Agricultural University, Navsari Gujarat*

Total geographical area in India is about 329 million hectares, out of which 68 million hectares is critically degraded and another 107 million hectares is severely eroded. A total of 175 million hectares area is subjected to serious erosion problems such as wind, water, water logging, soil alkalinity and salinity etc. It is expected that about 61 per cent of soil is displaced from one place to another. The conservation and management of the rain water is very important in dry land area to reduce the impact of moisture stress. Conservation of soil and water means being good stewards of the earth. Using our resources wisely, so we farm minimizing soil erosion. Never plowing up and down slopes, practicing no-till or minimum tillage where possible. Sometimes even when the best management practices are used rainfall events exceed our ability to control erosion, but we should always do our best. Our quality of life is directly dependent on both. The upper layer contains most of the moisture and nutrients as a general rule and plants have the majority of their roots in this layer. Once this layer of top soil erodes away then it is difficult to establish vegetation. Major objective of soil conservation is to keep everything in the soil in its place. It manages the soil erosion and process of sedimentation. Soil erosion, the displacement of soil particles from soil surfaces is a serious problem in our country. This process ultimately loses the productivity of soil as a whole causing some other problems like environmental issues. But soil erosion enriches valley bottoms and forms the rich plains. Although erosion is considered as a natural process but it is also caused by human beings. The activities like deforestation, farming of slopes, road construction, overgrazing etc. increase soil erosion. Soil erosion can be a slow process but it can be very fast causing serious loss of topsoil. Many nutrients and organic matter of soil is lost by soil erosion. The loss of topsoil certainly affects the production of crops. It affects the surface water quality and the drainage system of soil is also disturbed.

IMPACT OF CLIMATE CHANGE ON POLLINATORS, POLLINATION AND FOOD SECURITY**RITESH KUMAR*, SUSHIL KUMAR AND RAVINDRA KUMAR***Department of Entomology, GBPUA&T, Pantnagar, Uttarakhand, India*

The climate smart agriculture has gained attention in recent times among scientific fraternity including biologists, agro meteorologists, entomologists and related researchers of various fields. Climate change at global scenario is leading to increased habitat loss, geographical shift and extinction rates of biodiversity. Globally, pollination services may come under significant stress, more pronounced in the developing world than in the developed world and in the tropical than in the temperate regions. The most likely effect on pollinators will result from an increase in temperature. If there is an increase of the average global temperature by 1.5-2.5 ° C, then approximately 20-30 percent of known species will be threatened which may lead to extinction. Honey bees and other pollinators are an integral part of agroecosystems as these minute creatures ultimately decide the seed set and yield and quality of various crops through pollination services. Nearly 75 per cent of the world's food plants show increased fruit or seed set with insect visitation. The economic value of these services is estimated to be about \$ 153 billion per year. Pollinators are considered key-stone species in many situations not only because they support humanity via increased production and food security but also maintain diversity in an ecosystem. Globally, farmers manage only 11 of the 20,000 to 30,000 bee species worldwide, with the European honey bee (*Apis mellifera*) being by far the most important species, although not in the IUCN Red list. Climate change is altering the phenological response of plants including anthesis and pollinators may find it difficult to alter their foraging activities in synchronization with altered anthesis timing.

Key words: Pollinators, Climate change, Ecosystem, Synchronization**CLIMATE SMART AGRICULTURE: A FUTURE PROSPECT****¹RUPANJALI AND ²SANYOGITA**^{1, 2} *GBPUAT, Pantnagar*

For past some years, earth's climate is undergoing significant change, an increasing trend in global temperature by rate of 0.13°C / decade has been observed in past five decades. Global warming is expected to bring significant changes in rainfall, temperature and other weather parameters so sincere efforts are required for mitigation and adaptation to reduce the vulnerability of agriculture to the adverse impacts of climate change so CSA (climate smart agriculture) can be an effective tool. Adoption of varieties with multiple resistances for abiotic stress, conversion of C₃ to C₄ plants and adoption of millets are key factor for maintaining yield stability. Efforts for improving water use efficiency and nitrogen use efficiency assumes more relevance in the climate change scenario as water resources are likely to decline in coming years and for exploiting the useful effect of increased CO₂ level, crop demand for nitrogen is likely to increase. Adjustment of planting dates to reduce

temperature induced spikelet sterility is another considerable measure to maintain yield stability. An early warning system can be developed to monitor changes in disease and pest outbreak in changing climatic scenario. Some preventive measures for drought like on-farm reservoirs in medium land, growing of pulses and oilseeds instead of rice in uplands and ridge and furrow system for growing cotton can be adopted.

PRECISION TOOLS FOR SOIL-WATER CONSERVATION

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With continued population growth and increasing demands on water resources, precision conservation will have an increasing role during this new millennium. It has been reported that world population is expected to be about 9.4 billion by 2050, and that increases in crop yields will have to be achieved primarily from land that is currently under production since most of the world's arable land is already being cultivated. Since intensive farming can potentially impact soil and water quality, parallel increases in new practices and technology contributing to improved soil and water conservation practices will be needed to help sustain and maintain the needed yield increases from agricultural systems. Agriculture has vaulted into the space age using remote sensing, geographic information systems (GIS) and global positioning systems (GPS) into what is being referred to as precision agriculture or site specific crop management. Potential for conservation accrues from not irrigating non-cropped areas, reducing irrigation amounts to adapt to specific problems or fully optimizing the economic value of the water applied through irrigation.

Keywords – Precision, conservation, site specific

EFFECT OF SOLAR PANEL ARRANGEMENT ON SHADOW INTENSITY AND ENVIRONMENTAL PARAMETERS

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Renewable energy is the energy generated from natural processes that are continuously replenished. Distributed solar power generation would be facilitated if agriculture lands could be used for generation of solar power without adversely affecting agriculture production. Roof structure of the solar power plant is needed to be constructed with the appropriate design so that appropriate quantity of light can be transmitted through the gap of panels which will be useful for crop cultivation. The study was carried out to evaluate the effect of light on shadow intensity of panel on ground. The solar panel model was designed and developed for the observation of variation in environmental parameters. It was consisting of telescopic column of height 3,4,5 m, Solar panel frame of size 1.83 m × 1.83 m to accommodate 12 numbers of solar cells of size 0.46 × 0.60 m. Light weight thermocol sheets were fitted in blocks instead of PV module. The frame was oriented facing south at an angle of 23°. Three different variables like panel height, panel arrangement in frame and column pattern in rows were considered. Three heights as 3,4,5 m, three panel arrangements as full cover, checks and central row blank as well as three column patterns as single row, two rows and three rows tested for environmental parameters. It was observed that as increasing height, temperature, light intensity and radiation difference between open and shadow was decreasing and panel height has negligible effect on RH. It was observed that economic point of view 4m panel height is optimum. Out of different 27 combinations checked, panel arrangement of two rows column pattern and 4 m panel height, day average temperature difference in light intensity and radiation were minimum as 31300 lux and 458.2 w/m² respectively was found best combination for providing better environmental condition which is essential for crop growth.

ROLE OF BIOCHAR IN AGRICULTURAL PRODUCTION AND MITIGATION OF CLIMATE CHANGE

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Biochar is the carbon rich product obtained when biomass, such as wood, manure or leaves, is heated in a closed container with little or no available air. Discovered in sub-soils of fired forest in Amazonian region (Brazil) and known as terra preta. Due to its light weight, high nutrient content and water retention power by improving soil health, Biochar improves growth & development of crops. Biochar is created by heating organic material under conditions of limited or no oxygen (Lehmann 2007). Biochar to mitigate climate change- It has carbon in recalcitrant form and can hold it in soil for 100 of years. Crop

residues, poultry litter, green urban waste, industrial waste (from paper mills) can be used to produce Biochar. Due to high retention power, it reduces N₂O and CH₄ emission from soil. Otherwise easily decomposable OM can change in to resistant form by converting to Biochar. It can be used as plant growth medium in Following: Urban gardens, Roof & terrace gardens, Floatigation. It sequesters carbon for longer period. It improves physical, chemical and biological properties of soil. Mitigate climate change by reducing emission of GHG. Act as sink of heavy metals. Biochar is a fine-grained, highly porous charcoal substance that is distinguished from other charcoals in its intended use as a soil amendment (Hunt et al. 2010). Improves yield of crop, when applied in combination with other organic and inorganic fertilizers.

Keyword- Biochar, Crop Residues, Soil Health, Heavy Metal

ORGANIC FARMING: A WAY TOWARDS SUSTAINABILITY

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Conventional Agriculture though plays a significant role in meeting the demands of growing population but has also led to increased dependence on chemical fertilizer and pesticides. It causes natural resource exploitation in the form of soil degradation, reduction in microbial and faunal diversity, soil and ground water pollution posing a serious threat to human health and environment. On the contrary, Organic farming, often considered as an inefficient approach for food production, is a rapidly growing sector because of its environmental friendly and sustainable approach and increasing demand of organic food globally. Organic farming relies on organic inputs, beneficial microbes and plant products as biopesticides and biofertilisers. It emphasizes on rotating crops, managing pests naturally, diversifying crops and livestock, and improving the soil with compost additions and animal and green manures. The organic inputs when applied on seed or soil inoculants, they multiply and participate in nutrient cycling, thereby maintaining soil fertility and crop productivity. Crop protection under organic management is not directly focusses on managing a particular pathogen or pest, but at the management of the environment, so that the plants themselves are capable of defending them from potential attacks. It ensures food safety and at the same time increases bio diversity. Although it has an untapped role to play in the establishment of sustainable production system, it is not possible to feed the entire planet with a single approach. Instead, a collaboration of organic and other innovative strategies are needed. Such a harmonious blend is possible only after getting through the social and economic barriers and a great deal of policy making and implementation would be required to establish such a venture.

BIOTECHNOLOGICAL APPROACHES FOR THE CONSERVATION OF NATURAL RESOURCES AND SUSTAINABLE DEVELOPMENT

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The natural environment provides a large number of resources of value to the economic system. Rapid economic growth has been resulted in rapid environmental changes. In addition water is more variable in its availability, partly as a result of increased deforestation. Significant deforestation has occurred in recent decades and increased loss of biodiversity has occurred. Particular attention needs to be given to developing and transferring technologies. This can promote sustainable resource-use or the more efficient use of non-renewable resources. Therefore, it is necessary to accept the sustainable development as the only safe way to the actual society development, but also the rational alternative use of non-renewable resources. Amongst ex-situ conservation methods, Biotechnology, particularly plant, cell, tissue and organ culture technique has emerged as a profitable and now being widely used tool for conservation and sustainable utilization of genetic diversity. In addition, in vitro culture of plant cells coupled with other biotechnological techniques offer a valuable opportunity for enhancing the productivity of bioactive compounds. Transgenic approaches have opened up new opportunities to improve tolerance to abiotic stress by incorporating genes involved in stress protection from any source into agriculturally important plants. Transformed cells and organ cultures have proved valuable in the study of different aspects of secondary metabolism as these are genetically and bio-chemically more stable over long periods in culture. Biosynthesis of alkaloids has been manipulated through the application of biotechnological tools particularly by using in vitro techniques. New strategies need to be adapted to enhance the yield by introducing useful genes in desirable taxa. This will also ensure uniform yield of active principle. An efficient regeneration protocol of different regeneration stages-callusing, shoot induction, and rooting have been developed in number of species such as *Brassica oleracea* var. *botrytis* L. (cauliflower), *Tinospora cordifolia*, *Pluchea lanceolata*, *Ammi majus* *Dioscorea bulbifera*, *Datura innoxia*, *Baccopa monniera*, *Jatropha curcus*, *Tylophora indica* etc. An efficient transformation system for Indian cauliflower variety Pusa Meghna was also developed using *Agrobacterium tumefaciens* strains containing Insecticidal cry gene and selectable marker *bar* gene. The in vitro culture technique coupled

with molecular tools can fruitfully be employed for conservation, micropropagation, biotic and abiotic stress tolerant plant and enhancement of secondary metabolites.

ACCUMULATION AND COMPARTMENTALIZATION OF CD, CR, NI AND PB IN VARIOUS PARTS OF LUFFA AEGYPTIACA TREATED WITH THESE HEAVY METALS IN QUANTITIES AS DETERMINED IN GANGA RIVER SEDIMENTS AT KANPUR.

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Ten samples of soil sediments were collected from the bank of Ganga river, each at 100 m distance in Kanpur city and quantities of Cd, Cr, Ni, and Pb were determined on AAS as 48.3, 85.8, 173.2, 11 $\mu\text{g g}^{-1}$ dry soil sediments, respectively. The accumulation of these heavy metals in root, stem, leaf, unwashed fruit, washed fruit and fruit peel was determined on AAS in 75 days old *Luffa aegyptiaca*. The vegetable crop was grown in 25 cm pots filled with acid washed sand and 10 days after germination, the aqueous solutions of all the selected heavy metals were applied in pots in quantities as determined in the sediment samples. The uptake of Cd, Cr, Ni and Pb in the 75 days old plants and their subsequent partitioning in root, stem, washed fruit, unwashed fruit and fruit peel were determined on AAS. The quantities of all four heavy metals were significantly higher in root, stem, leaf, fruit (washed and unwashed fruit after peeling) and as well as in fruit peels when treated separately with each of the four heavy metals singly than on combination of all four heavy metal together.

Keywords: Ganga River, *Luffa aegyptiaca*, Heavy metals, Compartmentalization

BIODIVERSITY IN PRESENT SCENARIO

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With its varied climate and terrain, and characterised by at least 10 distinct bio-geographical regions, India supports a huge variety of forest types and harbours three global terrestrial biodiversity hot spots. Most of the terrestrial biodiversity now resides in the forest, as other terrestrial habitats have lost their natural state. An impressive protected area network, comprising 509 wildlife sanctuaries, 96 national parks (including 14 biosphere reserves), and several sacred groves maintained by indigenous communities, is in place. However, despite a benign forest policy and a strong regulatory regime, forest degradation and biodiversity loss continues. In India about 15000 species of higher plants endangered and in case of animals the number of endangered species is also worrying as there are 372, 580, 1175 and 1693 species are endangered respectively in mammals, reptiles and amphibians, birds and fishes. This continues loss of different species is because of the increasing requirements of the burgeoning human population, land use change and spread of invasive alien species. The extent and loss of biodiversity must be continuously monitored and people attracted to participate in biodiversity conservation rehabilitation on a massive scale.

Keywords: biodiversity, conservation, forest, hotspots, protected area network

AIR POLLUTION AND HUMAN HEALTH

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Air pollution occurs when harmful substances including particulates and biological molecules are introduced into Earth's atmosphere. It may cause diseases, allergies or death of humans; it may also cause harm to other living organisms such as animals and food crops, and may damage the natural or built environment. Indoor air pollution and poor urban air quality are listed as two of the world's worst TOXIC pollution. An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. The substance can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

Keywords: air pollution, toxic substances, human health

CLIMATE CHANGE IN AGRICULTURE AND ADAPTATION STRATEGIES**SARIKA***Department of Agricultural Meteorology, CCS, Haryana Agriculture University (CCSHAU), Hisar*

The climate change refers to a statistically significant variation in either the mean stage of the climate or in its variability, persisting for an extended period. The fourth assessment report of Intergovernmental Panel on Climate Change [IPCC] has reconfirmed that the phenomenon of existence of climate change in recent decade is due to anthropogenic activities. Impact of climate change alters global temperature and rainfall pattern which further leads to occurrence of floods, droughts, cyclones and gradual recession of glaciers, which would result in greater instability in food production. Agricultural production is the most sensitive and vulnerable to climate change. Crop production losses in India are more despite of the beneficial effect of higher CO₂ on crop growth. Duration of crop decreases which leads to decrease in crop yield. Dynamics of pest and diseases will be significantly altered. Agricultural factors which aids in climate change includes excessive use of fertilizer to gain optimum yield and emission of Green House Gases [GHG's] like methane from rice field and nitrous oxide from manures and fertilizers. Adaptation strategies can include crop management practices like shifting of sowing date, nutrient management and introduction of varieties having new genotypes. Land and water management strategies including afforestation to overcome effect of climate change. These adaptations needs to be linked closely to evolving policies in order to achieve win-win solutions at multiple scales and to replenish our environment.

Keywords: Climate change, anthropogenic activities, Green House Gases [GHG's], adaptation strategies.

ROLE OF INORGANIC AND ORGANIC SOURCES OF NUTRIENTS IN SALT STRESS MANAGEMENT**SARITA RANI*, SATYAVAN, ANIL KUMAR, RAMPRAKASH***Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana*

Soil salinization and sodification are two major emerging threats to crop production. Salt affected soil occurs in more than 100 countries with a widespread distribution in arid and semi-arid tracts of world. To meet the world food security challenges, cultivation of barren salt affected soils, offers a good solution. The available options for reducing salt stress included irrigation management, addition of inorganic/organic nutrient sources, appropriate crop/variety selection, cyclic/alternate application of saline and fresh water, bio saline agriculture, agro-forestry etc. Various organic and inorganic amendments are used to reclaim salt stressed soils and selection for appropriate amendment is largely depends on the location specific geographical and physio-chemical characteristics of soil. It is evident from the scientific literature that use of organic amendments produce positive effect on crop productivity, soil properties and therefore provide feasible scope of using problematic soil and water under crop production to meet global food demand. Organic amendments improves soil physical, chemical and biological properties by reducing the exchangeable sodium percentage (ESP) and improving cation exchange capacity, infiltration rate, organic carbon content, and microbial status of soil. All these changes help in reducing the negative impact of salt over crop productivity.

Key words: Salt stress, recommended dose of fertilizer, nutrient sources, crop growth.

SOIL CARBON SEQUESTRATION –A WAY TO MITIGATE CLIMATE CHANGE**SAYANTIKA BHATTACHARYA, M.SC SOIL SCIENCE AND NIDHI LUTHRA, M.SC SOIL SCIENCE***G.B.P.U.A&T, PANTNAGAR*

Carbon sequestration implies transferring atmospheric carbon di-oxide into long lived pools and storing it securely. Thus it means increasing soil organic carbon and soil inorganic carbon stocks through judicious management and recommended management practices (RMP). The rate of carbon sequestration depends on soil structure, texture, temperature, rainfall, farming system and management practices. Most agricultural soils have lost 30% to 75% of their antecedent soil organic carbon pool. Due to combustion of fossil fuels and land use change the concentration of carbon di oxide in atmosphere increases upto 31% since 1750. Global emission of CO₂ is estimated at 270 Pg due to fossil fuel combustions and due to land use changes, it is 136 Pg. Thus adoption of RMPs can reduce the rate of enrichment of atmospheric CO₂. The global potential of Soil Organic Carbon Sequestration through RMPs is 0.9 Pg/year that may offset one – fourth to one – third of the annual increase in atmospheric CO₂. Thus carbon sequestration entraps the green house gases and prevents raising global temperature.

CONCEPTS: SOIL AND WATER CONSERVATION FOR AGRICULTURAL SUSTAINABILITY

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The growth of agriculture sector depends on important natural resources like soil and water. High productivity goals and inter-generational food security is achieved critically by the conserving these vital natural resources. Conservation of soil and water resources also plays vital role in sustainable agriculture. Soil and water are two basic resources which are under intense pressure from increased population and degradation. It is expected that we need to produce about 64 per cent more of present level of agricultural production to feed the estimated 800 million population upto 2020. The main problems in management of these resources are continuous soil erosion and runoff inflicting permanent damage to land and water system. Soil and water resources are being deteriorated due to different anthropogenic and natural factors. The basic factors causing soil erosion-induced degradation are wind and water erosion. Acidification, compaction and salinization are some other causes of soil degradation. Soil and water erosion disturbs agricultural, environmental and ecological functions performed by the soil and resulting in depletion of soil fertility, decreased moisture storage capacity and consequently decreased crop productivity. There is always a strong link between measures for soil and water conservation. Reduction of surface run-off by developing structures or by changes in land management will also help to reduce erosion. Likewise, reducing erosion will usually involve preventing splash erosion, formation of crusts and breakdown of structure, all of which will increase infiltration, and so help in the water conservation. For sustainable agriculture, it is pertinent for the protection of soil resources against erosion or degradation. It is therefore a pre-requisite that soil and water conservation practices should be adopted. Conservation practices include soil management, crop management, engineering, range management etc. Therefore, the agricultural sustainability can be achieved with the adoption of appropriate and efficient strategies for soil and water conservation.

Keywords: Soil, Water, Erosion, Conservation, Sustainable Agriculture

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION

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The term "natural resource" means anything that we use from our environment to achieve our objective. For example, we require bricks, cement, iron, wood etc. to construct a building. All these items are called resources for construction of building. A resource can be defined as 'any natural or artificial substance, energy or organism, which is used by human being for its welfare. Water is essential for survival of all living organisms. It is the most important component of all life forms and necessary for sustaining life. Water also regulates climate, generates electricity and is also useful in agriculture and industries. Health About 97% of the water on earth is saline in nature, found in seas and oceans. The remaining 3% is fresh water, most of which is stored in ice caps and glaciers, and just about 0.36% is distributed in lakes, rivers, ponds, etc. as 'fresh water'. Natural resources provide fundamental life support, in the form of both consumptive and public-good services. Ecological processes maintain soil productivity, nutrient recycling, the cleansing of air and water, and climatic cycles. The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving nature and natural resources. In our country the conservation of natural forests is known from the time of Lord Ashoka. Sacred forests are forest patches of different dimensions dedicated by the tribals to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. Worshipping certain plants like banyan, peepal, tulsi etc. has not only preserved them but also encouraged their plantation. History recalls numerous instances where people have laid down their lives for protecting trees. Recent Chipko movement in India is one of the best examples. This movement was started by women in Gopeshwar village in Garhwal in the Himalayas. They stopped the felling of trees by hugging them when the lumbermen arrived to cut them.

Keywords : Chipko movement, Natural Resource Management (NRM, Lord Ashoka

CLIMATE CHANGE & GLOBAL WARMING: PLANNING AND MANAGEMENT**SHITAL YADAV¹, JITENDRA SINGH BAMBORIYA², ROHIT KUMAR NAYAK, PAWAN KHILERY⁴,***1. Swami Keshwanand Rajasthan Agriculture University, Bikaner (Rajasthan)**2. Mharanapratap university of agriculture and technology, Udaipur (Rajasthan)**3. Shri karan narendra agriculture university, Jobner (Jaipur)**4. Mharana pratap university of agriculture and technology, Udaipur (Rajasthan)*

Climate change is the change in the statistical distribution of weather pattern when that change lasts for an extended period of time. Climate change also called global warming, refers to the rise in average surface temperature on earth due to increase in the concentration of atmospheric green house gases like – carbon dioxide and methane. In part because of the risk climate change poses to sustainable development, efforts to target green house gas emission reduction globally have been the focus of international discussions in an effort to achieve the broad participation necessary to manage the risk. Climate change management approaches fall into four broad categories that is:- efforts to reduce green house gas emission (regulation, research development and deployment of new technology, conservation, efforts to increase public awareness, positive incentives to encourage choices that lower emission, adding a price to green house gas emission), adaption- increase society capacity to cope with the changes in climate, Geo-engineering or climate engineering- additional, deliberate manipulation of the earth system, efforts to learn and understand more about the climate system, which can help support proactive risk management. Agricultural solutions for climate change management – Establish “Nutrient-Trading” programme and improve soil management.

LAND DEGRADATION IN ARID AND SEMI ARID REGION AND THEIR MANAGEMENT**SHIV SINGH MEENA*¹ AND RAKESH KUMAR²***^{1*} Department of Soil Science, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand**²Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand*

Now a day's degradation of land in arid and semi arid region is a major problem, also called desertification. Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes acting upon the land. It may be due to by various process *e.g.* vegetation degradation in rangelands, sheet erosion, silting, acidification, salinization, urbanization, pollution, Monoculture, destabilizing the local ecosystem, Soil contamination, Loss of soil carbon and environmental change. Land degradation affects a large number of people over a significant proportion of the earth's surface which has led to extreme poverty and hunger. This is associated with declining status of natural resources, and environmental un-sustainability. Around the world, land degradation can be viewed as any change or disturbance to land perceived to be undesirable that affect human activities like agriculture and settlements. Management of degraded land by various processes *e.g.* Prevention of soil erosion, Reduction of peak rate of runoff, Creation of water resources/bodies, Improvement of soil fertility and productivity for ensuring higher income, Increasing cropped area and cropping intensity, crop diversification, Resource Conservation Technologies, Reclamation of problem soil, Rainfed Area Development and Soil Health Management. Objective behind to manage degraded land is, to make agriculture productive, sustainable, remunerative and climate resilient, conserve on-farm resources, optimize utilization of water resources, adopt comprehensive soil health management practices based on soil fertility status and establish an effective co-ordination for prevention of land degradation for sustaining food grain production in the country.

ROLE OF PHEROMONES IN IPM**SHIVANI KHOKHAR* AND ROOMI RAWAL*****Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana 125 004*

Pheromone is a class of semio-chemicals or mixture of chemical released by an organism to outside that cause specific reaction in receiving organisms of same species. Pheromones are divided into two type *i.e.* releaser and primer effect pheromones. Releaser effect pheromone are more important from integrated pest management point of view and they are subdivided into different pheromones such as sex pheromone, aggregation pheromone, alarm pheromone, trail pheromone and oviposition marking pheromones. Sex pheromones are secreted by one sex and triggers off a series of behaviour patterns in the opposite sex of the same species and thus facilitates mating and can be utilized in three ways *viz.*, monitoring of a pest, mass trapping and mating disruption. Aggregation pheromones are released by one sex elicits response in both the sexes of a species. It induce aggregation or congregation of insects for protection, feeding and reproduction. Aggregation pheromones can be exploited in the following areas *viz.*, Monitoring, Activation of insect, Lure and infect, Push-pull, Mass trapping and Mating disruption. Addition of pheromone-based trapping of *Rhynchophorus palmarum* using trap densities of less than one trap per five hectares lowered red ring disease in plantations by over 80% in one year near the pacific coast of costa rica. It is demonstrated that mean percent fruit infestation in PAU fly trap (cue lure) in guava orchards was very less (26.7 %) as

compared to control (80 %). Alarm pheromones raise alert in conspecifics, to raise a defence response and/or to initiate avoidance. E- β -farnesene (EBF) is an alarm pheromone in over 19 genera of aphids. Alarm pheromone can control aphids because it attracts natural enemies, disperses aphids and alters their physiological systems. Trail pheromones are essentially used to indicate sources of requisites to other members of the colony and are less volatiles than alarm pheromones. Host marking, spacing or epidietic pheromones elicit dispersal away from potentially crowded food sources and reducing members. The resulting effect is reduced time spent on the marked and previously utilized resource as well as reduced probability of oviposition. Pheromones can play an important role in integrated pest management for structural, landscape, agricultural, or forest pest problems because they are species-specific chemicals that affect insect behaviour, non toxic to beneficial insects and environment.

Key words: Pheromone, integrated pest management

WEATHER BASED YIELD FORECASTING MODELS

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Yield forecasting is a very important task that plays a significant role in agriculture. Various crop yield estimation models have been introduced by the various eminent workers in order to facilitate the farmers and the economic status of the country. A number of models and techniques have come up based on the weather factors that are developed in accordance with the various crops at different agroclimatic zones. These models used weekly/fortnightly weather data or in some cases for district based forecasting agricultural inputs were used as input data. The techniques included revolved around the indices that were used as regressors in the models, discriminant analysis technique and water balance technique. Reliable forecasts before harvest can be obtained for some of the major crops like rice, wheat, sugarcane and maize. Major factors influencing yield like the pests and diseases are also affected by weather conditions thus models forewarning the disaster by pests and diseases can also be predicted through regression techniques. Weather based models providing forewarning on various pests and diseases occurrence in major crops at various locations using techniques like regression analysis, complex polynomials through GMDH technique and Artificial Neural Network. The above mentioned approaches were utilized by various workers and organizations in order to forecast yields and the disease forewarning helped farmers in taking plant protection measures timely. Here discussion about the various important models being used for yield forecasting have and the most reliable method has been decided on the basis of the various results obtained through studies.

Keywords: Yield forecasting models, artificial neural network, Adaptive Neuro Fuzzy Inference System

MANAGEMENT OF GROUND WATER RESOURCES IN INDIA

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Ground water has made significant contributions to the growth of India's Economy and has been an important catalyst for its socio economic development. Its importance as a precious natural resource in the Indian context can be gauged from the fact that more than 85 percent of India's rural domestic water requirements, 50 percent of its urban water requirements and more than 50 percent of its irrigation requirements are being met from ground water resources. As per the latest assessment, the annual replenish able ground water resource of country has been estimated as 433 billion cubic meter (bcm), out of which 399 bcm is considered to be available for development for various uses. The irrigation sector remains the major consumer of ground water, accounting for 92% of its annual withdrawal. Though the overall stage of ground water development is about 58%, the average stage of ground water development in North Western Plain States is much higher (98%) when compared to the Eastern Plain States (43%) and Central Plain States (42%). As far as ground water resource availability is concerned the share of alluvial areas covering Eastern Plain states of Bihar, Orissa (part), Eastern Uttar Pradesh and West Bengal and North Western plain states of Delhi, Haryana, Punjab, Western Uttar Pradesh, Chandigarh; is about 44% of the total available resource. However, these groups of states have overall development of the order of 43% and 98% respectively. In view of the marked difference in stage of ground water in these areas, there is a need to critically analyze the underlying factors responsible for the imbalances in terms of technical and socio-economic considerations. There is urgent need for coordinated efforts by various Governments and non-governmental agencies, social service organizations and the stakeholders for evolving implementable plan for effective management of this precious natural resource.

Keywords: Ground water, irrigation, alluvial, development, imbalance etc.

ROLE OF MICROBIAL CONSORTIA TO INDUCE SYSTEMIC RESISTANCE IN CHICKPEA AGAINST *FUSARIUM OXYSPORUM* F.SP. *CICERI***SHUBHA TRIVEDI, MUKESH SRIVASTAVA*, VED RATAN, ABHISHEK MISHRA, SUPRIYA DIXIT, AND Y. K. SRIVASTAVA***Biocontrol Lab, Department of Plant Pathology, C.S. Azad University of Agri. & Tech., Kanpur (U.P.), INDIA.***Rani Lakshmi Bai Central Agricultural University, Jhansi (U.P.), INDIA.*

Chickpea (*Cicer arietinum* L.) is one of the major grain legume widely grown in India as well as other parts of the world. Among various factors attributing to low productivity, susceptibility to diseases is very important. Van Emden et al. (1988) estimated that yield losses due to insects and diseases ranges from 5 to 10% in temperate and 50 to 100% in tropical regions. Wilt caused by *Fusarium oxysporum* f.sp.*ciceri* (*Foc*) is a major constraint in chickpea production. Infected seed, chlamydospores surviving in the soil are the major sources of primary inoculum. Since 75% cultivation of chickpea in India is under rainfed, the crop faces severe moisture stress which predisposes the crop to wilt. The saprophytic survival ability of the pathogen in soil makes chemical control and crop rotation ineffective. Cultivation of resistant varieties is an economical approach for the management of the disease but up to now effective resistant cultivars are not available to combat with the pathogen. The preference for biological control methods is justified also by the undesirable side effects of pesticides. The technology that seems promising to manage the disease without disturbing the equilibrium of harmful and useful composition of environment and ecosystem is the use of more and more biological control agents. It was stated by various workers that use of biological agents has been very much successful against soil borne diseases for which no resistant sources have been identified (Cook and Baker, 1983; Mukhopadhyay, 1994; Mukhrejee et al., 2012). *Trichoderma*, *Pseudomonas* and *Bacillus* spp. are effective biocontrol agents that have been extensively used in agriculture. They provide systemic resistance to plants infested by various fungal phytopathogens. The biocontrol agents are highly effective, inexpensive with excellent shelf life and suitable method of delivery. Hence, it is important to investigate the potential of biological control measures in agriculture, especially where economic issues restrict the use of expensive inputs or when there are environmental concerns about toxicity of agrochemicals. Although studies delineating biocontrol activity of *Trichoderma*, *Pseudomonas* and *Bacillus* spp. against fungal pathogens are documented, there is a need to understand the biochemical basis of disease resistance being induced by these species. In this regard, current study was designed to understand the role of *T. harzianum*, *Bacillus subtilis* and *Pseudomonas fluorescens* (single and in combination) in inducing systemic resistance in chickpea exposed to *Fusarium oxysporum* f. sp. *ciceris* (*Foc*) by increasing production of Chlorophyll, Protein and defense enzymes such as Peroxidase (PO), Polyphenol Oxidase (PPO) and total phenolic content in chickpea. It was observed that seed treatment with talc based formulation of such bioagents in combination induced higher levels of defense enzymes in chickpea during pathogenesis by *Fusarium oxysporum* f. sp. *ciceris* (*Foc*). Thus, it is concluded that biocontrol agents play an important role in inducing plant defense enzymes during pathogen host interactions. Findings of the present studies will be helpful in formulating novel bioformulations using fungal and bacterial bioagents to control wilt which might be exploited for sustainable disease management programs to save environmental risk.

BT BRINJAL: CHALLENGES AND PERSPECTIVES**¹SHUBHAM KUMAR, ¹SUNIL KUMAR, ¹PRIYANKA, ¹ESHANEE, ¹SHIVANI CHAUHAN, ¹HARNOOR KAUR DHILLON AND ²BHALLAN SINGH SEKHON***CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.)*

Brinjal is one of the most popular and principal vegetable crops grown in India and other parts of the world. The Bt brinjal is a suite of transgenic brinjals (also known as an eggplant or aubergine) created by inserting a crystal protein gene (*Cry1Ac*) from the soil bacterium *Bacillus thuringiensis* into the genome of various brinjal cultivars. Brinjal production is extensively affected by brinjal fruit and shoot borer. For controlling this, many chemical pesticides are used which are neither environment friendly nor good for human health. The Bt brinjal has been developed to give resistance against lepidopteron insects, in particular the brinjal fruit and shoot borer (*Leucinodes orbonalis*) by Mahyco, an Indian seed company to reduce the uses of chemical pesticides. Bt brinjal could effectively control the target pest and was found to be safe for environment and human health. On October 30, 2013, Bt brinjal is commercialized in Bangladesh with approvals from the ministries of Environment and Forests (MoEF) and Agriculture (MoA), Govt. of Bangladesh. Bt brinjal is surrounded by many controversies like human safety, environmental impacts and ethical concerns. In India, in spite of all the scientific studies, release of Bt brinjal has been put under moratorium. Indian government has constituted an expert committee to address this issue. Now the question arises, what should be done to the Bt brinjal? Is there any test remain? If yes, then the process should be fastened because Bt brinjal is approved by many other countries and they are cultivating and consuming it without any problems. In this review we have tried to explore the facts related to Bt brinjal including its production, use of Bt toxin, use of chemical pesticides in controlling the fruit and shoot borer along with perspective of public opinion and government initiatives.

Keywords: Bt brinjal, Brinjal Fruit and Shoot Borer, GM Vegetables, Human Health, Ethical concerns

DEVELOPING RUST RESISTANT CULTIVARS IN WHEAT: AN OVERVIEW

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Wheat crop is attacked by three rust diseases of which stripe rust caused by *Puccinia striiformis* f. sp. *tritici*, leaf rust caused by *Puccinia triticina*, stem or black rust caused by *Puccinia graminis* f. sp. *tritici* West are the most economically significant and common diseases causing greater yield losses among wheat cultivars. Growing cultivars resistant to rust is the most sustainable, cost-effective and environmental friendly approach for controlling rust diseases. To date, more than 187 rust resistance genes (80 leaf rust, 58 stem rust and 49 stripe rust) have been derived from diverse wheat or durum wheat cultivars and their related wild species using different molecular methods. There is need for rust resistance genes, their primitive sources, their distribution in global wheat cultivars and the importance of durable resistant varieties for controlling rust diseases. Consolidating information on durable resistance varieties and their mechanisms for controlling rust disease is also important for the development of new disease-resistant varieties with high-yielding capabilities and their acclimatization in new environment. This information will serve as a foundation for plant breeders and geneticists to develop durable rust-resistant wheat varieties through marker-assisted breeding or gene pyramiding and will contribute toward enriching diversity for rust resistance in bread wheat improvement programmes.

Keywords: gene pyramiding, marker-assisted breeding, resistance, rust, wheat

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION

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This abstract discusses the effective management of the world's natural resources. Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. Monitoring vegetation dynamics and land cover change are essential for the sustainable management of natural resources and biodiversity conservation. Natural resource management deals with managing the way in which people and natural landscapes interact. It brings together land use planning, water management, biodiversity conservation, and the future sustainability of industries like agriculture, mining, tourism, fisheries and forestry. It recognises that people and their livelihoods rely on the health and productivity of our landscapes, and their actions as stewards of the land play a critical role in maintaining this health and productivity. Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources. Environmental management is also similar to natural resource management. The article also shows that the initial clash between development and conservation has been reframed as 'sustainable development', which is a useful analytical framework to bridge the North-South divide.

Keywords: effective management, natural resources, development, conservation, clash, North-South divide.

SCREENING OF BASMATI RICE VARIETIES FOR THEIR ARSENIC ACCUMULATION IN PUNJAB, NORTH-WEST INDIA

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A pot study was conducted to screen different basmati rice varieties for their accumulation of arsenic (As). Different amounts of arsenic (0–800 µg/L) were applied through irrigation water to four basmati rice varieties (Pusa basmati-1121, Pusa Punjab basmati-1509, Punjab basmati-2, and Punjab basmati-3). Highest arsenic concentration was found in the grains of Punjab basmati-3 and lowest in the grains of Pusa Punjab basmati-1509. In all varieties, grain As concentration ranged from 0.038 to 0.288 mg/kg, which was within the permissible limit of 1.0 mg/kg in rice grain recommended by World Health Organization (WHO). In husk, highest As concentration was found in Pusa basmati-1121 and lowest in Punjab basmati-2. Among the four varieties, highest content of As was accumulated in roots and straw of Pusa Punjab basmati-1509, whereas least was

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accumulated in Punjab basmati-2. The distribution of arsenic among plant parts was found in the order: roots > straw > husk > grain. The mean arsenic concentrations in grain, husk, straw, and root of basmati rice varieties increased with increasing concentration of arsenic in irrigation water. Highest grain yield was obtained in Pusa Punjab basmati-1509 variety due to lesser accumulation of arsenic compared with other varieties. Rice yield, plant height, root weight, straw weight, test weight, effective tiller, and filled grain per panicle decreased with increase in arsenic concentration in irrigated water.

FERTI-FORTIFICATION: AN EASY APPROACH TO ALLEVIATE MALNUTRITION BY NUTRITIONAL ENRICHMENT IN CEREALS

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Micronutrient deficiencies in plants lead to several nutrient deficiency diseases in human and animals feeding on them. Among micronutrients, zinc (Zn) and iron (Fe) are essentially required for plant, animal and human nutrition. As for deficiency of Zn and Fe is concerned, more than 3 billion people globally suffer from Fe and Zn deficiencies especially children below 5 year and pregnant women. Deficiency of Zn and Fe cause diseases like acrodermatitis, abnormal skin and hooves, bone and joint problems, poor wound healing and fertility problems (due to Zn deficiencies) and anemia and blood loss (due to Fe deficiencies). According to WHO report (2002) Zn and Fe stands at 5th and 6th rank, respectively, among 10 major risk factors causing health issues in developing countries. To ameliorate this deficiency in plant, animals and human beings, enrichment of grains and fodders with Zn and Fe can be done through bio-fortification and ferti-fortification. Bio-fortification is a genetic technique and can be defined as the idea of breeding crops to increase their nutritional value. Whereas ferti-fortification is an agronomic concept and defined as a technique to enrich various crop grains and straw with micronutrients through fertilizer application. Mainly cereals (rice, wheat, maize etc) are included in programme of bio-fortification/ferti-fortification because these are inherently low in micronutrient and serve as staple food for more than 50 per cent population of world. Ferti-fortification is done through different methods viz. soil application, seed treatment, foliar, soil+foliar etc. Among all these, soil+foliar method of micronutrients application are best technique of enrichment and give highest percent increase in Zn and Fe contents in plants. Being safe and cost effective, agronomic biofortification is rapid used for enrichment as compared to genetic biofortification.

SOIL ORGANIC CARBON MANAGEMENT FOR SUSTAINABLE FOOD PRODUCTION

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It is widely recognised that Soil Organic Carbon (SOC) sequestration can be of great importance as a climate change mitigation and adaptation measure. It is often over looked, however, that SOC plays an equally important role in ensuring food security. This is achieved by enhancing soil productivity and maintaining consistently high yields, particularly by increasing water and nutrient holding capacity and improved soil structure, thus improving plant growth conditions. Climate change is likely to have a strong impact on agriculture, thus posing a major threat to food security. Credible research projections foresee the possibility of a 4°C temperature increase by the end of the 21st century. Should this occur, environmental repercussions could be devastating for food security given the increasing global food demands. Climate change is one of the major challenges that the world's agricultural sector faces in meeting the global food requirements. Food security in relation to climate change is affected in four different dimensions and these are food availability; food accessibility; the stability of food supply; and the ability of consumers to adequately utilise food (food safety and nutrition). There is a drive to implement and improve measures that alleviate these risks to global food security. As vital as it is for climate change mitigation and adaptation, SOC is key for ensuring a consistent global food supply. SOC content is one of the key soil properties associated with many soil functions. It is a source of nutrients and is crucial for agricultural production. Increases in SOC stock increases crop yields in high-input commercial agriculture, but especially in low-input degraded land. In areas where subsistence farmers experience deficiencies in fertiliser availability and proper irrigation, SOC is the key for increased production.

Keywords: Soil organic carbon, food security, Climate change, sustainability

IMPROVING WATER PRODUCTIVITY UNDER FAST CHANGING SCENARIO OF CLIMATIC CONDITIONS

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Increase in greenhouses gas concentrations have resulted in the increases in globally-averaged mean annual air temperature and variation in regional precipitation and these changes are expected to continue and intensify in the future. Freshwater limitations in some heavily irrigated regions could necessitate reversion of 20–60 Mha of cropland from irrigated to rainfed management. Worsening resources and climate crises, water and soil resources scarcity, and extreme weather events such as severe drought and flooding have been affecting global agricultural production. Therefore sustainable use of water resources and food security are essential for ensuring sustainable social and economic development. Water productivity is the net return for a unit of water used. Improving water productivity aims at producing more food, income, better livelihoods and ecosystem services with less water. There is considerable scope for increasing water productivity which is achieved by practices like water harvesting, supplemental irrigation, precision irrigation and soil-water conservation. Priority areas where substantive increases in Water productivity are possible include: (i) areas where poverty is high and water productivity is low, ii) areas where competition for water is high, iii) areas with little water resources development where high returns from a little extra water is high, iv) areas of water-driven ecosystem degradation, such as falling ground water tables, and river desiccation. Water productivity can be increased by following some adaptation options for water supply and demand i) Prospecting and extraction of groundwater Improvement of water-use efficiency by recycling water, ii) Increasing storage capacity by building reservoirs and dams, iii) Reduction in water demand for irrigation by changing the cropping calendar, crop mix, irrigation method, and area planted iv) Desalination of sea water v) Reduction in water demand for irrigation by importing agricultural products, i.e., virtual water vi) Expansion of rain-water storage vii) Promotion of indigenous practices for sustainable water use viii) Removal of invasive non-native vegetation from riparian areas ix) Expanded use of water markets to reallocate water to highly valued uses x) Water transfer xi) Expanded use of economic incentives including metering and pricing to encourage. In this way, the increase in water productivity ensures sustainable development under changing climate scenario.

Keywords: water productivity, climate change, sustainable development.

NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION

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Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals with a particular focus on how management affects the quality of life for both present and future generations. It deals with managing the way in which people and natural landscapes interact and brings together land use planning, water management, biodiversity conservation and future sustainability of industries. NRM is also congruent with the concept of sustainable development. It specifically focuses on a scientific and technical understanding of resources and ecology and the life supporting capacity of those resources. NRM issues are complex as they involve the ecological cycles, hydrological cycles, climate human beings, animals, plants and geography etc. The various natural resource management approach include top down or command and control, bottom up (regional or community base NRM), adaptive management, precautionary approach, integrated approach (INRM). Conservation is the proper management of a natural resource to prevent its exploitation, destruction and degradation. Recent Chipko movement in India is one of the best examples. Conservation is required to maintain ecological balance, to preserve different kinds of species to make the resources available for present and future generations and to ensure survival of human race. Natural resources management and conservation include encourage intermunicipal cooperation on nonpoint water pollution issues, to address problems on watershed basis, support programs to help reduce air pollution, consider and evaluate the cumulative impact of incremental air, soil and water pollution on natural resources, support continued and expanded hazardous waste collection programs, establish strong control for development in flood plains, wetland areas and aquifer protection zones, participate in educational programs to encourage the region's residents to conserve, recycle and reduce their individual pollution impacts.

Keywords: Conservation, resources, management, pollution

STOP AGRICULTURE POLLUTION

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Modern agricultural practices have started the process of agricultural pollution. This process causes the degradation of the eco-system land and environment due to the modern day by- products of agriculture. Excessive use of fertilizers alters the marine and freshwater nutrient cycles and as an outcome causes eutrophication. Contaminated water used for irrigation is also a source of pollution. Intensive farming operations contribute to soil erosion and sedimentation. In mechanical operations use of farm machinery that combat fossil fuel releasing greenhouse gas emissions into the atmosphere. Agriculture pollution control includes nutrient management, cover crops, buffers, Conservation tillage, Managing livestock waste, Drainage water management.

Key words: Eutrophication, soil erosion, sedimentation, Conservation tillage, cover crops

RESOURCE MANAGEMENT: A KEY FACTOR FOR SUSTAINABLE AGRICULTURE

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This title addresses a modern days major topic; sustainability. Due to increase in the population, urbanization and industrialization the available land for agriculture is continues decreasing. So the sustainability of ecosystem as well as agricultural production is becomes more important issues. As compare to other aspect of sustainability, the resource management and allocation seems to left with little exploration. And this is all about the importance of resource management for the advancement of the modern sustainable agriculture. There is a close relationship between resource management and sustainable agriculture. The resource management followed the demand for effective use of available agricultural resources like land, irrigation water and other inputs. Recent inefficient management of agricultural resources has result in the decrease the agricultural production and imbalance in the sustainability. Therefore sustainable agriculture requires integration of resource management with the other aspects of agriculture for the long term sustainable achievement.

Keywords: Sustain ability, efficient management, integration of resources, sustainable achievement.

SOIL ACIDITY, ITS EFFECT ON CROP PRODUCTION AND MANAGEMENT OF ACID SOILS.

VARSHA PANDEY

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Soil acidity limits crop production in many regions of the world including India. Acid soils (soil pH <6.5) in India cover around 48 to 49 million hectares (M ha) arable land, of which 25 M ha have pH below 5.5 and 23 M ha have pH between 5.6 and 6.5 (Thakuria *et al.*, 2016). Crop productivity on acidic soils is mostly constrained by aluminium (Al) and iron (Fe) toxicity, phosphorus (P) deficiency, low base saturation, impaired biological activity and other acidity-induced soil fertility and plant nutritional problems (Kumar *et al.*, 2012). These factors may directly restrict growth and development of both below ground and above ground plant parts or indirectly restrict plant growth through interference in the development and functioning of symbiotic or mutualistic associations with beneficial soil biota communities. Soil acidity management and crop productivity improvement on these soils is, therefore, important for enhancing food security globally and regionally. Lime application along with integrated nutrient management is often recommended to increase the phyto availability of essential nutrients and ameliorate the other acidity induced fertility constraints on such soils (Thakuria *et al.*, 2009). Evidences clearly showed that soil application of organic manures either alone or in combination with agricultural lime could directly neutralize the soil acidity. Some plant species have evolved the variable levels of tolerance to aluminum, enabling breeding of high Al-tolerant cultivars for these soils. Continuous monitoring of soil nutrient status, use of acid soil compatible bioinoculants, inorganic fertilizers in an integrated mode, and cultivation of Al tolerant crops may be a preferred option to ensure maximization of crop productivity on acid soils. Hence, systematic acid soil research considering all these aspects together needs to be formulated for devising context specific acid soil management technologies.

WATER POLLUTION RELATED TO AGRICULTURAL, INDUSTRIAL, AND URBAN ACTIVITIES.

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In recent times, due to increase in population, urbanization, industrialization and the use of chemicals in agriculture, there is an ever-increasing threat to the quality of water resource base, resulting in the decrease of fresh water availability. While this crisis is most pronounced in developing countries, the developed world also experience major environmental problem and human health consequences. The problem also includes water shortage due to imbalances between water demand and supply, and ecosystem deterioration, caused by improper land use. Erosion and sedimentation, floods included by urbanization, the problem of fresh and salt water interaction both in the surface water and in the ground water environment. Looking to the problems, an attempt has been made to assess physico-chemical quality including metal levels in water from various sources. Sampling sites included municipal, surface as well as ground water sources. Physico-chemical parameters such as temperature (°C), pH, total solids, total dissolved solids, total suspended solids, dissolved oxygen, total hardness, total alkalinity, nitrate, phosphate and chloride along with metal such as calcium, magnesium, manganese, copper, lead, iron and zinc were studied and estimated in all the water samples collected thrice during pre-monsoon, monsoon and post-monsoon of the year. The analytical data of physico-chemical qualities of all the water samples have been presented with desirable and maximum permissible limits prescribed by Bureau of Indian Standard (BIS) drinking water specification (1996).

Key words: Agricultural, Industrial, Urban, Physico chemical, BIS

RESPONSE OF RICE (ORYZA SATIVA) TO INCREASING CO₂ AND TEMPERATURE

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Carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) are the key greenhouse gases (GHG) that contribute towards the global warming at 60, 15 and 5%, respectively. Because of industrialization and urbanisation, the Earth's surface temperature has increased by 0.6°C mainly due to changes in CO₂ and other greenhouse gases during that period. Future changes in the greenhouse gases are projected to increase surface temperature by another 1.5–4.5°C by the end of this century. Increasing CO₂ content in the atmosphere gave some beneficial effect to the paddy under controlled environment. By increasing the CO₂ from an average of 365 to 627 ppm increased rice yields by 23%. The increase in rice yields at elevated carbon dioxide came from a combination of increased individual grain mass (+7%), greater panicle number (+17%), and greater grain number (+27%). The elevated CO₂ in the atmosphere increase the uptake of nitrogen (N) and its growth and grain yield in rice. Increase in the maximum temperature has negative impact on paddy productivity. Under controlled environment increasing the CO₂ content increase number grains per panicle, test weight, grain yield and straw yield of the crop. With management options, such as time of planting, method of sowing and proper fertilizer application, additional yield gains were predicted in response to the future climate in this earth. Other than management practices we also found that improving genetic traits should be another option to get further yield increases.

Keywords: global warming, industrialisation, green house gases, elevated CO₂, maximum temperature, productivity

STUDY LAND USE LAND COVER CHANGE USING EARTH OBSERVATION DATA-SETS OF SHEONATH RIVER BASIN

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The land use/land cover (LULC) change belongs to a rapidly increasing scientific field because LULC change is one of the most significant ways that humans effect the environment. It is also one of the important variables that results in global warming. Satellite images and socioeconomic statistical data were collected as of 1995, 2005 and 2015. Landsat satellite datasets of the years 1995, 2005 and 2015 were employed for land use mapping purposes due to their medium spatial resolution (30 m). Land cover maps of the years 1995, 2005 and 2015 were derived from Landsat TM and ETM+ (acquired on August 1, 1995, August 18, 2005, and 2015). The unsupervised method was employed to classify the satellite images of year 1995, 2005 and 2015 to meet the magnitude of LULC change. The results of the accuracy assessment of the classified imageries of the year's 1995, 2005 and 2015 indicates that the land use changes have been accurately identified and extracted during the classification, which is also confirmed by the overall accuracies and Kappa indices. The results showing the spatial pattern of the sub-basin is largely influenced by the biophysical and socio-economic drivers leading to growth of agricultural lands and built-up area in the basin.

Keyword: land use/land cover, Sheonath Basin, Satellite images

NATURAL RESOURCES CONSERVATION & MANAGEMENT**VIKALP SHARMA *, ARJUN SINGH RAJPUT*, RAJNEESH****** Dept. of Agricultural economics and management RCA, MPUAT Udaipur,**** Dept. of Extension Education, RCA, MPUAT Udaipur.*

Natural resources, especially water and soil, are essential for the function and structure of agricultural production systems and for the overall social and environmental sustainability. Agriculture accounts for roughly 70% of total freshwater withdrawals globally. Farming also contributes to water pollution from nutrient and pesticide run-off and soil erosion. Without improved efficiency measures, agricultural water consumption is expected to rise by about 20% globally by 2050. Climate change is already affecting water supply and agriculture through changes in the seasonal timing of rainfall and snow pack melt, as well as with higher occurrence and severity of droughts and floods. One-third of the planet's land is severely degraded and fertile soil is being lost at the rate of 24 billion tonnes a year as a consequence of bad farming practices, such as heavy tilling, multiple sequential harvests and abundant use of agrochemicals. An increase of productivity can help push progress towards future food security and the general wellbeing of producers and rural communities globally, but given the limited natural resource base on which agriculture depend, sustainable development will ultimately depend on the responsible management of the planet's natural resources. SAN proposes a series of good practices to help reduce agriculture's pressure on natural resources, and build more efficient and resilient production systems. Impact delivering Encourage the protection and restoration of water sources, and promote water use optimization. Require the implementation of systems for wastewater treatment before reuse or disposal. Foster soil conservation and improved carbon stocks.

CLIMATE RESILIENT VARIETIES: THE WAY TO COMBAT CLIMATE CHANGE**VIKAS KUMAR SINGH, RAHUL KUMAR, SOURABH KUMAR, DINESH KUMAR SAINI***Department of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut*

The people of world get 75 percent of their sustention, either directly or indirectly from three crops, viz. rice, wheat & maize. these crops differ in their climatic requirement and economic importance. the world's rising population is predicted to reach 11.2 billion by the end of this century, which would require more food crop to sustain their life and in a report of world bank, it was estimated that, global food production must increase by 70% in the next 35 years to fulfill the food demand. The change in global climate patterns which is attributed to the increased level of atmospheric green house gases produced by the use of fossil fuels, faulty agricultural practices etc. would reduce the production of food crops drastically in forthcoming years. There is an urgent need to adopt new sustainable methods of agriculture practices in order to achieve the increase food demand. Climate-smart agriculture is an approach that helps to transform and reorient agricultural systems under the new realities of climate change. It involves various approaches like sustainable increase in productivity, strengthening resilience to climate change and climate resilient varieties and reducing agriculture's contribution to climate change. The climate resilient varieties have the ability to survive disruption anticipate, adapt and flourish in the face of climate change. The climate smart agriculture requires an extensive research work and use of it will make possible to produce such genotypes of plants which can be grown successfully in adverse climatic conditions. The detail of the paper will be discussed.

Keyword: global warming, climate smart agriculture, sustainable agriculture, rising population.

NO SOIL, NO US!***VINITA, PARTE¹; J.S.RANAWAT²; VISHNU, K. SOLANKI¹; ANJANA, KUJUR³**¹*College of Agriculture, Ganjbasoda, Vidisha, JNKVV, Jabalpur (MP)*²*College of Horticulture & Forestry, Jhalawar, AUK, Kota (Raj)*³*Rajmata Vijayaraje Scindia Krishi Vishwa vidyalaya, Gwalior (MP)*

Soil is most essential for the growth and sustenance of plant life. Soil is a basic natural resource for food production, the vast majority of food we consume is either directly or indirectly derived from soil. Protecting the soil's physical, chemical and biological integrity is therefore of vital importance in safeguarding global food security. Though soil, a source available in plenty, they are not distributed equally in quality and quantity in every part of the world and are not inexhaustible. As land is cleared for agriculture, the unseen root systems within the soil are destroyed. These root systems provide habitats and food sources for microbes and therefore, their degradation and destruction results in a decrease of microbe biodiversity within the soil. It takes centuries to form one inch layer of soil, but it does not take long to lose it by erosion. The relationship of soil to biodiversity is intimate and complex; it spans vast spatial and temporal scales and is essential for life. Soil is an asset as is biodiversity-the two should not be considered separately when it comes to protecting one or the other. Soil management includes mulching, strip cropping, contour bunding etc.

Key words: Soil, agriculture, erosion, biodiversity, microbes, bunding.

AN INTRODUCTION OF CHITOSAN AND ITS ROLE IN WATER STRESS

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Water stress is mainly caused by a water deficit such as drought or high soil salinity. Water stress is defined as the demand for water is more than the amount of water available over a given period, and also when poor water quality restricts its usage. In another term, water stress means deterioration in both the quantity and quality of available water due to contrary factors that affect available water. Drought is a condition that lowers plant water potential and turgor to the extent that plants face difficulties in performing normal physiological and biochemical functions. More than 50% average yields of major crops are reduced by different kinds of stresses. However, plants also have developed inherent adaptations to stress conditions with an array of biochemical and physiological interferences that includes the function of many stress-associated genes. Chitosan is a linear polysaccharide which is made by treating the chitin shells of shrimp and other crustaceans with an alkaline substance, like sodium hydroxide. Chitosan is produced commercially by deacetylation of chitin which is the structural element in the exoskeleton of crustaceans (such as crabs and shrimp) and cell walls of fungi. It can be used in agriculture as a seed treatment, bio pesticide, inhibit fungal growth and development, active against viruses, bacteria, and other pests and different stresses. The agricultural and horticultural uses for chitosan, primarily for plant defense and yield increase. In the case of *Thymus daenensis*, foliar application of chitosan compensated to some extent for dry matter and oil yield reduction under drought stress. Foliar application of chitosan plays an important role in *Phaseolus vulgaris* increased plant growth, yield, quality of produce and plant shoot dry matter.

Keywords: Water stress, Drought, Chitosan, Chitin, Sodium hydroxide *Thymus daenensis*, *Phaseolus vulgaris*.

IMPACT OF WATER CONSERVATION MANAGEMENT PRACTICES FOR SUSTAINABLE DEVELOPMENT

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Water is prime life sustaining natural resource which cannot be created. It is a finite resource that is fundamental to human well-being and only renewable if well managed. Unfortunately for our planet, supplies are now running dry – at an alarming rate. Around one third of the global population is currently water stressed, with about one billion people not getting safe drinking water- the water crisis is perceived as a top-order threat. Water Management is facing major challenges due to increasing uncertainties caused by climate and global change and by fast changing socio-economic boundary conditions. Smart water management is a pre-condition of sustainable development. The conservation groundwater and water bodies, is essential for sustainability of available water. Strategies for sustainable water resource management for water scarce regions are: (a) to transfer the focal point of water resource development from engineering water conservancy to resource water conservancy; (b) to make rational strategic visions and operational plans for water resource development; (c) to set up a water-saving society; (d) to protect water resources and to reconstruct water environments; (e) to construct conjunctive regional water supply systems; (f) to intensify capacity building for sustainable water resource management. There is need to develop a policy and enabling framework aimed at mainstreaming conservation and efficiency in water and drainage/storm management, conservation of lakes and other water bodies, and rainwater harvesting and groundwater recharge, including reuse/recycle of treated wastewater. Water Governance in India continues to remain non-uniform, inconsistent, and somewhat inadequate to deal with today's complex water situation characterized by scarcity and depletion of this renewable but limited resource, and increased demand. Good national water management requires a paradigm shift, comprising at least the following: Clear and comprehensive science based Water Resource Policy at Central and State levels for Integrated River Basin Planning and Management, which focuses on both supply and demand side dimensions of water use.

ABSTRACTS

THEME-3

**ADVANCES IN BIOLOGICAL SCIENCES
AND BIODIVERSITY CONSERVATION**

HARNESSING THE POWER OF SOCIAL MEDIA IN DELIVERY OF AGRICULTURE EXTENSION SERVICES**PROF. M. A. ANSARI***Department of Agriculture Communication, GBPUAT, Pantnagar, UK*

Advances in Information and Communication Technologies (ICTs) have completely transformed the way we communicate and interact in the contemporary society. Among all the ICTs, mobile has become the 'technology of choice of the masses' across the social pyramid. The increasing access and affordability of mobile telephony has been phenomenal during the last decade in India. Technological advances in ICTs are providing opportunities to share and access agricultural information at a much faster pace to a wider audience through a variety of user-friendly platforms. Consequently, a number of innovative and imaginative applications of mobile based dissemination of agriculture information to farmers have transformed the way agriculture extension services are delivered.

NEW/ EMERGING CHALLENGES IN AGRICULTURE**Indian agriculture is at cross roads and faces new challenges as given below:**

Improving productivity, farm profitability and input use efficiency: e.g. more crop per drop of water, improving production efficiency, etc.

Farmer's Welfare: Enhancing farmers income and their purchasing capacity

Sustainability: Increasing productivity and production efficiency through optimized use of natural resources

Climate change adaptation: Information needs & Strategies for minimizing adverse impact of climate on agriculture; and developing location-specific adaptation strategies

Markets: Access, Prices, Middlemen elimination, Values chain rationalisation,

Food safety - New standards and regulations, changing consumer preferences and concerns

Recognition of women's participation in agriculture – Extension needs, gender sensitive extension approaches Attracting Youth in ARD & Small farmers: Farming needs to be established as business enterprise with focus on engaging youth in agriculture or agriculture related professions. These challenges cannot be tackled without improved and enhanced sharing of data, information and knowledge nationally as well as globally. Besides, farming communities needs to be sensitized about these emerging challenges and motivate them for imminent changes.

WHAT IS SOCIAL MEDIA?

Social media includes digital tools and applications that are used to share or disseminate the information for discussion among the people and different stakeholders. Social media refers to "a group of internet-based applications that build on the ideological and technological foundations, and which allow the creation and exchange of user generated content (Kaplan and Haenlein, 2010). Social Media includes Internet-based tools for sharing and discussing information among the people/ stakeholders. Social media also refers to the content: user generated information, opinion, video, audio, and multimedia that is shared and discussed over digital networks (Andres and Woodard, 2013). Further, Merriam-Webster (2015) defines social media as forms of electronic communication through which users can create online communities to share information, ideas, personal messages and other content. Some of the major characteristics of social media that distinguishes it from other forms of online communication are: participation, openness, conversation, community, and connectedness. Social Media enhances interactions, information flows, capacities and collaborative actions Social media platforms include (i) Social networking sites such as Face book, Whatsapp, Messenger, Snapchat, Google+; (ii) Blogs and Vblogs such as Wordpress, Blogger; (iii) Micro blogs such as Twitter, Instagram; (iv) Virtual platforms such as Websites, Webpages, Portals, etc; and (v) Professional networking platforms such as Research Gate, LinkedIn; and many others.

WHY USE SOCIAL MEDIA

Social media is the recent and most innovative and imaginative form of digital communication and has now become the inseparable part of peoples' lives, be it in urban areas or remote rural areas. The power of social media has expanded from merely connecting with people/ organisations; it has become the fulcrum of public expressions of support, anger/ aggression and revolution across personal, social as well as political spheres nationally as well as globally. The power of social media comes from its penetration across the entire social spectrum and rural-urban divide, and the increased activism that it can generate among the masses for generating support, action, aggression or convergence around the issues of social and public

importance. The political class as well as the systems of governance can't ignore the social media as it can bring mass support or gather social momentum around the issues affecting the public as many incidences of public support or anger to events or government policies have demonstrated. Social media is more about sociology and psychology of communication than about technology (Saravanan and Bhattacharjee, 2014). Major characteristics of social media that distinguishes this form of online communication from others are participation, openness, conversation, community, and connectedness (Mayfield, 2008). The phenomenal growth of social media can mostly be attributed to the common platform it gives to people to share their ideas and create their own content – be it texts, images, sound clips or videos and also the affordability of these platforms as they can be accessed without incurring extra charges, Convergence of technologies and evolution of multi-functional portable gadgets are other reasons for expanding social media reach. The popularity of these social media platforms to a global audience is like never before owing to the increased reach of internet enabled mobile phones and increased number of social media platforms across the globe.

SOCIAL MEDIA IN AGRICULTURE

Farmers, Scientists and Extension workers as Individuals or in groups have been using social media to share information, express their opinions, search for information, network with others. Various social media platforms can be used for sharing information about agriculture news, weather forecasts, current market prices of major crops in nearby agricultural markets besides offering customized solutions to their personalized farming related problems through e-extension and advisory services. Organisations have also been using social media to improve their visibility and reach, improving access to their programs and projects, transparency and also engaging with their clientele. Companies are building their brands on social media. Social media connect people and communities; they also help in joint planning, doing tasks together, sharing resources and communicating. Social media are also compatible with most smart phones. Social media platforms change the dynamics of social networks in at least three ways - by encouraging expansion of the scope and density of networks; speeding the diffusion of information between links and increasing the visibility of opinions and behavior across the network, according to World Bank Report (World Bank, 2016).

SOCIAL MEDIA: STRENGTHS

1. Democratization of information

- Content created & shared accessible to all
- All the stakeholders included in discussion on key issues

2. Voice of the community:

- Gives voice to the voiceless
- Face to the faceless and marginalised and neglected sections of community
- Bottom-approach approach

3. User generated content:

- Power to the users to generate as well as share content
- Ensure involvement of youth involvement

4. Easy access:

- Universal access through mobile device

5. Extended reach

- reduction in cost of mobiles have made it accessible to BoP
- Can reach remote rural and under-served areas

6. Social capital:

- building sustainable communities involving Extensionists, Farmers, Managers, Researchers, and Policymakers using their highly interactive platform, to build and utilise social capital to derive larger benefits for the society
- Unique platforms (e. g. GFRAS, AESA, ICT4D) for discussion and collaboration b/w different stakeholders

SOCIAL MEDIA: SOME OF THE CHALLENGES FACED WHILE USING SOCIAL MEDIA IN AGRICULTURE ARE

- Quality control: Content filtering: for quality & reliability
- Institutionalizing social media: Mainstreaming with routine extension efforts of agricultural institutions
- Measuring impact: monitoring and assessing the value of information shared through social media
- Success of social media use can be measured to some extent by tracking number of Visitors, Friends, Followers, Mentions, Facebook "likes," conversation index, and number of shares
- Privacy concerns: Irrelevant posts, conflicting perceptions, credibility of shared content
- Inclusion of women and disadvantaged sections of community for all-inclusive development

INTEGRATING SOCIAL MEDIA IN THE AGRICULTURE EXTENSION AND COMMUNICATION STRATEGY

Social media can be a powerful extension tool if used judiciously and intelligently. Social Media can be effectively integrated in extension and advisory services and help in enhancing interactions and information flows among different actors/ stakeholders involved in agricultural innovation. However, lack of awareness and skills about its use are challenges which constrain its widespread use. The organisational culture within extension organisations also restricts exploitation of its full potential by extension professionals (Saravanan Raj and Suchiradipta Bhattacharjee, 2014). However, use and effectiveness of social media in agriculture is also dependent on infrastructure availability, spectrum connectivity and technological convergence. Besides, the psycho-social barriers coupled with lack of necessary skills in the use of social media can be a big handicap in realizing the potential of social media in agriculture.

CHALLENGES IN THE USE OF SOCIAL MEDIA IN AGRICULTURE

Although social media can be a very powerful tool for information dissemination and empowerment tool for the farming community. However, the challenges in the use of social media includes: (i) Passive users: While many visit the group pages, only few post, share and discuss ideas and issues. (ii). Irrelevant Information often gets posted along with useful information, which increases the need for monitoring. (iii). Participation of agricultural stakeholders: Except for few groups, farmer participation is almost nil in groups; and (iv). Limited ICT infrastructure and internet connectivity is still a major issue in rural areas. While developing Agriculture Extension and Communication strategy, the focus needs to be on developing appropriate, relevant and useful Content for Social Media. Creating a social media account and uploading content may be easy. However maintaining it on a continuous basis with updated content is a challenge. Points to keep in mind are: (i) Content needs to be packaged for a platform and according to the target clients, (ii). Focused on user/ client requirements; (iii) Authenticity, Credibility and validity of the messages is important.

CONCLUSION

Social media can prove to be a game changer in the delivery of extension and advisory services. However, we need to generate mass awareness among the farming communities about the potential of social media use in agriculture. Upscaling the required skills in the use of social media coupled with the strengths and weakness of various social media would prove to be a challenging task for extension professionals as well as policy makers. Engagement of private sector in social media use can enhance its utility, applicability and affordability. The government should also provide policy support as well as incentives in promoting the use of social media in agriculture.

NANOMATERIALS FOR WATER PURIFICATION AND SUSTAINABLE USE OF WATER RESOURCES: RECENT ADVANCES.**SHAMS TABREZ KHAN***Department of Agricultural Microbiology, Aligarh Muslim University, Aligarh, 202002, UP, India*

Clean water is vital for life; it is required not only for drinking but also for the preparation of food and proper hygiene. The requirement of water for an individual varies from a minimum of 7.5 liters per day for drinking and cooking to about 20-50 liter per day for sanitation and other daily needs (Hunter, MacDonald, & Carter, 2010). Unfortunately, more than fifty percent of the world population mainly in China and India faces a severe scarcity of water. Other than India and China, people living in Bangladesh, Pakistan, Nigeria, Mexico and arid and semi-arid regions of USA also face scarcity of water. Around 1.8 billion people inevitably drink water from sources having fecal contamination. Furthermore, the water scarcity results in inadequate sanitation subsequently leading to the uncontrolled spread of a number of preventable diseases such as Diarrhoeal diseases, Legionellosis, Hepatitis, Malaria, and Dengue. These water-borne diseases result in the death of about a million children every year (Bartram & Cairncross, 2010; Pruss-Ustun et al., 2014). Among various waterborne diseases, diarrhoeal diseases alone claim two million lives every year (World health organization, WHO) (Pruss-Ustun et al., 2014). Most of these deaths occur in low to middle-income settings (Pruss-Ustun et al., 2014). Moreover, the unavailability of clean water also incurs great economic losses. It is estimated that a household lacking the supply of clean water and proper sanitation incur an additional health cost of about US\$340 per year costing US national health systems an additional 7 billion dollars annually (Haller, Hutton, & Bartram, 2007). Hence, to ensure the supply of safe water; innovation in water purification is both crucial and urgently required. These innovations should aim at improving the efficiency of water purification and making it more cost-effective. Some progress has already been made such as the development of biomimetic membranes, use of *Euglena* and the use of nanomaterials-based membranes for water purification systems. Nanomaterials-based technology offers an economical and effective alternative for water purification and decontamination. Nanomaterials, especially engineered nanomaterials have extremely small size and a very high size to specific surface area ratio, resulting in the unique properties of these materials suitable for various industrial processes. Therefore, the use of these nanomaterials is increasing globally with their use in various industrial products. Nanomaterials-based approach can be both technically and economically feasible and sustainable. Furthermore, in addition to the well-known antimicrobial activity nanomaterials demonstrate remarkable efficiency to remove organic and inorganic pollutants from water such as mercury and arsenic. Therefore, these materials can be used for the purification and decontamination of groundwater, surface water, and wastewater. Here the role of nanomaterials in the purification of drinking water is discussed. Nanomaterials have already been tailored with unique desirable properties suitable for water purification. These include remarkable antimicrobial activity, antiparasitic activity, catalytic activities, and the ability to absorb toxic chemicals like mercury and dyes from polluted water. Anti-parasitic and the antimicrobial activities of nanomaterials against waterborne pathogens and parasites of primary concern like *Shigella dysenteriae*, *Vibrio cholera*, and *Entamoeba histolytica* has already been demonstrated. The remarkable ability of nanomaterials to adsorb toxicants like mercury from water has also been demonstrated. Nanocomposites are developed to combine two or more desirable properties for water purification or to overcome some of the demerits of nanomaterials. Nanomaterials based water purifying devices such as Karofi, Lifestraw, TATA swach, and Tupperware are already available in the market. The water purification system by Panasonic employs the unique photocatalytic activity of nano titanium. These devices may have simple nanomaterials-based filters where the dirty water is filtered through manual suction or is filtered under simple gravitational force. For community-scale water purifier, a more advanced system similar to that of wastewater treatment plant can be developed. As most of the population facing water scarcity belongs to the middle or low-income groups, it is also important to make the technology affordable and accessible (Harhay, 2011). This can be achieved by designing cost-effective devices for water purification or by using renewable and accessible energy sources such as solar energy for scaled up water purification systems. There are other bottlenecks that require the attention of the scientific community. For example, the aggregation and seepage of nanomaterials into drinking water and subsequent adverse effects on human health and the environment is an important problem. Therefore, health concerns associated with the potential toxicity of nanomaterials needs to be addressed adequately and convincingly through careful and realistic long-term in-vivo studies. A wise and sustainable use of nanomaterials will also require a robust legal framework which can effectively regulate the use of nanomaterials for water purification. If these inherent bottlenecks and concerns are adequately addressed, the widespread and large-scale use of nanomaterials for water purification soon may become a reality.

POMEGRANATE- A BOON IN LIVER DISEASES: BIOCHEMICAL AND MOLECULAR EVIDENCES**RIAZ AHMAD****Section of Genetics, Department of Zoology, Faculty of Life Sciences, Aligarh Muslim University, Aligarh*

In ancient times, people were solely dependent on plants and their derivatives as a means for curing diseases. The healing properties of many plants and their concoctions have been summarized in holy books. However, with the availability of technology and advancement of science people gradually switched over onto synthetic medication in order to have quick relief from any serious suffering. Quite late, it is realized that these synthetic medications as well as dependency on the processed food posing unwanted threat to human life. These synthetic medications and ingredients used in food industry (may lead to nitrosamines generation) are putting extra burden on the liver health. Liver is a vital organ of the human body which is involved in detoxification and synthesis of many important biomolecules. Continuous exposure to noxious substances consequently lead to compromised liver function and, in some cases may culminate into complete liver failure. Therefore, these days the demand of friendly medication with least side-effects is the priority. In this context, many herbs and their parts have been extensively utilized to investigate active ingredients which can serve as promising therapeutic agents against human diseases. Pomegranate or Anar is widely consumed fruit. In some parts of the world, the juice of the whole fruit is consumed while in other juice from the arils is recommended as a source of nutrition. In our country, mostly the arils juice is recommended and believed to have essential nutrients required by the human body. Previous researches also emphasized on the use of pomegranate and reported its anti-inflammatory, anti-cancerous and anti-obesity effects. The whole fruit juice has also been demonstrated to show hepatoprotection. Liver fibrosis is a dynamic condition in which there is amassing of collagen fibres, which restricts the normal functioning of the liver. Liver fibrosis starts with the differentiation of hepatic stellate cells. These specialized cells normally remain in quiescent state, however as the stimulus is received these cells transdifferentiate into activated type. Activated hepatic stellate cells are reported to express alpha-smooth muscle actin (α -SMA) which facilitates synthesis of collagen. This collagenesis may become extensive with the passage of time and can lead to erroneous outcomes. It is the collagen network that obstructs normal liver functioning, which could be well examined by routine liver function biomarkers levels such as ALT, AST, ALP, GGT and bilirubin. If untreated for long time, then it may result in even worst effects to direct to cirrhosis, then hepatocellular carcinoma which ultimately lead to death. There are only a few known developed models of liver fibrosis. The most extensively studied model of hepatic fibrosis is the rodent model wherein the hepatic fibrosis is induced by repeated doses of N'-Nitrosodimethylamine (NDMA) within three weeks time. This model perfectly imitates the pathological condition in humans and hence being utilized for comprehensive understanding of the molecular mechanism of the disease. Further, the disease model has been exploited to discover therapeutic efficacy of various synthetic and natural compounds. There are many reports, including from our own lab, on the exploration of molecular mechanism of hepatic fibrosis as well as on the therapeutic efficacy of certain phytoextracts and their ingredients during liver injury. Another way of inducing liver injury is by means of N'-Nitrosodiethylamine (NDEA), which is also a reported mutagenic, carcinogenic and hepatotoxic agent. The occurrence of this noxious compound has been recorded in cheddar cheese, tobacco smoke, dry milk powder etc. Literature reveals that a single dose of NDEA is enough to generate liver injury/fibrosis in Wistar rats within two weeks time. Due to shorter time and comparatively lesser frequency of doses given to animals, NDEA-induced disease model may be preferred.

Despite many documented roles of Pomegranate juice, there are scarce reports on its effect against experimental liver fibrosis. Hence, evaluation of therapeutic potential of pomegranate juice derived from arils during NDEA-induced liver injury is of great significance. Fresh Pomegranates (*Punica granatum*) were brought to the laboratory, washed in running tap water. The peel of the fruit was carefully removed and the arils were collected in a clean glass vessel. The juice was extracted from the arils at room temperature using a commercial blender. The collected juice was filtered through sterilized gauze, centrifuged and then passed through filter membrane. The collected filtrate was analyzed afresh for its antioxidant activity or otherwise stored at -20 °C in aliquots. FRAP analysis, DPPH assay and total phenolics were estimated as per the established procedures. Animals (male Wistar rats) of 5-8 weeks were selected for the present study and kept in animal house facility. They were fed regular diet and clean drinking water ad libitum. Liver fibrosis in animals was induced by a single intraperitoneal injection of NDEA, as described in the literature. Another group of animals treated with NDEA, received Pomegranate juice as supplement. Appropriate controls were also run simultaneously. After fourteen days from the start of the experiment, blood was collected and kept at RT to ooze out the pale yellow colored sera. The sera were separated from the clot following centrifugation. The animals were sacrificed and the liver was excised out carefully, liver homogenates were prepared and analyzed fresh. Liver function examination was done by estimating the levels of ALT, AST, ALP, GGT and bilirubin content in the serum of the animals belonging to different groups. Lipid peroxides generation, levels of Na^+/K^+ , Mg^{2+} , Ca^{2+} ATPases, G_6PD estimation, assessment of SOD, CAT were also performed in NDEA-treated (fibrotic), pomegranate juice supplemented and controls animals. Further, histopathology of liver sections was performed by H&E, Masson's trichrome and Direct red stainings. Immunohistochemical localization of α -SMA, COX2 along with western immunoblotting of Nrf2 and NF κ B were carried out in all the groups. To assess the ultrastructural changes in the liver tissue,

electron microscopy (SEM/TEM) was performed. The exhaustive data, collected altogether clearly indicate NDEA-induced damage in the animals and significant amelioration by pomegranate juice within fourteen days of its treatment. It is revealed that the pomegranate juice regress the experimental liver fibrosis by declining oxidative stress via regulation of Nrf2 and NFκB. Implications of this study will be discussed in view of the molecular mechanism by which pomegranate juice abrogates NDEA-induced liver fibrosis.

ISOLATION OF METHYL EUGENOL FROM *OCIMUM BASILICUM* LEAVES AND INFLORESCENCE AND ASSESSMENT OF THE PLANT POTENTIALITY AS FRUIT FLIES ATTRACTANT

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Ocimum basilicum L. (basil), which is annual plant belong to the plant family Lamiaceae. Methyl Eugenol was found as one of the basil oil component. This study was carried out at Shendi area to assess the amount of Methyl Eugenol extracted from the plant and the potentiality of raw plant as fruit flies attractant. Basil plant parts were extracted using Soxhlet apparatus, steam and water distillation, the highest produced oil percentages from flowers and leaves were (5.75 and 3.03%) respectively, while, the lowest percentages were obtained from the seed and stem (0.02 and 0.21%) respectively. The produced oil was analyzed using GCMS, Methyl Eugenol was found as one of 32 compounds produced. The raw plant parts (leaves and flowers) were baited and used into two forms (powder and paste) to test the basil efficiency in fruitflies attraction. The basil traps catch was too low compared with that of the control traps. The Methyl Eugenol extracted from basil plant was verified and compared with the standard synthetic Methyl Eugenol. The extracted Methyl Eugenol from basil plant when used in the insect traps gave lower catch of fruitflies numbers than the synthetic Methyl Eugenol traps, but the difference was not significant.

Key words: *Ocimum basilicum*, Attractant, Fruitflies.

EFFICACY OF DIFFERENT BAIT AND ATTRACTANT COMBINATIONS IN MALE ANNIHILATION OF *BACTROCERA (ZEUGODACUS) CUCURBITAE* (COQUILLET) (DIPTERA: TEPHRITIDAE)

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An experiment was conducted to determine the annihilation of males of melon fly, *Bactrocera (Zeugodacus) cucurbitae* (Coquillett) from March-August, 2018, i.e. standard weeks 9 to 35. Flies were trapped in self-made bottle type traps by using six different combinations of baits, attractant (cue-lure) and insecticide mixtures and each treatment was replicated three times. The male flies were collected and counted at weekly intervals. Males of *B. cucurbitae* were annihilated throughout the experimental period. The rate of annihilation of adult flies followed a more or less uniform pattern. Maximum numbers of flies, i.e. 194.67 flies/ trap/ week were annihilated during 20th standard week in treatment T₁ having protein hydrolysate as bait. Minimum numbers of flies were trapped in treatment T₅ (without attractant) and therefore it was inferior over other treatments in annihilation of flies. Total 48526 adult males were trapped during the experimental period in all treatments and their replications. Total mean number of flies/ annihilated in treatments T₁ – T₆ during the period of experimentation was 4527.66, 2005.53, 3890.32, 3539.99, 804.00 and 1407.54, respectively. Mean number of flies annihilated (per trap/ week) in T₁ – T₆ were 167.69, 74.27, 144.09, 131.11, 29.78 and 52.15, respectively. The results indicate that protein bait along with cue-lure was most effective in annihilation of males of *B. cucurbitae* followed by molasses and fruit juice, respectively.

FORAGING PERIOD OF VARIOUS BEE SPECIES OF HONEY BEES IN HOURS

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A.indica initiated pollen and nectar foraging at 07.30 and 08.05 hr and ended by 17.10 and 16.30 hr, respectively. Similarly, *A. mellifera* started its foraging activity for pollen and nectar at 06.45 and 07.10 hr and stopped its activity at 17.45 and 17.05 hr, respectively. *A. florea* initiated pollen and nectar foraging at 07.10 and 07.45 hr and completed its foraging 17.15 and 16.35 hr, respectively. *A. dorsata* started foraging for pollen and nectar at 07.05 and 07.35 hr and ended by 17.35 and 17.10 hr, respectively. *Trigona* sp. was late in starting its foraging activity for pollen and nectar i.e. 08.35 and 08.50 hr and completed at 17.05 and 16.25 hr, respectively.

FIELD STUDY ON ALLELOPATHIC ASSESSMENT OF WINTER WEEDS ON GROWTH OF LITTLE CANARY GRASS (*PHALARIS MINOR* RETZ.)**AARADHANA CHILWAL¹***Punjab Agricultural University, Ludhiana, Punjab, 141004*

Medicago denticulata, *Chenopodium album* and *Melilotus indica* are the major annual weeds of cultivated wheat, other than *Phalaris minor* which is the most dominant one. In order to determine the allelopathic potential of these winter weeds, sole aqueous extracts of 10 % concentration and their combinations were tested on growth of little canary grass (*Phalaris minor* Retz.) in a field experiment. Results showed that application of extracts showed significant effect on seedling emergence of *Phalaris minor* which was reported lower under treatments containing *Melilotus indica* aqueous extracts. Maximum inhibition of germination and seedling emergence was reported under *Medicago denticulata* (10%) + *Melilotus indica* (10%) + *Chenopodium album* (10%) and *Melilotus indica* (10%) + *Chenopodium album* (10%). Number of shoots of *Phalaris minor* under *Medicago denticulata* (10%) + *Melilotus indica* (10%) + *Chenopodium album* (10%) was 75.0%, 49.7%, 38.9%, 27.7% and 26.6% less than that under control at 15 DAS, 30 DAS, 45 DAS, 60 DAS and at maturity. However, plant height of *Phalaris minor* was found at par under different treatments at each crop growth stage (15, 30, 45, 60 DAS and at maturity). *Medicago denticulata* (10%) + *Melilotus indica* (10%) + *Chenopodium album* (10%) and *Melilotus indica* (10%) + *Chenopodium album* (10%) were the best treatments in terms of dry matter accumulation as these treatments led to lowest dry matter production in *Phalaris minor* and thus showing inhibitory effect on weed growth. Inhibitory effect of weed aqueous extracts on growth and development of *Phalaris minor* however reduced with subsequent stages of crop growth, being 75% at 15 DAS and 25% by maturity stage. This study validated the allelopathic potential of all three weeds and concluded that combination of aqueous extracts of *Medicago denticulata* (10%), *Melilotus indica* (10%) and *Chenopodium album* (10%) and *Melilotus indica* (10%) + *Chenopodium album* (10%) achieved significant control of *Phalaris minor*. Allelopathic potential of simultaneously growing weeds in wheat field can thus be utilized to manage the most problematic weed, *Phalaris minor*, of wheat in an eco-friendly manner.

RESPONSE OF TWO MENTHOLMINT CULTIVARS *MENTHA ARVENSIS* (L.) TO PLANT GROWTH REGULATOR APPLICATION AND CADMIUM STRESS DIFFERING IN CADMIUM STRESS TOLERANCE**ABBU ZAID*, AND FIROZ MOHAMMAD***Plant Physiology and Biochemistry Section, Department of Botany, Aligarh Muslim University, Aligarh 202002, India.*

In the present study, we evaluated the morpho-physiological and antioxidant responses of two mentholmint (*Mentha arvensis* L.) cultivars in the presence of plant growth regulator (PGR) application and varying (50, 100, 150µM) doses of cadmium (Cd) stress. The results revealed that growth is significantly affected by all Cd doses, but differentially in two cultivars namely Kosi and Kushal. Nevertheless, PGR application (5µM) each of like methyl jasmonate (MeJ), kinetin (Kn), salicylic acid (SA), gibberellic acid (GA₃), Indole acetic acid (IAA) and triacontanol (Tria) improved the growth and biochemical traits in both cultivars. Cd stress also decreased photosynthetic parameters, mineral nutrient contents but increased oxidative stress biomarkers like electrolyte leakage, malondialdehyde, and hydrogen peroxide contents. Moreover, differential upregulation of proline content and antioxidant enzyme activities under Cd stress was assessed in both the cultivars. Interestingly, the study got further confirmation by studying the stomatal responses under electron microscopy and SEM-EDX analysis. In conclusion, Kushal cultivar was more found to be more tolerant against Cd stress as well as more responsive to PGR application than Kosi. Thus, the PGR application can be utilized as one of the best innovative approaches in improving Cd-stress tolerance in cultivars of mentholmint, hence specific doses of suitable PGR can be recommended to farmers to accelerate their income under Cd challenged environments.

PHYTOCHEMICAL ANALYSIS AND STANDARDIZATION OF DNA ISOLATION PROTOCOL IN *CANNABIS SATIVA*, THAT CAN BE USE IN VARIOUS MEDICINES.**ABDUL SAMAD***Department of Biotechnology and Microbiology, M.I.E.T., Meerut-250002, India*

The success of chemotherapy lies in the continuous search for new drugs to counter the challenges for various diseases. This evaluation is based on phytochemical and pharmacological approaches which leads to the drug discovery referred as natural product screening. Any part of the plant may contain active components such as bark, leaves, flowers, roots, fruits and seeds. As we have seen, these days useful plants are cultivated and then commercially exploited to extract some phytochemicals but there are various weed plants like, *Cannabis sativa* is one of the wonderful plant which is rich in the phytochemicals like alkaloids, phenolics, flavonoids, etc; and some essential micronutrients like Zn, Fe, Mo, S, K, P, N etc. *Cannabis Sativa* is an annual herbaceous flowering plant indigenous to eastern Asia but now of cosmopolitan distribution due to widespread cultivation. Plant spices traditionally used in Indian folklore medicine since from the immemorial time. It has been cultivated

throughout recorded history, used as a source of industrial fiber, seed oil, food, recreation, religious and spiritual moods and medicine. Phytochemicals are the chemicals produced by various parts of the plants. These bioactive constituents of plants are steroids, terpenoids, carotenoids, flavanoids, alkaloids, tannins and glycosides. Study of phytochemical analysis enables us to select species of *Cannabis sativa* for reduce the commercial exploitation on other crop plants. The genetic studies may further reveal presence of some useful genes. Gene tagging can be achieved using suitable markers. Perquisite of this study is availability of good quality DNA which can be subjected for cloning and PCR amplification. Due to presence of phenolics compounds it is difficult to isolate the DNA. Depending upon the amount of phenolics present, certain modification are required for good yield of DNA. The observation clearly indicate close relation and linkage between phenols and antioxidants activity plants phenolics constitutes one of the major groups of compounds that act as primary antioxidants or free radicals scavengers. Alkaloids are colorless substance often contain nitrogen and oxygen, these are caffeine, nicotine, quinine, atropine used in anti cancer, blood pressure, heart failure etc. and the flavonoids constituents like kaempferol, tiliroside etc. which contributes the medicinal properties like anti inflammatory, muscles spasm, etc. The variation of flavonoid, phenols and alkaloid content can be exploited to choose different species offer various therapeutic uses.

Key words: *Cannabis sativa*, DNA isolation, medicinal plants, secondary metabolites

CHEMICAL MODELS OF CYTOCHROME P450 IN DRUG METABOLISM

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Most of the drugs are metabolised by cytochrome P450 in the liver of human and other animals. Primary metabolites of drugs contribute to the efficacy, side effects and toxicity of parent drugs. Drug metabolisms have been studied by using purified enzymes. Since isolation and purification of membrane bound cytochrome P450 in large amounts for metabolic studies are laborious and costly processes, therefore the chemical models of cytochrome P450 have been developed and applied in the oxidative metabolism of selected compounds in different reaction conditions.

MULTI-AGENT MANAGEMENT APPROACHES FOR *BIPOLARIS SOROKINIANA* CAUSING FOLIAR BLIGHT COMPLEX OF WHEAT

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Wheat [*Triticum aestivum* (L.)] is one of the most important cereal crops of India. There has been tremendous increase in area, production and productivity of this crop during the green revolution phase of Indian agriculture. Leaf blight of wheat is an important disease as it acts as one of the limiting factors in its production. We collected the leaf samples of wheat from various wheat growing regions of India and isolated the fungus. Morphological and physiological studies of *Bipolaris* spp. isolates were done. Multi-Agents management approach of *Bipolaris sorokiniana* based on biocontrol, biofilm and plant extracts was studied. The biocontrol agents used were Actinomycetes, fungus (*Trichoderma*) and bacteria. On the whole actinomycetes were found to be better and gave maximum inhibition (72.40%) in comparison to *Trichoderma* (67.0%) and PGPR strain Br3 (68.0%). Evaluation of plant extracts (Botanicals) against *Bipolaris* spp. was done by poison food technique. Aloe vera plant extract was found to be better than other plant extracts and gave maximum inhibition (54.0%) of mycelial mat with dry weight of 0.17g as compared to control dry mycelial weight 0.91 gm. Induced systemic resistance were also studied by enzymes activity analysis of three enzymes viz Peroxidase (POX), Poly phenyl oxidase (PPO) and Phenylalanine lyase (PAL) on 30 days old plants with six treatments (T1 to T6) was performed. Maximum POX and PPO activity were observed in treatment no.6 (T6) with (15 unit min⁻¹ mg⁻¹ and 4.6 unit min⁻¹ mg⁻¹) as compared to control after 48 hours (3 unit min⁻¹ mg⁻¹ and 0.4 unit min⁻¹ mg⁻¹ protein) of post challenged inoculations. PAL was higher in T6. Multi-agents like fungi, bacteria, biofilm and botanicals were found good in management of *Bipolaris sorokiniana* causing foliar blight of wheat.

Keywords: PGPRs, *Bipolaris sorokiniana*, ISR

BIOLOGICAL PLANT PRODUCTS AS ECO-FRIENDLY FUNGICIDES FOR PLANT DISEASES CONTROL

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The use of synthetic fungicides has been the major commercial means of controlling plant diseases. However, the chemical residues are liable to remain on the plant or within its tissues following fungicidal treatment. Fungicide residues in plants and their fruits pose a great health risk to the consumer, led to the search for safe alternatives to synthetic fungicides. Moreover, with their excess applications pest resistance may exist. Natural plant products have been found effective in plant disease management and could be safely incorporated as suitable alternatives for synthetic fungicides. It is estimated that there are 3,

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00,000 higher plant species on earth that can be evaluated for their anti-microbial bio-active chemical compounds. During last several decades' researchers have evaluated plant extracts and oils against plant pathogens, valuable results have been achieved and some commercially botanical formulations have been prepared and marketed. If we are supposed to move towards production of safer agricultural fungicides in the near future. The organic agriculture cannot rely on a limited number of commercially fungicides of natural origin, therefore it seems that more researchers in formulating more commercially botanical products as fungicides are still needed.

Key words: plant pathogens, anti-microbial, organic agriculture, botanicals, plant extracts.

MORPHO-MOLECULAR CHARACTERIZATION OF POTENTIAL *TRICHODERMA* SPECIES AND THEIR PHYLOGENETIC ANALYSIS

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Most isolates of the genus *Trichoderma* were found to act as a mycoparasites against many economically important aerial and soil-borne plant pathogens. *Trichoderma* has gained importance as a substitute for chemical pesticides and hence an attempt was intended to corroborate the positive relatedness of molecular and morphological characters. In present study, focus was given on the ITS region of ribosomal genes for the construction of primers that can be used for proper identification of *Trichoderma* sp. ITS regions of (600bp) rDNA was amplified using genus specific ITS-1 and ITS-4 primers. Under microscopic studies, all *Trichoderma* strains were found very closely similar, thus ITS markers were used for its proper identification. Among them, CA-01, CA-02, CA-03, CA-06, and CA-07 amplified with ITS 1 and ITS 4 while, CA-04, CA-05, CA-08, CA-09, CA-10, CA-11, CA-12, amplified with ITS 1 and ITS 2 primers. Universal ITS-1 primers 19F and ITS-4 primers 20R were used for the amplification and sequencing of the 18S rDNA fragment of CA-03 (*Trichoderma asperellum*), CA-06 (*Trichoderma harzianum*) and CA-07 (*Trichoderma harzianum*). Total 573, 541 and 578 base pairs of the 18S rDNA region were sequenced and used for the identification of selected *Trichoderma* isolates and further 18S rDNA sequences of isolate CA-03, CA-06 and CA-07 were deposited in GenBank and allotted accession numbers were KU821782, KU947032 and KX579941 respectively. Thus an integrated approach of morphological and molecular markers can be employed to identify a superior strain of *Trichoderma* for its commercial exploitation.

Keywords: 5.8S ribosomal RNA gene, *Trichoderma*, ITS, Biocontrol, Antagonist.

BIOCHEMICAL EVALUATION OF LINSEED VARIETIES AND ITS OIL

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The present study entitled "Biochemical evaluation of linseed varieties and its oil" was conducted at Agronomy research farm and analysis carried in laboratory of Department of Biochemistry, N.D. University of Agriculture and Technology, Kumarganj, Faizabad, U.P. during rabi season of 2017. Ten varieties of linseed were executed in Completely Randomized Design (CRD) with three replications. In respect of each different treatments of linseed have been collected separately and used for analysis of physical and biochemical parameters. In physical parameters, number of pods per plant, 1000 seed weight, colour of seeds and yield per plant were determined whereas biochemical parameters were explored for the determination of protein content, methionine content, tryptophan content, lysine content, total carbohydrate content, reducing sugar, non reducing sugar, oil quality, fatty acid composition and analysis of defatted cake. The data obtained in the experiment showed the highest seed weight (7.96), yield per plant (8.26) and number of pods (59.38) in NDL-3. In the case of protein content (23.65%), methionine content (0.48g/16g N), tryptophan content (0.43 g/16g N), lysine content (0.93 g/16g N) is highest in NDL-3. In sugar content the highest sugar content in Garima (1.92%) with reducing sugar (0.57 %) and non reducing sugar (1.35%) and carbohydrate content maximum in Garima (31.50%). The highest content of oil was found in NDL-3 (44.58%). Oil quality in terms of acid value (1.95), iodine value (175.67) and saponification value (192) is highest in NDL-3. The essential amino acid contents in defatted cake namely tryptophan (0.34 g/16g N), lysine (0.93 g/16g N) and methionine (0.43 g/16g N) highest in NDL-3. The protein content in defatted cake was highest in NDL-3 (19.7%) and carbohydrate content in Garima (31.96%). It is, therefore concluded that the NDL-3 was found superior and better in most of the physical as well as biochemical parameters.

COMPATIBLE SOLUTE ENGINEERING IN PLANT FOR DROUGHT AND SALT TOLERANCE**ABHISHEK SINGH ALOK KUMAR SINGH AND R.S SENGAR***Department of Agriculture biotechnology Sardar vallabhbhai patel university of agriculture and technology Meerut*

Drought and salt stress collectively are responsible for crop losses worldwide. Drought and salinity are the most catastrophic. Various strategies have been proposed for controlled of these stresses, Being a complex trait conventional breeding approaches have resulted in less or not successful. Agriculture biotechnology has prominent tool for overcome this drought and salt stresses related problem. The role that compatible solutes play in somatically stressed plant often has been defined as osmoprotection. That is, solute accumulation is assumed to have a putative protective function against water deficit. Genetic engineering of plant offers an best opportunity to test the adaptive significance of compatible solutes directly. Drought and salt sensitive plant can be transformed with gene encoding enzyme that are critical for synthesis of putative osmoprotectant. The transformed transgenic plant than can be assayed for enhanced accumulation of compatible solutes and for the ability to adjust osmotically in response to drought and salinity. Recent genetic engineering experiment hold promise for future development of stress resistant variety of different agriculture crop which sensitive for drought and salt. Biotechnological approaches to enhanced drought tolerance typically involve dissection of the biosynthesis pathway of specific osmolytes and subsequent manipulation of activities of the enzyme operating in the pathways. Some important compatible solute are the amino acid Proline, Glycinebetaine and Mannitol, Pinitol. Based on recent information and data it was concluded that reduced shoot and root growth, decreased photosynthetic pigments and remarkable accumulation of compatible solute make the plant survive salinity stress and drought.

Keywords: Compatible solutes, Osmotic stress, Salinity, Drought, Glycinebetaine, Proline, Mannitol, Pinitol, Salt stress,

BIODIVERSITY (PLANT/ANIMAL) RESOURCES AND THEIR CONSERVATION**ABHITEJ SINGH SHEKHAWAT¹, AKANSHA DEORA², PUSHPENDRA SINGH³ & VIMAL SINGH RAJPUT⁴**

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Biodiversity is the biological diversity which includes the variety of the whole species present on earth. It includes different animals, plants, micro-organisms and their genes, water ecosystems, terrestrial, and marine ecosystems in which they all are present. Biodiversity is necessary for our existence as well as valuable in its own right. This is because it provides the fundamental building blocks for the many goods and services which provides a healthy environment to lead our life. Main threats to our biodiversity are degradation, fragmentation and loss of habitat; spreading of invasive species; unsustainable use of natural resources; change of climate; inappropriate fire regimes; changes within aquatic environment and water flows. Human should conserve biodiversity because of its benefit for ecosystem services and biological resources which are essential to live our life on earth. However, it also provides spiritual as well as social benefit. Biodiversity can be conserved by In-situ biodiversity conservation and Ex-Situ conservation methods. In-situ biodiversity conservation means the conservation of species within their natural habitats, this way of conserving biodiversity is the most appropriate method for biodiversity conservation. In this strategy, you have to find out the area with high biodiversity and this area should be covered in form of natural park/sanctuary/biosphere reserve etc. In this way biodiversity can be conserve in their natural habitat from human activities. Ex-situ conservation involves the conservation of biodiversity outside of their natural habitats. This involves conservation of genetic resources, as well as wild and cultivated species and draws on a diverse body of techniques and facilities. This can be done by forming Gene banks which store seeds, sperm & ova at extremely low temperature and humidity; by forming Zoo and Botanical Gardens for research purpose and to increase public awareness; collecting living organisms for aquaria, zoos and botanic gardens; by collections of In vitro plant tissue and microbial culture and by captive breeding of animals and artificial propagation of plants with possible reintroduction into the wild.

EVALUATION OF THREE CHEMOTYPED MICROBIAL SIDEROPHORES ON IRON NUTRITION IN HYDROPONICALLY GROWN WHEAT**ABIRAAMI TV[#], BHUPINDER SINGH¹, K ANNAPURNA[#] AND ARCHNA SUMAN^{#*}**

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Wheat is widely cultivated cereal crop and plays a significant role in providing global food security. It is the second staple food crops for millions of Indians. Although wheat is rich in dietary calories and protein but it's a poor source of micronutrient especially in iron and zinc. Poor micronutrient status of soil further aggravates the situation. Fe is relatively immobile in plants and deficiency leads to yield loss. Natural chelators like siderophore can play crucial role in improving the iron nutrition of Fe. Siderophore are iron chelating compounds produced by microorganisms that chelates Fe³⁺ (ferric iron) with high specific activity, which in turn make it available to the plant system. The present study addressed it by studying the role of three chemotyped siderophores— catecholates – *P.agglomerans*(BC1 and Sid1), hydroxamate – *Pseudomonas*

plecoglossida(BC2 and Sid2)and carboxylate-*Lactococcuslactis*(BC3 and Sid3)in plant Fe uptake and related functionsunder Fe sufficient (100 µM EDTA) and deficient (1 µM EDTA) conditionin hydroponic system.

P.agglomerans Sid1increased Fe uptake significantly by 47.8% than Fe⁺ control plants and 90.97 % than Fe⁻ control plants while BC1improved 43.6% and 85.5 % than Fe⁺ and Fe⁻ plants.On measuring the chlorophyll contentcatecholate BC1 improved chlorophyll content by 56.09% than Fe⁺ control plants.Catalase and Guaiacol peroxidase Sid1 influenced much better than other Sid and BC treatments. The siderotyped treatments Root Surface Architecture (RSA) values lies greater than Fe⁻ control plants and less than Fe⁺ control plants. PCA analysis grouped volume and surface area of roots with Sid1 most influenced, average diameter of roots with BC3 and length and number of root tips least influenced by the treatments.

It is concluded that efficient siderophore producing bacteria and their cell free siderophore preparations have role in providing iron nutrition to the wheat plant with catecholate Sid preparation (Sid1) proven to be best. This study paves promise for commercial exploitation of siderophore based formulations.

MEASUREMENT OF COLONY FORMING UNITS (CFUS) FROM SOILS PLANTED WITH TOMATO AND UNPLANTED MIXED WITH DE-OILED CAKES GROWN *TRICHODERMA HARZIANUM*

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Artificial addition of bio culture of *Trichoderma harzianum* to the soil planted with tomato and left unplanted was measured in the form of colony counting (cfu) per gm of soil. *T. harzianum* was grown on de-oiled cakes of neem, mahua, jatrophia and karanja and was mixed @ 100gm per 3kg of soil per pot. Soil samples were collected after 15 days of inoculation of *T. harzianum* into soil of categories sterilized planted and unplanted and non-sterilized planted and unplanted. Samples from rhizospheric zone of tomato hold more number of CFUs per gm than unplanted in both the categories of soils.

Key words: De-oiled cakes; *Trichoderma harzianum*; Colony forming units; Tomato; Longevity; Survivability.

POTENTIAL OF *CICHORIUM INTYBUS* L. IN PHYTOREMEDIATION OF HEAVY METAL CONTAMINATED SOIL

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Chicory (*Cichorium intybus* L.) is fleshy tap rooted herbage plant of family Asteraceae, extensively grown in Indian subcontinent for Ayurvedic medicine, coffee adulteration, animal forage and could also be used as potential biomonitor of soil heavy metal contamination. Lead (Pb), copper (Cu) and cadmium (Cd) are common soil contaminants in arable lands posing ecotoxicity and shift in ecosystem structure. Chicory, with its fleshy tap root system and herbaceous leaves, could be potentially used for heavy metal removal to reclaim soil health. Experiment was set up under natural conditions to test the phytoremediation potential of test plant grown in earthen pots filled with garden soil contaminated with chloride salts of Pb, Cu and Cd. Treatment with different concentrations of heavy metals (mg/kg of soil) had shown maximum accumulation of Pb followed by Cu and Cd. Increasing concentration of these heavy metals led to increased phyto-accumulation of these heavy metals and negative effects on visible and growth markers. As an adaptive strategy initial leaf fall, lesser branching and early blooming was evident in heavy metal concentration dependent manner. Other morphological parameters affected were height, dry weight, number of leaves and number of flowers, maximum for Cu (750 mg/kg soil) followed by Cd (75 mg/Kg soil) and Pb (750 mg/Kg soil). It was concluded that Chicory could be potentially used for the phytoremediation of heavy metal contaminated soils preferably for Pb.

Keywords: Cadmium, Chicory, Copper, Lead, Phytoremediation.

GENOME WIDE ASSOCIATION MAPPING FOR IDENTIFICATION OF GENES INVOLVED IN IRON (FE) HOMEOSTASIS FOR DEFINING SEED IRON CONTENT TRAITS USING DIVERSE COLLECTION OF FINGER MILLET GERMPLASMS

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Finger millet (*Eleusine coracana* L.), commonly known as Madua (ragi) is an under-utilized staple food crop of semi-arid and tropical regions of the world. It harbours many important nutritional traits with unique nutraceutical properties, which makes it a wonder grain in Indian and African sub continents. Because of its wider adaptability, longer shelf life, higher nutritional quality and higher multiplication rate under ambient conditions makes finger millet a “climate-smart crop” for use

as a staple food for famine prone areas. Hence, these properties of finger millet could be explored to enhance value of Agri-food products and can make an effective contribution to alleviating the global food concern, so called 'hidden-hunger'. Marker-trait studies in finger millet could be useful in the detection of markers associated with high grain iron and, eventually, in selection of superior genotypes. With an aim to identify markers linked to grain yield or its component traits and grain iron content, initially phenotyping was done for fourteen agro-morphological traits amongst 202 finger millet global germplasm collection at two different environments viz. GBPUAT, Pantnagar and VPKAS, Almora. Analysis of variance for both the environments resulted in highly significant differences among accessions for most of the traits, which showed the existence of sufficient variability. Also the wide range of variation in the agronomic performance of the accessions suggested that these traits could be considered as good candidates for marker-trait associations. The grain iron content varied from 26.71 mg/Kg seed to 78.59 mg/Kg seed with an average of 44.33 mg/Kg seed at Pantnagar and from 28.85 mg/Kg seed to 77.34 mg/Kg seed with an average of 48.61 mg/Kg seed at Almora, which indicates presence of sufficient variability for grain iron trait amongst the selected finger millet genotypes. SNPs through GBS were used for association mapping to identify reliable marker(s) linked to peduncle length or its component traits and iron content. Five SNP markers showed homology to candidate genes of *Oryza sativa* and *Setaria italica*, which play an important role in peduncle length and days to maturity. Two potential SNP markers were found to be significantly associated to grain iron content. The orthologous regions of the two identified SNP markers were found in cereal crops like *Setaria italica* encoding genes for Yellow Stripe-Like (YSL) and iron-regulated transporter (IRT), which might play important role in grain iron accumulation process. Therefore, these genes could be considered as strong candidates for higher peduncle length, iron accumulation and its further use for iron bio-fortification. However, exploration of its spatial distribution within seed, over expression and knockout studies will help in understanding the exact role of these genes in high seed iron accumulation. Since, there is not yet any information on genetic analysis of iron content in finger millet grains is available, so results from the present study would provide a fundamental basis for future research on genetic improvement of iron content in finger millet and other crops.

SILUROID FISHES OF DEHRA DUN (UTTARAKHAND)

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The present communication deals with 15 species of siluroid catfishes from Dehra Dun (Uttarakhand) with their taxonomy, vernacular names, diagnostic features, length, distributional records in and outside Dehra Dun, habitat & ecology and conservation status. These belong to seven families viz. Amblycipitidae (1 sp.), Bagridae (3 spp.), Horabagridae (1 sp.), Heteropneustidae (1 sp.), Schilbeidae (1 sp.), Siluridae (1 sp.) and Sisoridae (7 spp.) under order Siluriformes. The doubtful records from Dehra Dun during the past have also been listed.

Keywords: Siluroid fishes of Dehra Dun.

RECENT ADVANCEMENTS IN FORMULATION OF INSECTICIDES.

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Management of insects on crops is largely dependent on synthetic chemical pesticides, many of them are residual in environment, have high operational cost, environmental pollution and insecticidal resistance to these products pave the need to develop new insecticidal formulations. Some of the recent formulations such as biopolymer-pesticide formulations, combination insecticide formulations, nicotine oleate formulations, bamboo tar emulsifiable concentrates, diatomaceous earth mixtures, straight chain fatty acid formulations, nanoformulations (includes nanogels and nanoemulsions) and oil formulations are being developed. These formulations in future can substitute the commercial formulations which inspite of their advantages also have their own major drawbacks. In this review, We have a few advanced formulations cited which can be used in effective control of pests in near future.

Keywords: biopolymer-pesticide, formulations, nicotine oleate, bamboo tar, diatomaceous earth, nanoformulations.

ALOE VERA ON WOUND HEALING: A SHORT REVIEW

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The Aloe Vera (*Aloe barbadensis*) plant has been known and used for centuries for its health, beauty, medicinal and skin care properties. The name Aloe Vera derives from Arabic world "Aloeh" meaning shining bitter substances, while "Vera" in

Latin world means "true". The Egyptians called Aloe "The plant of immortality". Aloe vera is a cactus like perennial succulent belonging to the liliaceae family that is commonly grown in tropical climates. The leaves of this plant contains numerous vitamins, minerals, enzymes, amino acids, natural sugars and other bioactive compounds with antimicrobial, anti-inflammatory, anti-oxidant, antifungal and antiseptic values for health care. In some studies on animals it has been suggested that Aloe Vera may help accelerate the wound healing process. Scientific evidence of its benefits would be of great value for physicians, since its use could increase adherence to treatment among patients with wounds that are healing and could also lower the costs. Thus the authors searched for randomized controlled trials. The few studies included in this review and it is concluded that further research with appropriate methodological designs is needed in order to elucidate this subject better.

KeyWords: Aloe vera, health, wounds, Animal studies.

ENHANCEMENT OF CAROTENOIDS BY THE GREEN MICROALGA *ASTERARCYS QUADRICELLULARE* PUMCC 5.1.1 UNDER OPTIMIZED CULTURE CONDITIONS

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Commercial production of carotenoids from microorganisms competes mainly with synthetic manufacture by chemical procedures. Efficient stimulation of carotenoids biosynthesis is expected to promote accumulation of carotenoids by microalgae. The goal of the present investigation was to find a new good source of these pigments. We hereby report a green microalga *Asterarcys quadricellulare* PUMCC 5.1.1 as a new good producer of carotenoids. The organism produced 35 ± 1.75 μg carotenoids mg^{-1} dry biomass during stationary phase. The growth and carotenoids production by the test microalga were optimized by varying nutrient growth media, pH, nitrogen and phosphate source, salinity, light quality, intensity and duration. The optimized culture conditions for carotenoid production were: Bold basal (BB) medium with pH 8.5, 10 mM nitrate, 3.5 mM phosphate, 0.17 mM salinity, blue light with $60 \mu\text{mol m}^{-2} \text{s}^{-1}$ photon flux light intensity. Cultivation of cultures in above mentioned cultures conditions resulted in nearly 3.0 fold increase in carotenoids compared to the control cultures grown in unmodified BB medium. Using HPTLC, four carotenoids have been identified as β -carotene, lutein, astaxanthin and canthaxanthin. Further, these carotenoids were separated and purified by flash chromatography and the amounts of purified carotenoids were determined. The test micro alga produced 33.01, 15.26, 8.9 and 6.6 μg β -carotene, lutein, astaxanthin and canthaxanthin mg^{-1} dry biomass, respectively. The amount of total carotenoids (118 μg mg^{-1} dry biomass) produced by *Asterarcys quadricellulare* PUMCC 5.1.1 under optimized culture conditions was significantly higher. Thus, this microalgal strain is a promising candidate for carotenoid production at commercial level.

Keywords: *Asterarcys quadricellulare*, Carotenoids, β -carotene, Lutein, Astaxanthin and Canthaxanthin, HPTLC

EXAGGERATIVE DEFENSE MECHANISM OF *BRASSICA JUNCEA* L. BY BRASSINOSTEROIDS (24-EPIBL AND 28-HOMOBL) TREATMENTS UNDER HIGH TEMPERATURE STRESS

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Agriculture represents a core part of the Indian economy and provides food and livelihood activities to much of the Indian population. While the magnitude of impact varies greatly by region, climate change is expected to impact on agricultural productivity and shifting crop patterns. Climatic changes and increasing climatic variability are likely to aggravate the problem of future food security by exerting pressure on agriculture. Increased concentration of greenhouse gases (GHGs) in the atmosphere resulted in warming of the global climate system by 0.74 °C between 1906 and 2005. The trends of rise in temperature, heat waves, droughts and floods, and sea level shown by the Indian scientists are in line with the Inter-Governmental Panel on Climate Change (IPCC) though magnitude of changes could differ. The mean temperature in India is projected to increase up to 1.7 °C in kharif (July to October) and upto 3.2 °C during rabi (November to March) season, while the mean rainfall is expected to increase by 10% by 2070. This increased temperature affects the agriculture productivity and shifting crop patterns in India. Adaptation of crop plants to environmental stresses is dependent upon the activation of cascades of molecular networks involved in stress perception, signal transduction and the expression of specific stress-related genes and metabolites. To mitigate the impact of high temperature on agriculture crops, biotechnological and breeding approach play a crucial role followed by physiological approaches (by applying phytohormone). Applications of Phytohormones has several advantages over the biotechnological and breeding approach like cost effecting and time saving and without altering the genome of crops. Presents study was pertaining to explore the role of 24-epiBL (brassinosteroids) in the mitigation of harsh effect of high temperature on *Brassica juncea* L. RLM 619 at physiological, biochemical and molecular level. In order to explore the ameliorating potential of BRs in plants particularly in agriculture crops like *Brassica juncea* L. subjected to high temperature stress with various concentrations of 24-epiBL. The morphology of *B. juncea* L. seedlings has revealed remarkable reduction under high temperature stress and 24-epiBL helps in ameliorating this reduction.

Photosynthetic pigments such as chlorophyll and carotenoids decreased significantly in seedlings subjected to high temperature (25 °C to 45 °C). 24-epiBL helps in ameliorating photosynthetic ability by protecting chlorophyll and carotenoids content from high temperature stress. All concentrations ameliorate carbohydrate, vitamin C and Proline content in seedlings exposed to different temperatures as compared to control seedlings. Enzymes of antioxidant defense system ameliorate in 24-epiBL treated seedlings as compared to untreated control seedlings when exposed to different temperatures. Observation suggested that photosynthetic machinery reduce their efficiency under high temperature and 24-epiBL treatment helps in maintaining the efficiency of photosynthesis by increasing the activities of antioxidant enzyme followed by enhance level of osmolytes compounds. Improved health of plants with 24-epiBL at morphological level increasing activity of antioxidant enzyme followed by the enhance level of Vit. C and Osmolytes indicate, 24-epiBL can be used to mitigate the toxic effect of environmental stress in agriculture crops.

GROWTH AND SURVIVAL OF CYANOBACTERIAL LIQUID INOCULANT FORMULATIONS WITH POLYMERIC ADDITIVES

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We evaluated three different polymeric additives Starch, Gum Arabic and CMC as thickener for their ability to support growth and promote survival of several strains of cyanobacteria during storage. There was a large interaction between strains of cyanobacteria and the additives in relation to cell survival. Shelf life of liquid inoculant formulations depended on the strain of cyanobacteria and additives, when stored at 4°C, 28°C and 40°C. Liquid inoculants formulated with Gum Arabic promoted long-term survival of cyanobacteria strains. Survival of cyanobacteria was maintained for 12 months of incubation. Liquid inoculant formulated with CMC stored at 4°C provided the greatest protection to cells of cyanobacteria followed by at 28°C and 40°C. Gum Arabic supported survival at all the three temperature i.e., 4°C, 28°C and 40°C and starch supported survival only at high temperature i.e., at 28°C and 40°C. We found that liquid inoculant performance was as good with polymeric additives Starch, Gum Arabic and CMC as without polymeric additives.

SEASONAL TRENDS IN POPULATION STRUCTURE OF BUTTERFLY COMMUNITY IN CENTRAL HIMALAYAN OAK FOREST: A CONSIDERATION FOR PROMOTING BUTTERFLY ECOTOURISM AT NAINITAL (LAKE CITY)

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Butterflies have long fascinated humans and nowadays addressed as a vital element from ecotourism point of view. The state of Uttarakhand located in Lesser Himalayan Domain of Indian Himalayan region, being a tourist hotspot promotes ecotourism in protected areas and in some exclusive areas of Kumaun and Garhwal regions; however such integrated planning of conservation is much awaited in regions important from the standpoints of sustainable tourism development. In the present study, a foot trail lying in a unprotected temperate forest was assessed based on seasonal data on distribution of butterfly fauna to generate impetus for 'Butterfly Ecotourism' in city Nainital located in Kumaun Himalaya of state Uttarakhand. Field surveys conducted from June, 2017 to April, 2018 downhill up to 5 km in the forest along the walking trail revealed the presence of 42 species of butterflies under six families and six species of the total recorded species protected legally under Indian Wildlife (Protection) Act, 1972. Family Nymphalidae with 17 species of the total recorded species was found dominating in the study area, followed by Pieridae (10 species), Lycaenidae (six species), Papilionidae (four species), Riodinidae (three species) and Hesperidae (two species), respectively. Database relating to seasonal pattern in abundance of butterflies indicates that abundance varied in between three periods of observations: spring, rainy and autumn seasons. Of the total recorded butterfly species, eight species were seasonal i.e. they were found in specific seasons and 19 species of butterflies i.e. 45.23% of the total recorded species were found active across all the seasons. Moreover, spring season based on evaluation of diversity indices for different seasons exhibited maximum butterfly diversity during the study period which coincides with peak tourism season in the city. These findings are important providing baseline data for studying population dynamics of butterfly fauna in the region which can also be used for development of 'Butterfly Trail' as a part of promoting education, research, conservation and ecotourism in city Nainital.

Keywords: Butterfly trail, Lake City, rare species, seasonality, sustainable development

ANTIOXIDATIVE POTENTIAL OF HYDROMETHANOLIC LEAF EXTRACT OF *MELIA AZEDARACH* L. IN CHICKEN LYMPHOCYTES**AMANDIP KAUR AND SONU AMBWANI****Department of Molecular Biology and Genetic Engineering, C.B.S.H., G. B. Pant University of Agriculture and Technology, Pantnagar India*

Since ancient Ayurveda medicinal system, medicinal plants are always used for their therapeutic potential and for having no side effects. These medicinal plants are rich in various phytochemicals that includes polyphenols and carotenoids responsible for beneficial effects on health. The polyphenols and carotenoids are having antioxidative potential which makes medicinal plants a source of natural antioxidants. Free radicals produced during metabolic process produces various pathological conditions. The antioxidants are able to prevent the damage caused by these free radicals. *Melia azedarach* is potent medicinal plants reported to have various medicinal and therapeutic effects. Leaves of *Melia azedarach* is traditionally used to cure various diseases viz. malaria, diabetes, cough, skin diseases etc. In the present study, the antioxidative potential of hydromethanolic leaves extract of *Melia azedarach* (MAE) was explored through DPPH and NO radical scavenging assays. The antioxidative potential of the extract was estimated after *in vitro* exposure of MAE to chicken lymphocytes through conducting various assays viz. membrane lipid peroxidation (LPO), reduced glutathione (reduced GSH), Superoxide dismutase (SOD) and catalase. Content of cellular nitric oxide was also estimated in chicken macrophages rich population after MAE treatment. MAE showed significant antioxidative activity in both DPPH and Nitric Oxide (NO) radical scavenging activity. Nitric oxide content and membrane lipid peroxidation was decreased in MAE treated cells in comparison to control untreated cells. But the content of SOD, reduced GSH and catalase was increased significantly after MAE treatments as compared to control. In conclusion, this study showed that hydromethanolic leaves extract of *Melia azedarach* (MAE) showed marked antioxidative potential and it could be a potential source of natural plant antioxidants.

PROTOPLASTING IN *SCLEROTINIA SCLEROTIORUM* PRODUCING HIGH REGENERATION EFFICIENCY**AMIT KUMAR KESHARWANI*^{1,3}, JYOTI MISHRA², JAGREET KAUR³**¹*Amity Institute of Biotechnology, Amity University, Noida-201308, Uttar Pradesh, India*²*CSIR-National Botanical Research Institute, Lucknow-226001, Uttar Pradesh, India*^{1,3}*Department of Genetics, University of Delhi South Campus, New Delhi-110021, India*

Sclerotinia sclerotiorum (Lib.) de Bary is a highly successful necrotrophic plant pathogen that causes white mold and capable of infecting more than 450 plant species worldwide including canola, potato, cotton etc. Its broad host range restricted the efficacy of cultural disease management practices to minimize infection. To overcome the disease incidence of crops, host mediated pathogen gene silencing is an alternative strategy but due to the low rate of DNA transformation by protoplast, the analysis of the gene silencing on host plants is intricate. Therefore, in this experiment an attempt has been made to prepare the protoplasts having high regeneration efficiency as well as viability for obtaining the successful transformation event in *Sclerotinia*. The protoplasts were prepared by using the combination of two different enzymes such as Lysing enzyme from *Trichoderma harzianum* and Driselase from *Basidiomycetes spp.* which are proficiently digested 2 days old mycelia of *S. sclerotiorum* by improving the no. of protoplasts in digesting solution. Finally, protoplasts were dissolved in STC buffer solution and regeneration efficiency of protoplasts were analyzed on regeneration medium (RM). However, more than 50% of regeneration efficiency was achieved through this protoplasting. Preparation of protoplast is the key step in filamentous fungi to achieve successful transformation rate and it is imperative for obtaining the highly reproducible and viable protoplasts. In addition, the method is also helpful in yielding a higher number of protoplasts with a prominent regeneration efficiency, which will be used for the genetic transformation in *Sclerotinia sclerotiorum*.

Keywords: Protoplast, necrotroph, STC and *Sclerotinia*.**PATHOGENICITY OF *XANTHOMONAS CAMPESTRIS* PV. *CAMPESTRIS* IN *BRASSICA OLERACEA* (CABBAGE) AND IDENTIFICATION OF AVIRULENCE GENE****AMIT KUMAR KESHARWANI^{1,2}, DINESH SINGH¹, SANJEEV KUMAR², ABHIJEET S. KASHYAP¹**¹*Division of Plant Pathology, ICAR- Indian Agricultural Research Institute, New Delhi*²*Amity Institute of Biotechnology, Amity University, Noida, Uttar Pradesh*

Xanthomonas campestris pv. *campestris* (Xcc) (Pammel) Dowson is a gram-negative bacterium and a vascular pathogen that causes black rot disease of vegetable brassica (cabbage and cauliflower), other cruciferous crops, ornamental plants and weeds including model plant *Arabidopsis thaliana*. The pathogenicity of Xcc (Race 1) on cabbage was determined by pathogenicity assay at Indian Agricultural Research Institute, experimental field, New Delhi. 48-72hrs old growth of Xcc was used for the pathogenicity assay. The disease symptoms were appeared after 15dpi (day post infection). The infected leaf of cabbage showed a small, wilted, typical V-shaped lesion that extends inward from the leaf edge towards the midrib.

Furthermore, The Xcc culture was isolated from the infected leaf tissues of cabbage and purified on YGCA (Yeast glucose sucrose agar) medium. The avirulence genes are involved in the pathogenicity of Xcc. To check one of the pathogenicity causing factors, an avirulence gene (*AvrBs1*) was amplified using gene-specific primers and visualized on 1.5% agarose gel. The molecular detection of avirulence genes showing the specificity of the Xcc isolate of Race 1 and confirm the evolutionary relationship with other *Xanthomonas* spp.

Keywords: Xcc, *Brassica oleracea*, pathogenicity, avirulence.

UTILIZATION OF WOLFFIA PLANT AS A PHYTOREMEDIATION FOR TREATMENT OF WASTE WATER

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The Worlds smallest flowering, aquatic plant *Wolffia* is also known as duckweed or Watermeal. *Wolffia* plants are green, free floating thalli and without roots. For experiment, culture tray filled with pond water and waste water with level of 0 (control), 20, 40, 60, 80 and 100% waste water. Physico chemical parameter viz. pH, TDS, TS, TSS, Turbidity, DO were recorded. Fix amount of *Wolffia* plant cultured in each tray. Above parameter of waste water again recorded after 7, 15 and 21 days with *Wolffia* culture. Fresh matter yield and dry matter yield of *Wolffia* plant was increased upto 40% level of waste water. Further increase in waste water level, decrease fresh matter yield and dry matter yield of *Wolffia* plant was observed at 7, 15 and 21 days growth. Phytoremediation by *Wolffia* indicated that the process with *Wolffia* was successful as demonstrated by significant decrease in parameter measured for waste water.

EFFECT OF METAL MIXTURE, (COPPER AND CHROMIUM) ON BEHAVIOUR OF “TAILLESS FRESH WATER FLEA” *SIMOCEPHALUS VETULUS* (CRUSTACEA - CLADOCERA)

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“Tailless fresh water flea” *Simocephalus vetulus* (Crustacea - Cladocera) is a well suited lab model for environmental monitoring. Various heavy metals despite being an essential micronutrient, becomes highly toxic when present in excess quantity in aquatic ecosystem thereby causing deleterious effects on aquatic flora as well as fauna. The water-flea exposed to acute 0.06 mg/l (24hr LC₅₀), 0.04 mg/l (48hr LC₅₀), 0.02 mg/l (72hr LC₅₀) and 0.01 mg/l (96hr LC₅₀) value of metal mixture showed behavioural alterations like initial hyperactivity, fast appendage movements and in phototaxis, geotaxis and avoidance indices. At later stage spinning and erratic swimming, reduced activity, reduced feeding, loss of balance and darkening of cuticular coloration, reduced geotaxis, phototactic and avoidance indices were the major effects on its behaviour. The behavioural alterations of *S. vetulus* showed the most susceptible and foremost indication of potential toxic effects. Various behavioural parameters, used in present study may serve as better biomarkers about metal toxicity and monitoring of drinking water quality.

Keywords: Behavioural alterations, Metal mixture, *Simocephalus vetulus*, Tailless water flea

ROLE OF IRRADIATED SODIUM ALGINATE AND BORON ON GROWTH AND PHYSIOLOGICAL CHARACTERISTICS OF *ARTEMISIA ANNUA* L.

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In the present investigation, the role of irradiated sodium alginate (ISA) in inducing boron stress tolerance was studied in *Artemisia annua* L., which is a major source of antimalarial drug artemisinin. ISA, when applied at 80 mg/L provided considerable protection against boron stress imposed by adding 1 mM and 2 mM to the soil. Boron had inhibitory effects on growth as evident by shoot length, fresh and dry weights of the plant. Boron stress also reduced the values of chlorophyll and carotenoid content and inhibited the activities of nitrate reductase and carbonic anhydrase however a follow up treatment of ISA alleviated the toxic effects of boron. When ISA was applied exogenously, it alleviated the toxicity of B, improved the growth and induced enzyme activities. Most importantly, artemisinin content was higher in ISA treated plants under boron toxicity. Therefore, it can be concluded that ISA had stimulatory effects on artemisinin biosynthesis under mild B toxicity (1mM).

Keywords: *Artemisia annua* L., Irradiated Sodium Alginate, Boron stress, Artemisinin.

LIMNOLOGICAL STUDIES ON THE RIVER YAMUNA AT BAGHPAT (UP) INDIA.**ANIL KUMAR***Deptt of Zoology, J.V.College Baraut Baghpat*

This paper presents physico chemical observations obtained from February 2017 to December 2017 to ascertain the relationship between water chemistry and the state of pollution in the River Yamuna. Excess chloride was found to be the best parameter for determining the extent of pollution (sewage and natural drainage) in this river. The oxygen balance provide a useful measure of the ability of the river to cope with pollution under the prevailing conditions. Stream discharges exert an overriding influence on most of the parameters of pollution. There is an indication of self purification in the river, but this process is retarded by the entrance of sewage and natural drainage at different places.

IMPACT OF POTENTIAL CLIMATE CHANGE ON HONEY BEE LIFE**ANIL KUMAR***Department of Entomology, Mandan Bharti Agriculture College, Agwanpur (Saharsa) J.R.S, Katihar*

Climate change, the variability of the honey bees life-history traits as regards the environmental factors shows that the species possesses such ability and genetic variability that could give rise to the selection of development life-cycles suited to new environmental conditions *Apis mellifera* species that has shown great sustainability potential, as it is found almost everywhere in the world and in diverse climates. Although we do not know the precise impact of potential environmental changes on honey bees as a result of climate change long-term declines in colony numbers and increasing annual colony losses, have led to significant interest in their causes and environmental implications the authors examine the potential impact of climate change on honey bee behaviour, physiology and distribution, as well as on the evolution of the honey bees interaction with insect pest

Key words: Biodiversity, Climate change, Climate resilience, Honeybee, Colony.

A NEW DIGENETIC TREMATODE OF THE GENUS *HELICOMETRINA* PLAGIOPORINAE MANTER,1947 FROM MARINE FISHES FROM BAY OF BENGAL, PURI, ODISHA(INDIA)**ANITA NIGAM* AND A.M. SAXENA***Department of Zoology, University of Lucknow, Lucknow -226007, U.P.*

Genus *Helicometrina* Plagioporinae Manter,1947(Trematode: Alloecreadiidae Stossich,1903) is one of the most important digenean trematode parasite. It is prevalent in the intestine of a marine Fish *Engraulis mystax* (cuv.and val.) from Puri, Odisha, were examined for infectivity with marine fish as a digenean trematode species. For examination and measurement acetoalum carmine stain was performed, followed by camera lucida drawing of morphological characters and measurement of morphometrical criteria. Total 15 marine fishes were found infected. During the survey of marine digenetic trematode parasites, collected one species of the Genus *Helicometrina*, i.e. *Helicometrina mystaxi* sp.nov., another is redescribed to show certain variations, the new parasite was obtained from intestine of marine fish *Engraulis mystax* (cuv.and val.).

Key Words: Digenean, Marine Fishes, Parasite, Trematode

Social relevance of the study: Due to the survey we know about different new helminthic parasites and which part of fishes are infected by them. Thus we can take some precautions and remedies to protect fishes from these parasites.

RNA SILENCING AND ITS UTILISATION IN CROP IMPROVEMENT**ANJALI JOSHI***Department of Genetics and Plant Breeding, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar, 263145, Uttarakhand, India.*

Gene silencing is a general term used to describe the regulation of gene expression. It refers to the ability of a cell to prevent the expression of certain gene. Mechanism of gene silencing includes genomic imprinting, paramutation, position effect, RNA silencing etc. RNA silencing was first observed in petunias by Napoli and Jorgensen in 1990. It is a nucleotide sequence specific process that induces mRNA degradation or translation inhibition at the posttranscriptional level (PTGS) or epigenetic modification at the transcriptional level, depending on RNA directed DNA methylation. RNA silencing is induced by a group of RNA species called as small RNA. Small RNA includes small interfering RNA, micro RNA and piwi RNA. Major RNA silencing pathways currently identified have mechanism of action which may involve both post – transcriptional gene silencing (PTGS) as well as chromatin dependent gene silencing (CDGS) pathways. CDGS involves the assembly of small RNA complexes on nascent transcripts and is regarded as encompassing mechanisms of action which implicate transcriptional gene silencing (TGS) and co transcriptional gene silencing (CTGS). RNA silencing in nature helps in genome wide regulation. It is known to be an adaptive antiviral mechanism that protects plants against viral infection. RNA silencing

can be used to find out the most redundant gene and was used to knockdown the expression of TaABCC13 in order to evaluate its functional importance in wheat. Beside these, it is also helpful in development of transgenic varieties resistant to viral infection and insect damage. One of the most important applications involves the utilisation of RNA silencing in up regulation and down regulation of specific genes. Therefore RNA silencing is an important biotechnological tool that can be effectively exploited in development of transgenics resistant to specific diseases and pest thereby reducing the requirement of chemical pesticide and enhancing sustainability of agriculture.

ANTIMICROBIAL SCREENING OF AZADIRACHTA INDICA LINN. EXTRACT ON STAPHYLOCOCCUS AND PSEUDOMONAS

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Antimicrobial activity in leaf extract of neem (*Azadirachta indica*) against human pathogenic bacteria. *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Antimicrobial activities of different solvents as methanol, ethanol, chloroform and benzene extracts of neem leaves were used. Different extracts of *Azadirachta indica* leaves were prepared at varying concentrations and soaked on Whatmann filter paper discs, which were applied on inoculated plates of Muller Hinton agar. The disc diffusion method and well diffusion method were to screen the antibacterial activity of *Azadirachta indica* leaf extract. This study showed that methanolic neem extract possess antimicrobial activity and further studies need to be done in order to exploit the bioactive compounds of neem in order to reveal its potential as a new source of antibacterial agent.

Key Words: Antimicrobial activity, *Azadirachta indica*, Disc diffusion, Well diffusion

RESPONSE OF DIFFERENT CULTURE MEDIUM ON IN VITRO PLANT REGENERATION THROUGH DIFFERENT EXPLANTS IN ISHWARMUL (ARISTOLOCHIA INDICA LINN)

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The present investigation was under taken to the study of Response of different culture medium on *in vitro* plant regeneration through different explants viz., Cotyledons, Stem segment and Leaf base in Ishwarmul (*Aristolochia indica* Linn). For In-Vitro regeneration of Ishwarmul, seven media were tested out of which five based on Murashige and Skoog's medium (MS), one on Gamborg's B₅ and one on White's media for their response on induction of callus from Stem segment, Leaf base and Cotyledons. Media based on MS responded well irrespective of explants used. Leaf base proved to be the best for callusing percent and fresh weight of callus in MS based media. The highest callusing efficiency was observed in MS medium with full strength of MS salts, 5mg/l 2,4-D + 1.6mg/l BAP. Observation on shoot regeneration capacity suggested that MS medium contained MS salt +5mg/l 2,4-D+1.6 BAP has shown superior performance and was highly effective in inducing multiple shoots from callus. The MS medium with half strength of basic MS salts in combination with 1.2mg/l BAP/ 0.6 mg/l IBA was also found to be the best for root regeneration. The Darkness supports the fast root regeneration in Ishwarmul. The rooted plantlets were successfully transplanted in pots in poly house, after 25 days these plants with pots were transferred in to green house for further acclimatization under natural environments. The survival rate was 63%.

Key words: callusing induction, explants, Ishwarmul, *Aristolochia indica*

INCREASE THE CROP YIELD OF CITRUS VARIETIES IN SUMMER SEASON BY USING PLANT TISSUE CULTURE

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In summer season to fulfil the daily energy requirement of our body citrus fruits are suggested as these fruits come with huge amount of vitamins, minerals, inorganic nutrients etc. These fruits are called citrus as the name suggests they are rich in high amount of citric acid in its pulpy core. Such types of citrus fruits are- lemon (*Citrus limon*), Orange (*Citrus sinnensis*), Pomelo. Of these lemon is majorly cultivated and used in all over the world because not only for its vitamin content but also for its broad medicinal purposes. But the cultivation of lemon in dry summer season is difficult as the seed dormancy does not break easily but it best grows in rainy season. So the need is not completely fulfilled in summer season, that why to prevent the pre harvest losses we can increase the crop yield of citrus fruits by using Plant Tissue Culture technique that imply the cultivation of citrus varieties in laboratory under aseptic conditions. The idea is to grow the seeds of a major citrus variety such as lemon in M.S media in three different variants. It means to culture seeds in three different types of M.S media

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differing in their vitamins concentration. One type of media contain Standard concentration of vitamins, next type of media contain 5X vitamins, and third type of media contain 9X vitamin. Then it is allowed to grow under aseptic conditions and after 2-3 days of cultivation we can observe different growth rates in the three types of media used. This was happened because the increased amount of vitamins in media supports very fast breakdown of seed dormancy in comparison with standard ones. So by this experiment it is clear that if we prepare a manure containing high amount of vitamins concentration and mix with soil so that it can increase the high temperature tolerance of citrus varieties in dry summer season.

Keywords: Citrus Fruits, Plant tissue culture, M.S media, Seed dormancy, Aseptic condition, Vitamins.

INSECT VECTOR MEDIATED TRANSMISSION OF PLANT VIRUSES.

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The majority of plant-infecting viruses are transmitted to their host plants by insect vectors. The interactions between viruses and vector vary in duration and specificity but some common themes in vector transmission have emerged. Although there are different types of plant-associated organisms including fungi, nematodes and various types of invertebrates that serve as vectors for different plant viruses. Majority of plant viruses utilize specific plant feeding insects as their primary vector(s), and here we focus on insect vector belonging to the following genera: caulimovirus, crinivirus, tospovirus, luteovirus, geminiviridae and reovirus. Approximately 99% virus transmission is by insect and 70% insect vector belong to order Homoptera. Plant viruses can be transmitted by insects in various ways. These have been classified as nonpersistent, semipersistent, and persistent, depending on the length of the period the vector can harbour infectious particles, which can range from minutes to hours (nonpersistent) to days (semipersistent) and to live-time and even inheritance by the insect progeny (persistent). Another classification of vector distinguishes them to stylet-borne, foregut-borne, and circulative transmission, usually corresponding to non-persistence, semi-persistence, and full persistence. In circulative transmission, viruses move from the foregut further to the mid- and hindgut, from where they are transported to the hemolymph and further to the salivary gland, from where they are released into the plant tissue during feeding. In some cases, plant viruses are further replicated in the insect haemolymph. Persistent Transmission is usually associated with highly specific virus-vector relationship. Basic knowledge of virus – vector interactions has led to new Biorational control opportunities. Understanding the interactions between plant viruses and their insect vector can underpin approaches to protect plants from infection by interfering with virus uptake and transmission through vectors.

INTEGRATED ANALYSIS OF MIRNA-MRNA NETWORK FOR EBV ASSOCIATED GASTRIC CARCINOMA

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MicroRNAs are one of the most important molecules that regulate gene expression in organisms. These are short having 21~23 nucleotide which are bind un- translated region to 3' of their target miRNAs. EBV virus associated with various types of cancer such as Gastric Carcinoma that means infection of EBV virus is most common, and works as a causative infectious agent for gastric carcinoma, Nasopharyngeal Carcinoma and Burkett's Lymphoma. Gastric carcinoma is a heterogeneous disease, which characterized by epidemiologic and histopathological difference in different countries. Computational methods have been adopted for miRNA prediction and analysis of their related gene by various computational approaches, to understand the network of miRNA and regulation of targeted genes. Analysing miRNA involved in EBV associated Gastric Carcinoma we had find the relationship between miRNA-mRNA with the help of tool Cytoscape for visualize and analyse the network. We have analysed this network's topological features and have looked at functional enrichment of the network nodes and edges by integrating the gene ontology database. In this research work approx. 21 potential miRNAs were found and these miRNAs gives many target sites out of which hsa-miR-16, hsa-miR-146, hsa-miR-126, hsa-miR-30c and hsa- miR-96 are played major role in regulation of miRNA- mRNA interaction and gene oncology which shows carcinogenic attributes and TWF1, WEE1 targeted genes. Analysis of these interactions and gene attributes reveals the key genes which are responsible for EBV associated gastric carcinoma, which can further useful for curing gastric carcinoma by suppressing them or inhibiting their activities.

METABOLISM AND GENE EXPRESSION OF ABIOTIC STRESS TOLERANCE IN PLANTS

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The studies of environmental factors, both abiotic and biotic have been fore players towards considerable loss of crop yields over the years. Techniques have utilized broadly three basic biological platforms, viz. genomics, transcriptomics and

proteomics to overcome these hurdles in achieving the full potential of crop plants. Numerous transgenic plants showing enhanced stress tolerance have been developed to date. Such genetically engineered plants have generally been developed that produce proteins which control stress regulatory networks. These proteins include transcription factors, protein kinases, receptor-like kinases, enzymes related to osmoprotectant or plant hormone synthesis, and other regulatory or functional proteins. Cold, salinity and drought are among the major stresses, which adversely affect plants growth and productivity; hence it is important to develop stress tolerant crop. Understanding the mechanism of stress tolerance along with a plethora of genes involved in stress signaling network is important for crop improvement. In plants, abscisic acid (ABA) is accumulated under osmotic stress conditions caused by drought, and has a key role in stress responses and tolerance. Comprehensive molecular analyses have shown that ABA regulates the expression of many genes under osmotic stress conditions, and the ABA-responsive element (ABRE) is the major cis-element for ABA-responsive gene expression. Transcription factors (TFs) are master regulators of gene expression. Recent studies using crops have shown that stress-specific overexpression of TFs improves drought tolerance and grain yield compared with controls in the field. In this study, various aspects of cold, salinity and drought stresses have been emphasized.

Keywords: Abiotic stress, ABA, transcription factor, signal transduction, stress tolerance

ESTIMATION OF GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE OF RICE (ORYZA SATIVA L.) IN SALINE AND NORMAL CONDITION

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Rice is an important versatile food crops which feeds over half of the world's population and provides essential food elements, employment opportunity as well as raw materials for different products used by human kind. Salinity is a major abiotic stress that limits rice production across rice areas as high-yielding modern rice varieties are generally sensitive to salt stress. The present investigation consists of twenty rice genotypes in RBD Design with three replications. The data were recorded for fourteen quantitative characters to study genetic variability, heritability, genetic advance, correlation coefficient analysis and path analysis. Analysis of variance among twenty genotypes showed significant difference for all characters studied. Highest genotypic coefficient of variation (GCV) and phenotypic coefficient variation (PCV) was observed for panicle bearing tillers per plant followed by grains per panicle and spikelet per panicle in controlled condition whereas in saline condition for grains per panicle followed by spikelet per panicle and panicle bearing tillers per plant indicating that these characters could be used as selection parameters for crop improvement. High estimates of heritability were observed for spikelet per panicle followed by grains per panicle, plant height, days to 50% flowering and test weight in controlled condition, whereas, in saline condition highest broad sense heritability was recorded in the case of spikelet per panicle followed by grains per panicle, grain yield per plant, days to 50% flowering and plant height. In controlled condition high genetic advance were observed for grains per panicle followed by spikelet per panicle, whereas, in saline condition maximum genetic advances was recorded is same as in controlled condition, indicating predominance of additive gene effects and possibilities of effective selection for the improvement of these characters.

PLANT BIOTECHNOLOGY: APPLICATION, UTILITY AND IT'S BARRIERS.

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Plant biotechnology play the wide role in enhancing agricultural production especially for those where agricultural conditions is very typical. The 'Gene Revolution' challenges as well as opportunities for the region to develop its sector. However, the assessment of biotechnology's role in addressing food and nutrition insecurity must go beyond total acceptance or rejection, and weigh both its benefits and risks. This represents the conceptual position taken within the thesis, and is exemplified in the "bio-transformationalist" perspective. An international political economy approach serves to highlight the critical structures of biotechnology development required for success in the industry, specifically, security, production, finance and knowledge. It also brings to the fore those issues that impact developing countries which derive from the traditional global division of labour. The Caribbean occupies a peripheral position within each of the structures, but can be given credit for the strides made in terms of security (biosafety), and finance (commercial projects). Marginality in production is attributed to the absence of commercial production, while a general lack of awareness of GMOs is the major deficit within the knowledge structure. The research found that there is a role for biotechnology applied to Caribbean agriculture, but this is contingent upon the region improving its position within each of the afore-mentioned structures. Relevant legislation, capacity building, appropriate infrastructure, research and development funding, private sector involvement, public education and government support for the sector are all pre-requisites for success. Further, alternative production systems must be considered address concerns associated with the application of genetic modification to food production.

Keywords: Michelle Cynthia John; GMOs; agricultural trade; bio-transformation.

FREE RADICAL SCAVENGING AND ANTIOXIDANT IMPACT OF INDIAN MEDICINAL PLANT EXTRACTS ON H₂O₂ MEDIATED OXIDATIVE STRESS ON HUMAN ERYTHROCYTES

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Oxidative stress (OS) plays a major role in the development of chronic and degenerative ailments such as arthritis, aging, autoimmune disorders, neurodegenerative and cardiovascular disorders and cancer. Many plant species have been investigated in search of novel antioxidants. Plants synthesize several antioxidants to them against damage caused by active, reactive oxygen species (ROS). In the present study four traditional Indian medicinal plants *Orchis latifolia*, *Boswellia serrata*, *Boerhavia diffusa* and *Centrathurum anthelminticum* were investigated for their antioxidant potential and their protective effect in preventing haemolysis and lipid peroxidation in human red blood cells. In this study methanolic (MeOH) extracts of these four plants were partitioned with various solvents of different to obtain fractions. The fractions first subjected to phytochemical analysis followed by evaluation of their antioxidant potential by measuring the total phenolic content, total flavonoid content, 1, 1-diphenyl-2-picrylhydrazyl (DPPH) scavenging potential and Ferric reducing antioxidant power (FRAP) potential. After this the selected fractions were tested *in vitro* to determine their protective effect against H₂O₂ induced haemolysis and lipid peroxidation in human RBCs. The study demonstrated a strong antioxidant potential of the ethyl acetate fraction of *C. anthelminticum* and *O. latifolia* as evident from high phenolic and flavonoid content and strong free radical scavenging activity. Further, the results also show a strong relation between the total phenolics and flavonoid content and antioxidant activity as demonstrated by the selected plant fractions. The fractions also protected membrane integrity resulting in a reduction of RBC haemolysis and lipid peroxidation during artificially induced oxidative stress. The results also provide scientific evidence to support the folk medicinal utilization of these plants for the treatment of various ailments and may offer new possibilities in the therapy of pathological conditions related to generation of free radicals.

Keywords: Medicinal plants, Antioxidant potential, Phenolics, Flavonoid haemolysis, Lipid peroxidation.

BIODIVERSITY CONSERVATION

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The issue of biodiversity conservation is regarded as an important element in natural resource management. The main purpose of biodiversity conservation today is to protect individual species, preserve habitat and ecosystems, and make certain human neighbors benefit. Precautionary Biodiversity Management The "threats" wreaking havoc on biodiversity include; habitat fragmentation, putting a strain on the already stretched biological resources; forest deterioration and deforestation; the invasion of "alien species" and "climate change". Since these threats have received increasing attention from environmentalists and the public, the precautionary management of biodiversity becomes an important part of natural resources management. Administration and guidelines "Ecosystem-based management" including "more risk-averse and precautionary management", where "given prevailing uncertainty regarding ecosystem structure, function, and inter-specific interactions, precaution demands an ecosystem rather than single-species approach to management".

"Adaptive management" is "a management approach that expressly tackles the uncertainty and dynamism of complex systems". "Environmental impact assessment" and exposure ratings decrease the "uncertainties" of precaution, even though it has deficiencies, and "Protectionist approaches", which "most frequently links to" biodiversity conservation in natural resources management. Land management In order to have a sustainable environment, understanding and using appropriate management strategies is important. Comprehending the processes of nature including ecosystem, water and soils. Using appropriate and adapting management systems in local situations Examine impacts of local decisions in a regional context, and the effects on natural resources. Avoid land uses that deplete natural resources. Retain large contiguous or connected areas that contain critical habitats. Minimize the introduction and spread of non-native species. Avoid or compensate for the effects of development on ecological processes.

EFFECT OF DIFFERENT PH AND TEMPERATURE LEVELS ON MYCELIAL GROWTH OF *PLEUROTUS CORNUCOPIAE* (BRANCHED OYSTER MUSHROOM)

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Pleurotus cornucopiae, the branched oyster mushroom is one of the *Pleurotus* species whose cultivation is not common in India. The physiological/cultural studies were conducted to evaluating different pH and temperature levels for the mycelial growth of *P. cornucopiae*. The test fungus was evaluated for its tolerance to low and high Ph levels. Out of different pH regimes ranging from 4.0 to 8.0 tested and pH 7.0 was found to support maximum average diametric growth (83.25mm) and minimum growth (53.91mm) was observed at pH 4.0. In all the treatments, type of growth ranged between sparse, fluffy to thick strandy. Six different temperature regimes ranging from 10 to 35°C were evaluated, the maximum average diametric growth (85.00 mm) was observed at temperature 25⁰C and minimum (39.16mm) was observed at 10⁰C. The type of growth at different pH & temperature's ranged between strandy, sparse, fluffy and thick strandy. Data were recorded after 7 days of inoculation of test fungus in both that is pH and temperature.

Keywords: temperature, pH, *Pleurotus cornucopiae*, diametric growth, average biomass, colour of mycelium and type of growth.

BIODIVERSITY RESOURCES AND THEIR CONSERVATION: A STRATEGY FOR LIVELIHOOD SECURITY.

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Biodiversity is a part of biosphere and plays an important role in livelihood security and climate regulation. The biological resources for our survival and sustainable development or livelihood resources are decreasing due to the human activities. Biodiversity holds great ecological value because of its indispensable capacity to maintain the ecological balance. Any disturbances in its ecological balance maintained by different organisms, will lead to severe problems, which may affect the survival of flora and fauna in general and human beings in particular. Deforestation and improper conservation techniques of the biological resources have the serious implications and reduced forest flora and fauna, decreasing ground water level, reducing grazing land and affect the soil health and air quality. Conservation of biological resources is very important, as the human beings derive countless direct economic benefits from the nature in the form of food, firewood, fibre, construction material, important medicinal and industrial products and various indirect benefits as well. Biodiversity has great economic value because economic development depends upon efficient and economic management of biological resources. Conservation of biological diversity is very important for the protection, upliftment and scientific management of biodiversity so as to maintain its threshold level, which leads to its sustainability for the present and future generations.

Keyword: Biodiversity, deforestation, conservation, organism.

MOLECULAR APPROACHES OF HEAT TOLERANCE IN WHEAT

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An experiment was carried out during rabi season (2016-17) at the Student Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj Faizabad- 224229 (U.P.), India. Five wheat lines NWL-10-14, NWL-12-13, KO-307, NWL-12-2, and NWL-12-4 were exposed to heat stress by delay sowing of forty days from normal date 15 November so that wheat lines could experienced severe heat stress at grain filling stage. The screening of wheat genotypes was done on the basis of plant height, tiller number per plant, stay green duration, number of grain per spike, test weight and yield plant-1. The heat stress at time of grain filling reduced grain yield and its components irrespective of wheat lines. Among the five wheat genotypes KO-307(12.72%), NWL-12-13(14.92%) showed tolerant on the basis of stability in chlorophyll content and stay green duration. Heat stress as the rise in temperature beyond a threshold level for a period of time sufficient to cause irreversible damage to plant growth and development. Tolerance to heat stress is complex phenomenon and controlled by multiple genes importing a no of physiological and bio chemical changes. Wheat is highly sensitive heat stress and even slight variation in temperature during critical stages like pollination and milky ripe reduce the quality and quantity of wheat grain.

ECO-FRIENDLY APPROACHES TO COPE AGRICULTURAL CHALLENGES**ASHISH KUMAR PANDEY, ARUN KUMAR AND R.S.SENGAR***Department of Agriculture Biotechnology, college of Agriculture Sardarvallabhbhai Patel University of Agriculture and technology, Modipuram, Meerut*

Nowadays agricultural issues are considered as the primary challenges in the world. India is one of the highest agriculture production country but production is depend upon high input of chemical fertilizers. Soil structure and food cycle is nowadays a matter of greater concern. Chemical fertilizers increase the production but it alters the quality of water, soil and air. These chemical can harm human and animal health and creating serious health issues when food material is utilize as grain and fodder. New technological approaches have to be necessitated as unlike other natural disasters, that can help to prevent this issue. While adopting the technique, one should keep in view the future perspective of the crises, i.e. the growing population, environmental damages and also the depletion of natural resources. Traditional techniques alone cannot fill the required criteria. Alternative measures need to be sorted out and thus Green Biotechnology is in urgent need of action. But in order to adopt the technique, farmers play a crucial role and the awareness of the farmers for the technology has to be evaluated firstly. So this paper relates Green Biotechnology to cope up with future challenges emphasizing on the applications of the techniques and the need for its adoption.

Keywords: Green Biotechnology, Organic farming, Micropropagation, Transgenic.

THE EFFECT OF CLIMATE CHANGE ON POPULATION DYNAMICS OF BUTTERFLY SPECIES (ORDER: LEPIDOPTERA)**ASHOK KUMAR AND BIPIN KUMAR***Department of Zoology, B.S.N.V. P.G. College (Lucknow University) Lucknow, (U.P.), India.**Department of Zoology, S.S.N.College (Delhi University), Alipur, Delhi-110036*

The geographical position of Lucknow is 26.84°N latitude and 80.92°E longitude, located at an elevation of 126 meters above sea level and in the plain of northern India, Lucknow's location is responsible for the diverse weather patterns and climate change. It does not have a uniform weather throughout the year and experiences extreme summers and extreme winters. Drastic changes in land use pattern associated with urbanization have resulted in an immense impact on these fringe areas of human habitations where forests are situated. The present study discusses variation in diversity of butterfly in different impact zone across natural and semi natural vegetation type close to Lucknow city in five study sites (two open field and three sites along with roads) with different disturbance levels were monitored for diversity and seasonal pattern in butterfly communities. Butterfly population was highest in late monsoon and early winter, majority of butterfly species also showed abundance peaks in these seasons. The study was surveying between 10.00AM to 5.00 PM the active biological hours for butterflies depending of the internship availability and the climate conditions.

Key words: Population dynamics, Climate conditions, Lepidoptera

EFFECT OF ARBUSCULAR MYCORRHIZAL INOCULATIONS ON YIELD OF *PISUM SATIVUM* L. UNDER BUNDELKHAND CONDITIONS**ASHOK SHUKLA, NARESH KUMAR AND ANIL KUMAR***ICAR - Central Agroforestry Research Institute, Jhansi – 284003, Uttar Pradesh*

A study was conducted to assess the response of *Pisum sativum*, an important pulse crop of Bundelkhand region of Central India, to eleven mycorrhizal treatments (ten arbuscular mycorrhizal (AM) species, namely *Acaulospora mellea*, *A. scrobiculata*, *Glomus aggregatum*, *G. arborensense*, *G. cerebriforme*, *G. eutunicatum*, *Paraglomus occultum*, *Rhizophagus diaphanus*, *R. intraradices*, *Simiglomus hoi* and a control i.e. un-inoculated) in two common soil types of the region viz., alfisol (red) and vertisol (black), with and without autoclaving, under net-house conditions. Values of almost all studied plant growth parameters were relatively higher in vertisol than the values recorded in alfisol. The growth parameters showed variable response to soil heating. The plants showed higher dependency on inoculated fungi in terms of yield plant⁻¹ (seed yield). Out of ten inoculated fungal species, seven (*G. arborensense*, *R. diaphanus*, *A. mellea*, *A. scrobiculata*, *G. aggregatum*, *G. cerebriforme* and *Sim. hoi*) recorded the best response with respect to the yield. The yield in AM-inoculated plants varied in the narrow range i.e. 10.74–17.33 g plant⁻¹, which was 7-12 times as compared to control (un-inoculated) plants. Such exceptional increase in yield after AM inoculations could be due to very poor yield in control plants, which is attributed to poor soil fertility status of Bundelkhand region. Nevertheless, the results demonstrated higher dependency of *P. sativum* on AM fungi for yield in less fertile areas, where farmers do not apply chemical fertilizers. Thus, the result of present study indicates that any one of above mentioned AM species can be used for inoculation of *P. sativum*.

Key words: Alfisol, AM fungi, Autoclaving, Mycorrhizal dependency and Vertisol

EFFECTIVE PLANT REGENERATION THROUGH *IN VITRO* MUTAGENESIS IN WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES USING MATURE EMBRYO CULTURES**ASHWANI KUMAR¹, SWATI SHARMA¹, PRAFULL KUMAR, PRIYA² AND M K YADAV¹**¹Department of Agricultural Biotechnology ²College of Biotechnology

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Wheat (*Triticum aestivum* L.) being an important crop of India grown in large area but due to drastic change in climatic conditions it is predicted that large area of India may face water scarcity. On the same time population is continuously increasing and it will be difficult to feed the population. To cope this alarming situation, there is need to accelerate research towards development of new cultivars with high yield with less water. More crop per drop is the great idea in that context. Mutations are the great tools to improve the traits for abiotic stress. If we combine these tools with *in vitro* technology then we will be able to attain the results many fold increase. Therefore, the *in vitro* response for callus induction and regeneration is prerequisite for improvement of wheat through mutation. *In vitro* technique may be used as a novel tool to assist plant breeders in crop improvements. In the present study mature embryo were used as explants in wheat of different concentration of 2, 4-D (2,4-Dichlorophenoxyacetic acid) and NAA (Naphthaleneacetic acid) for callus induction and regeneration, respectively. In our study, callus induction, regenerated shoots and roots development were observed by using different concentration of BAP (6-Benzylaminopurine), TDZ (Thidiazuron) and NAA (Naphthaleneacetic acid) after treating the seed with appropriate concentration of mutagenic agents. Along sides, the effect of different concentrations and combinations of the cytokinin, auxin has also been optimized. Using the optimized component, the efficiency of different wheat genotype, i.e., HD 2967 and C 306 were evaluated for regeneration. In the present study chemical mutagen (EMS) and a physical mutagen (UVB radiation) was investigated on the wheat genotypes.

Keywords: The plant tissue culture, regeneration, Mature embryo, 2, 4-D, NAA, TDZ, BAP, UV and EMS.

BIOTIC AND ABIOTIC STRESS MANAGEMENT**ASMA JABEEN, SANJAY CHADHA AND BASEERAT AFROZA**

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Biotic and abiotic stress may be defined as the negative impact of living and non-living factors on the specific environment. Due to limited availability of arable land and excessive damage instigated by microorganisms along with the high demand of vegetable crops around the world, cucurbits (cucumber, melon, squashes and watermelon) and Solanaceous (brinjal, tomato and pepper) crops are of global importance and frequently cultivated under unfavourable conditions. Biotic stresses include flooding, drought, supra-optimal temperature and salinity and abiotic stresses include bacterial wilt, root-knot nematodes and other soil-borne diseases. Plants exposed to such stresses exhibit various physiological, biochemical and pathological disorders limiting plant distribution and leading to stunted growth and severe loss in quality and yield. One way to avoid or combat losses in production caused by such environmental stresses in vegetables would be to graft them onto rootstocks having the ability to withstand the effects of stresses on shoot. One of the major advantages of using grafted plants is to utilize the strong resistance to soil-borne diseases. These include fusarium wilt in cucurbits and tomato, *Phytophthora* and bacterial wilt disease in chilli-pepper. The most widely used rootstock for cucurbits is an interspecific hybrid between *Cucurbita maxima* and *Cucurbita moschata*. The graft exerts strong resistance to all four races of *Fusarium*, tolerance to low soil temperature and good graft compatibility. Besides grafting also offers other benefits like increased yield and reduced fertilizer application. Hence it is necessary to amplify the research for novel rootstocks and evaluate new rootstock-scion combinations. Breeding and physiological approach are absolutely necessary to accelerate the progress in the identification of rootstocks with multiple benefits.

Keywords: Biotic, abiotic stresses, tomato, cucurbits, grafting

EFFECT OF DIFFERENT DOSAGE OF ZINC FERTILIZER ON MORPHO-PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS OF OKRA**AVNEET KAUR KHANDUJA*, TINU ANAND KAIN, SHAHID UMAR**

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Zinc, a vital micro-element is mainly utilized by plants in the form of Zn^{2+} and is involved in various plant processes like nitrogen fixation, biomass production, pollen function and chlorophyll synthesis. It also plays a secondary role in stabilizing membrane and DNA binding protein. The physiochemical analysis of pre-treatment soil suggested that loamy soils are apparently deficient in zinc. Zinc deficiency can be eliminated by adding zinc fertilizers which improve crop yield and nutritional quality. This study was conducted to examine the impacts of different levels of zinc fertilizer applied as $ZnSO_4$ on various morpho-physiological and biochemical parameters of Okra. Okra, also known as lady-finger, is a storehouse of vitamins, mineral matter, calcium and potassium. A field experiment was carried out on Okra (*Abelmoschus esculentus*) at

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Herbal Garden of Department of Botany, Jamia Hamdard, New Delhi. The experiment was laid out with randomized complete block design with nine treatments each with three replicates and the plants were treated with a recommended dose of NPK followed by different concentrations of zinc sulphate. The objective of this experiment is to ascertain the optimum level of zinc for maximum growth, yield and quality of Okra. It was found that plant yield increased significantly depending on the dosage of zinc fertilization. Biochemical parameters like chlorophyll content, protein content and sugar content also showed a significant increase with the increase of zinc fertilizers to an optimum level.

Keywords: Okra, Zinc, Nutrition

DESIGNING NUTRACEUTICAL RICH VEGETABLE CROPS THROUGH CONVENTIONAL AND MOLECULAR APPROACH

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The compositions of ingested foods have relationships to positive but also adverse health effects, such as cardiovascular disorders, cancers, diabetes, hypertension and obesity. Vegetables are important components of the diet, supplying a multitude of health-related phytochemicals viz., vitamins (A, B₆, C, E, thiamine and niacin), phenolic compounds, carotenoids, alkaloids, flavanoids, minerals and dietary fiber. The current breeding trends addressed the feasibility of breaking down overall bioavailability into components such as anti nutrients and promoters. Through conventional approaches, *Brassica villosa* segments carrying *QTL1* (Chr2) and *QTL 2* (Chr5) is introgressed into *Brassica oleracea* var. *italica* for enhanced sulphoraphane (Sarikamis *et al.*, 2006). A single gene 'β' from *Solanum pimpinellifolium* contributes to "Golden tomatoes" with 3 to 6 times higher than standard types (AVRDC, 2003). Spontaneous mutation of semi-dominant "Or" for orange gene enhanced β' carotene in cauliflower curd ranging from 3 to 320 µg/ 100 gram fresh tissue (Li *et al.*, 2001). To breed common bean with reduced endogenous edible toxic compounds, Shang *et al.* (2016) identified suitable common bean cultivars with low lectin, trypsin inhibitor, saponin and phytic acid. To pace the breeding process molecular-marker-assisted selection, transformation, chromosome manipulations and generation of useful mutant alleles have been employed (Rai *et al.*, 2012). Transgenic tomato plants accumulating high amounts (70–100 fold) of anthocyanin in the fruit is due to the expression of two transcription factors, *Delila* and *Rosea1* from *Antirrhinum majus* (Maligeppagol *et al.*, 2013). Li *et al.*, (2012) developed a transgenic carotenoid enriched potato carrying "Or" gene that stabilized the carotenoid accumulation in the lipoprotein–carotenoid sequestering structures at chromoplast.

Keywords: Nutraceutical, vegetable, MAS.

EFFECT OF SOME NEWER INSECTICIDES ON THE RATE OF ADULT EMERGENCE OF *T.CHILONIS* UNDER LABORATORY CONDITION.

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The present investigation was carried out to study the effect of insecticides viz. Chlorantraniliprole 18.5 SC, Diafenthiuron 50 WP, Cartap hydrochloride 50 SP, Spiromesifen 22.9 SC, Thiamethoxam 25 WG, Clothianidin 50 WDG, Flonicamid 50 WG, Azadirachtin 1500 ppm on rate of emergence of *T.chilonis*, when applied during different developmental stages i.e egg, egg-larval and pupal stages in biocontrol laboratory, entomology section, college of agriculture, Nagpur during 2016-2017. Percent mortality (Reduction in adult emergence) in different treatments during different developmental stages were recorded. On the basis of IOBC categorization of different insecticide with reference to reduction in adult emergence cartap hydrochloride was found moderately harmful towards all the developmental stages where as diafenthiuron and chlorantraniliprole were harmless. Spiromesifen and Azadirachtin was found harmless towards adult emergence when applied during pupal stages and slightly harmful when applied during egg and larval stages.

AN OVERVIEW ON PREBIOTIC FRUCTO-OLIGOSACCHARIDES AND ITS POTENTIAL HEALTH BENEFITS

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Fructo-oligosaccharides, well known as neo-sugars have been reported to contain numerous beneficial properties. Fos from sucrose which are considered as new alternative sweeteners with functional properties, also called soluble fibers, have a number of desirable characteristics viz. low calories, absence of cariogenicity and safe for diabetics and *Bifidobacterium* stimulating factor. Fructo-oligosaccharides are also known as prebiotics, since they stimulate the growth of probiotic organisms. The present review summarizes clinical and experimental data pertaining to the possible health benefits of prebiotic fructo-oligosaccharides. The outcomes from several studies, clearly demonstrate that the Fos prebiotic increase

fecal bulk and optimize stool consistency primarily by increasing fecal microbial mass. Prebiotics are primarily energy sources for holistic intestinal bacteria that ferment them into short-chain fatty acids. Several animal studies have demonstrated that inulin-type fructans, galactooligosaccharides, isomaltooligosaccharides, lactitol and lactulose substantially enhance mineral absorption, especially calcium and magnesium. The combination of inulin and oligofructose has been shown to aggrandize calcium and magnesium absorption more efficaciously than oligosaccharide alone. Most of the results on the effects of prebiotics and lipid metabolism are derived from research with inulin-type fructans. Oligofructose has also been shown to prevent hypertriglyceridemia induced by both fructose and high-fat feeding in rats. Research demonstrates that prebiotics modulate both intestinal and systemic immunity largely through their association with gut microflora. Research indicates some prebiotic-like substances may also be able to directly stimulate immune cells. Evidence suggests prebiotics can favorably influence serum glucose and insulin levels in a variety of ways. *In vitro* and animal studies have revealed the potential of prebiotics to enhance detoxification processes in colon cells, reduce toxic metabolite production in the gut and safeguard against colonic tumor development. In animal models, inulin-type fructans, galacto-oligosaccharides and xylo-oligosaccharides have been shown to suppress chemically induced colon cancer and precancerous colon lesions.

VERNALISATION: MEANING AND IMPORTANCE

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The cold treatment given to plant buds, seeds or seedlings for promoting early flowering is known as Vernalisation. The chilling treatment for induction of early flowering is called Vernalisation. The qualitative or quantitative dependence of plants on exposure to a low temperature to flower. Temperature affects flowering, metabolic activities, and germination of seeds in plants. Plants that grow in mild weather germinate at low temperatures whereas those that grow in hot regions germinate at high temperatures. Some plants need exposure to a low temperature to germinate. Furthermore, a plant can be induced to flower in a growing season by exposing it to low temperature. Therefore, it shortens the vegetative phase and hastens flowering in plants. Besides an appropriate photoperiod, certain plants require a low temperature treatment during their early stages of the life for subsequent flowering in the later stages. This low temperature treatment requirement was termed vernalization by Lysenko (1928). Due to vernalization, the vegetative period of the plant is cut short resulting in an early flowering. In nature, vernalisation takes place in the seed stage in annuals like winter rye (*Secale cereale*). The biennials and many perennials respond to cold treatment at a very late stage. E.g. Henbane, Apples etc.

GENETIC ENGINEERING OF TOMATO (*LYCOPERSICON ESCULENTUM*) PLANT USING ANNEXIN GENE THROUGH AGROBACTERIUM MEDIATED TRANSFORMATION

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Drought and high salinity are two major abiotic stresses that significantly affect agricultural crop productivity worldwide. Annexins are multigene family that plays an essential role in plant stress responses and various cellular processes. The present study involves the development of genetically engineered tomato, (*Lycopersicon esculantum*) plant with annexin gene. *E. coli* bacteria (resistant to kanamycin) carrying pGPTV/annexin, *E. coli* carrying helper plasmid pRK2013 and *A. tumefaciens* (MTCC431 strain) carrying disarmed Ti plasmid (resistant to Streptomycin) were used for tri-parental mating. The annexin gene construct was transferred into plant genomic DNA by using leaf disc preparation, co-cultivation and selection media transfer. The selection media consists of Kanamycin, Augmentin and Cefotaxime. Leaf disc containing gene construct survives on selection media and were allowed to grow in the form of callus that is regenerated into transgenic plantlets, indicating the presence of gene of interest, which was further confirmed by extraction of genomic DNA and PCR analysis. Study revealed that Agrobacterium-mediated transformation in tomato was successful method for transfer of annexin gene. The methodology may be used for the commercial production of transformed tomato plant with salt and Drought tolerance character.

Key words: *A. tumefaciens*, *Lycopersicon esculantum*, Annexin gene, *E. coli* DH5 α , pUC119, pGPTV,

ACTION OF ENDOPHYTIC BACTERIA RESIDING IN THE SUGARCANE**BEENU SHASTRI*, RAJESH KUMAR***Rhizosphere Biology Laboratory, Department of Environmental Microbiology, School for Environmental Sciences, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Raebareli Road, Lucknow, U.P. India,*

Plant are associated with a diverse range of bacterial communities of microorganisms. Endophytes are the special group of microorganisms which resides inside the plants and get adapted to their specific host tissue by forming a symbiotic association. Endophytic bacteria have been reported from wide variety of plants including sugarcane plants. In a recent era, endophytes reported from the sugarcane plants helps in combating the red rot diseases as well as increased the yield of crops. This is possible because of the role of various metabolites which functions as PGPRs and other attributes involve in arresting the growth of red rot fungus. The most important role played by endophytic bacteria on the plant system includes greater uptake of nutrients, modulation of plant metabolism and phytohormone signalling that lead to adaptation of environmental biotic/abiotic stress. Present study also investigated the production of various metabolites having the property to suppress or lyse the plant pathogen activity directly. These endophytic metabolites possess the capability of degrading the cell wall of fungi. Thus, endophytic bacteria possess the property and played a potential role in controlling the disease. However, this area of research is relatively new and unexplored. Very little knowledge is known about the interaction between endophytes, host plant and pathogen. Understanding of this interaction is essential for the development of proper biocontrol strategy.

*Keywords: Biocontrol, Endophytes, PGPRs, Red Rot***ABIOTIC STRESSES AND ITS MANAGEMENT IN CROP PRODUCTION****BHAWANI SINGH PRAJAPAT¹*, ATUL DHANSIL², ANIKET DIWEDI³ AND ABHITEJ SINGH SHEKHAWAT¹**¹*Ph.D Research scholar at MPUAT, Udaipur--313001, Rajasthan*²*M.Sc. COA, JAU junagadh, Gujarat - 362001*³*Ph.D Research scholar at CCSHAU, Hisar-125004, Haryana***Key words:** Abiotic Stresses, Crop Production, Mitigation

In today's climate change scenarios, crops are exposed more frequently to episodes of abiotic stresses such as drought, salinity, elevated temperature, submergence and nutrient deficiencies. Abiotic stress responses with a wide range of abiotic stresses able to adversely affect plants through a multitude of mechanisms and abiotic stress management is one of the most important challenges facing agriculture. Abiotic stresses adversely affect the livelihoods of farmers and their families as well as national economies and food security, include potentially adverse effects of salinity, drought, flooding, metal toxicity, nutrient deficiency, high temperature and low temperature, air pollution, wind, hail and gaseous deficiency which are often sporadic and highly localized in occurrence and showing different symptoms of stress *e.g.*, change in biomembranes or enzyme activities, necrosis, chlorosis, and discoloration, retarded growth, development, and reproduction, changes in the interference caused by heterotrophs, changes in the genotypes of which populations are composed and change in species composition of an ecosystem. These stresses limit crop production. Abiotic stress can persistently limit choice of crops and agricultural production over large areas and extreme events can lead to total crop failures. In recent years, advances in physiology, molecular biology and genetics have greatly improved our understanding of crops response to these stresses and the basis of varietal differences in tolerance. Furthermore, the severity of stress imposed on crops also depends on the susceptibility of different crops during different stages of their development. Mitigation of drought stress by using foliar spray of DAP, kaoline, cycocel, seed hardening, and flooding stress can be mitigated providing adequate drainage, ascorbic acid, and high temperature stress can be mitigated of plants need to be overhead irrigation and by using of gibberellic Acid.

SEED PRIMING: A TOOL TO MITIGATES THE ABIOTIC STRESS**BHUDEO RANA YASHU* UDAY PRATAP SINGH***Department of Plant Physiology, I. Ag. Sc., Banaras Hindu University, India*

Seed priming is a controlled hydration techniques in which seeds are soaked in water or low osmotic potential solution to a point where germination related metabolic activities begin in the seeds but radical emergence does not occur." Seed priming is the process of controlled hydration of seeds to a level that permits pre-germinative metabolic activity to proceed, but prevents actual emergence of the radical. Priming allows some of the metabolic processes necessary for germination to occur without germination take place. In priming, seeds are soaked in different solutions with high osmotic potential. This prevents the seeds from absorbing in enough water for radical protrusion, thus suspending the seeds in the lag phase. Seed priming has been commonly used to reduce the time between seed sowing and seedling emergence and to synchronize emergence. In seed priming, the osmotic pressure and the period for which the seeds are maintained in contact with the membrane are sufficient to allow pre-germinative metabolic processes to take place within the seeds up to a level limited to that immediately

preceding radical emergence. Various seed priming techniques are used these days which improve the seed vigourosity and viability such as Hydro-priming, Halo-priming, Osmoprimering, Hormonal priming.

MAJOR THREATS TO BIODIVERSITY AND WAYS TO CURB THEM

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Biodiversity is very important component of earth because the fewer animals we have, the fewer humans we will have. Plants, animals and even micro-organisms are vital to keep ecosystem healthy, balanced & thriving. But there are number of issues threatening our planet's biodiversity. There are five main threats to biodiversity like climate change, deforestation & habitat loss, overexploitation, invasive species and pollution. Rapid manmade climate changes lead to the extinction of various species. Climate has a major factor in the distribution of species across the globe, but climate change forces them to adjust & lead to the death of these species. Deforestation is a direct cause of extinction and loss of biodiversity. An estimated of 18 million acres of forests are lost each year. Overhunting, overfishing and overharvesting contribute greatly to the loss of biodiversity, killing of numerous species over past several hundred years. The introduction of nonnative species into an ecosystem can threaten endemic wildlife, affecting human health also. Pollution is the other important threat to biodiversity. Hence these threats need to be curbed by various practices like fighting climate change by reducing carbon footprints, adopting best practices and refuse to use timber and paper like supplies that contribute to deforestation. Recycling, conserving energy at home can also help in conserving biodiversity.

Keywords: Biodiversity, Threat, Climate, Extinctions, Species, Pollution, Deforestation.

ROLE OF SPOILAGE FUNGI IN SEED DETERIORATION

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A major problem of agricultural production is loss of grain during and after harvest. The current estimates of the cost of grain loss due to insect and microorganism damage of grain stored in developing countries each year ranged from \$500 million to \$1 billion. Moisture content of seed prior to storage is the most important factor for establishment, development, and growth of storage fungi during storage below which they fail to develop or may remain dormant with seeds without causing damage. Because it is not feasible to maintain all parts of large grain bulks below this critical moisture limit during prolonged storage time, an infection by seed-borne fungi is not rare in grain stored under humid temperate or hot climates, inducing irreversible qualitative losses. Additionally, some fungal species produce harmful mycotoxins. Seed and kernels were infested with six dominant fungi viz. *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Fusarium chlamydosporum* and *Penicillium glabrum* separately. The most harmful toxigenic species belong to the group of xerophilic species (genera *Aspergillus* and *Penicillium*). Deterioration of stored grain are mainly affected by moisture content, temperature (grain and air), relative humidity, storage conditions, fungal growth, and insect pests. Consequently, it is well-established that fungi destroy food and feed. However, the basic problem remains of implementing effective measures to reduce fungal losses. The prevention of myco-toxigenic fungi spoilage of stored grain can be managed by a preventive strategy. It is highly probable that invasion of the germ or embryo of seeds by storage fungi is a major cause of discoloration.

Keywords: Storage fungi, Moisture, Mycotoxins, Seed

MORPHOLOGICAL AND MOLECULAR SYSTEMATICS OF THREE SPECIES OF *BYCHOWSKYELLA* (MONOGENEA: DACTYLOGYRIDAE) IN SILURIFORM FISH FROM INDIA

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The siluriform fish generally known as catfishes comprise of more than 2,800 species with worldwide distribution (Mendoza-Palmero *et al.*, 2015). Catfishes are very much appreciated by fisherman, especially silurids and clarids, are used for local consumption. The phylogenetic relationships within dactylogyridae have been a matter of debate for several decades. Later, the status of all genera infecting siluriform fish was evaluated by Lim *et al.*, 2001 and raised Ancylo-discoidinae to the familial level. Here is a small effort to comprehend the phylogenetic relationships of *Bychowskyella* spp. with other dactylogyrids. Three species of genus *Bychowskyella* Akhmerov (1952) i.e., *B. fossilisi* Majumdar and Agarwal, 1989, *B. tchangi* Gusev, 1976 and *B. wallagonia* (Jain, 1959, a) Gusev, 1961 were found parasitize the gill filaments of siluriform fish in India. The re-description based on light microscopic examination of *B. fossilisi*, *B. tchangi* and *B. wallagonia* provides

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detailed taxonomic data for these species. We also amplified the 18S ribosomal RNA gene to evaluate the phylogenetic relationships of these three species. The comparative morphological and genetic profiles confirmed the validation and taxonomical relationships of the above mentioned species belonging to genus *Bychowskyella*.

Keywords: Monogenea, *Bychowskyella* spp., *Wallago attu*, Phylogeny, 18S rDNA, India

EFFECTS OF BIOFERTILIZER ON THE PERFORMANCE OF CABBAGE (*BRASSICA OLERACEA* VAR. *CAPITATA* L.) CV. GOLDEN GS 455

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Cabbage (*Brassica oleracea* var. *capitata* L.) is one of the most important cool season leafy vegetables in India, as well as in the world, belongs to the family Cruciferae. Cabbage is believed to have originated in Western Europe and it was the first Cole crop to be cultivated. Prior to cultivation and use as food, cabbage was mainly used for medicinal purposes (Silva, 1986). In addition to the fresh market, cabbage is now processed into Kraut, egg rolls and cole slaws and there is the potential for other specialty markets for the various types including red, savoy and mini cabbage. Cabbage contains a range of essential vitamins and minerals as well as small amount of protein. It is an excellent source of Vitamin C having 36.6 mg. In addition to containing some B vitamins, cabbage supplies minerals like Potassium 170 mg, Calcium 40 mg, Phosphorus 26 mg and Magnesium 12 mg per 100 gram to the diet (USDA Nutrient Database, 2016). In India it is grown in an area of 0.399 million ha that produced 9.049 million tonnes (Anon., 2016-17)). Its production technology have been carried out worldwide, but limited number of works has been done on different bio fertilizer spp. s of nutrients. Among the various factors involved in cabbage production, nutrient supply is an important for realizing higher cabbage yield. Fertility of a particular soil is determined by the presence of biofertilizer, therefore, bio fertilizer is needed to restore in soil either by supplying nutrient through bio fertilizer or through residue management. of bio fertilizer provided all the essential plant nutrients, but after application they require time to convert it from unavailable to available form. That's why the response of crops to bio fertilizer manures is initially low.

EFFECTS OF DIFFERENT INOCULUM DENSITIES OF *MELOIDOGYNE INCOGNITA* ON PLANT GROWTH, BIOCHEMICAL AND NUTRIENT PARAMETERS OF LENTIL (*LENS CULINARIS*)

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M. incognita is an important soil borne pathogen causing root-knot disease in lentil. An experiment was conducted to study the effects of different inoculum levels of *M. incognita* in lentil. The lentil seedlings were inoculated with 250, 500, 1000, 2000 and 4000 second stage juveniles (J2) of *M. incognita* per kg soil and their effects were observed on plant growth, number of pods, biochemical and nutrient parameters of lentil. The results revealed that the percentage reduction in all the parameters was directly proportional to the successive inoculum levels. A significant ($p=0.05$) reduction in plant growth parameters was observed at an above the inoculum level of 1000 J2 per kg soil, the reduction was maximum at the inoculum level of 4000 J2 per kg soil. Similar results were recorded in case of total chlorophyll and carotenoid content and nitrate reductase activity. Highest reduction in nitrogen and phosphorus content was observed at 4000 J2 per kg soil, with significant reductions taking place at and above 1000 J2 per kg soil. Nematode population was highest at 4000 J2 per kg soil however the reproduction factor was lowest at this inoculum level i.e. 3.92. Number of galls and egg masses were observed to be highest at 4000 J2 per kg soil.

Keywords: Nematode, inoculum, gall, lentil, pathogen

INTRODUCTION OF ELAPID REPTILES, AND THEIR CONSERVATION STATUS IN MIZORAM, NORTH EAST INDIA

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Reptiles are fascinating gift of nature which is paid least attention due to their associated biting behaviour. Reptilia is a group of animals, includes, crocodiles and alligators, turtles, lizards and snakes. Snakes are having serpentine body, covered with scales having no limbs, except some exceptions. There are several types of snakes in the world and in India which includes poisonous and non poisonous ones. Poisonous snakes' falls in a family called as Elapidae, which is characterised by the presence of poison gland with fangs, which is used to discharge the poison into the victim's body to paralyse. Poison in snake is a mixture of various types of proteins. Poisonous snake prefer mammalian diet specially rodents and mice, to produce sufficient amount of poison, which is not only a poison but an aid to digest their prey. This paper attempts to give an

introductory account of poisonous snakes (Reptilia : Elapidae) observed and their conservation status in Mizoram state of North East India.

BIOSENSORS: A RAPID TECHNIQUE FOR PATHOGEN DETECTION IN FOOD

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Biosensors are powerful alternative to conventional analytical techniques, harnessing the specificity and sensitivity of biological systems in small, low cost devices. A biosensor is described as a compact analytical device, incorporating a biological sensing element, either closely connected to, or integrated within a transducer system. The principle of detection is the specific binding of the analyte of interest to the complementary bio-recognition element immobilised on a suitable support medium. Depending on the method of signal transduction, biosensors can also be divided into different groups: electrochemical, optical, thermometric, piezoelectric or magnetic. Amperometric devices are the most commonly reported class of biosensors. Biosensors can be employed for food analysis, study of biomolecules and their interaction, medical diagnosis, environmental field monitoring, quality control, industrial process control, manufacturing of pharmaceuticals and replacement organs etc. The potential applications of biosensors in agriculture and food processing have been investigated by many researchers. Biosensors are fast compare to other analytical methods and they take less time. Pesticides and aflatoxin causes number of disease, the extent of presence of such disease causing can be estimated even if they are present in minute quantity. Biosensors are fast compare to other analytical methods and they take less time. Pesticides and aflatoxin causes number of disease, the extent of presence of such disease causing can be estimated even if they are present in minute quantity.

BIOLOGICAL SYNTHESIS OF PLANT DERIVED SILVER NANO-PARTICLES

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Among all the metal nanoparticles, silver nanoparticles have received attention due to their physical, chemical and biological properties due to their catalytic activity and bactericidal effects and hence finding applications in nanobiotechnology research. Also the use of eco-friendly reducing and capping agents in biological synthesis route makes the synthesized silver nanoparticles less toxic, biocompatible and useful for biomedical applications. Plant extracts have been demonstrated to be promising reducing and capping agents for biosynthesis of variety of metal nanoparticles including silver nanoparticles. With this view silver nano-particles using plants *Rosa indica* and *Camellia sinensis* were synthesized. The silver nano-particles using plant leaves extract of *Camellia sinensis* exhibited the absorbance peak at 438nm while silver nanoparticles using plant extract of *Rosa indica* showed absorption maxima at 396nm. The FTIR studies of plant derived silver nano-particles confirmed that the bioreduction of the silver ions to silver nano-particles is due to the reduction by capping material of the plant extract as revealed by the various functional groups observed in the FT-IR analysis. The synthesized silver nano-particles exhibit high stability at temperature 80-100°C. These plant extracts therefore can be used for the simple, rapid, cost effective and eco-friendly synthesis of silver nanoparticles and can be used potentially in industries for various commercial applications.

Keywords: Silver nanoparticles, Green synthesis, Nanofertilizer

MOLECULAR EVOLUTIONARY GENETICS ANALYSIS

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Molecular Evolutionary Genetics Analysis (MEGA) software, which contains many sophisticated methods and tools for phylogenomics and phylomedicine. In this major upgrade, MEGA has been optimized for use on 64-bit computing systems for analyzing larger datasets. Researchers can now explore and analyze tens of thousands of sequences in MEGA. The new version also provides an advanced wizard for building timetrees and includes a new functionality to automatically predict gene duplication events in gene family trees. The 64-bit MEGA is made available in two interfaces: graphical and command line. The graphical user interface (GUI) is a native Microsoft Windows application that can also be used on Mac OS X. The

command line MEGA is available as native applications for Windows, Linux, and Mac OS X. They are intended for use in high-throughput and scripted analysis. Both versions are available from free of charge.

Key word: gene families, time tree, software, evolution.

GENE EXPRESSION PROFILES- A MOLECULAR TOOL TO STUDY TOLERANCE ABILITY OF CROPS

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According to the agricultural reports it had seen that the crop's yield is mostly affected due to the biotic and abiotic stresses. It is especially an important factor in countries where crop management options are limited. These biotic and abiotic constraints may be exempted if the crop species having tolerance ability to cope these environmental stresses. However improvement of crop species to biotic and abiotic stress is a complex task but the development of new cultivars with better yield which escape itself to adverse environmental conditions is the fundamental approach to fulfill ever increasing future demand for food. Development of physiology and genomics in last few years led to a deeper understanding of how the plant responds against the environmental stresses and the mechanisms responsible for tolerance. In this regard, we require the cultivars which have the tolerance against particular stress in that region. The tolerance mechanisms may be assessed using molecular tools like gene expression profiles and some important experimental variables such as developmental stage, stress intensity, duration and biochemical attributes. These molecular strategies and biochemical attributes variation suggests that how different environmental stress may interact with the plants. The differential expression pattern and variations performed in biochemical assays must be considered as the practical applications in order to examine the tolerance to stress in crop cultivars. Therefore, the development of new techniques in gene expression analysis with lower costs may become a new revolution.

Key words: Stress; Crop cultivar; Gene expression.

PLANT CELL WALL-DEGRADING ENZYMES AND THEIR SECRETION IN PLANT-PATHOGENIC FUNGI

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Enzymes are generally large protein molecules that catalyze organic reactions in living cells. Each enzyme, being a protein, is coded by a specific gene. Plant cell-wall is a heterogenous structure consisting of cellulose, hemicelluloses, pectin, lignin and structural proteins. It is an important barrier that plant uses to limit the attack of phytopathogenic fungi. In order to overcome the barrier of plant cell wall, phytopathogenic fungi produce enzymes like cellulase, hemicellulase, pectinase, ligninase etc. to depolymerize the main structural components of the plant cell-wall. These enzymes are called as Cell Wall-Degrading Enzymes (CWDEs). These enzymes are particularly important for many plant-pathogenic fungi as they actively kill and degrade plant tissue to utilize the liberated monosaccharides and oligosaccharides for growth and reproduction. Secretion of enzymes is a vital process in fungi to transport proteins across the hyphal cell wall. Enzymes for chitin and 1, 3- β -glucan synthesis are thought to be active in the apical plasma membrane but other cell wall components including proteins are manufactured in the cytoplasm and are inserted into the wall by vesicles that fuse with the apical plasma membrane. Vesicles fusing with the plasma membrane deposit proteins on the outer surface and these will become included within the fabric of the wall. Fungi secrete enzymes from the surface of the plasma membrane into the periplasmic space, where they may be incorporated into the cell-wall or in many instances, may be secreted across the cell-wall into the external medium.

Key words: plant cell wall, pathogens, enzymes

USE AND FUTURE OF MICROBIAL INSECTICIDES IN RURAL PEST CONTROL

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Microbial insecticides are products based on living micro-organisms which are pathogenic to insects. However, in the past research has concentrated on pests of agriculture and, to a lesser extent, on medical and veterinary arthropods. Pests of the rural environment have been less studied but cockroaches, flies, termites and stored product insects have received recent attention. Selection of a micro-organism for development as a bioinsecticide is based on the following criteria, which are interlinked. A wide host range increases the market potential, but raises problems with effects on non-target organisms: however, these may be less critical in the rural environment than in agriculture. Some agents (viruses and protozoa, some bacteria) can only be produced *in vivo* and this is very expensive, although cell culture systems are under development and could reduce costs. Others (some bacteria: fungi and nematodes) can be produced using conventional fermentation

technology. Biological pesticides will usually compete with other pest control methods, especially chemical pesticides and are likely to have the greatest chance of success where limitations on the latter are most severe. for example: where conventional chemicals are withdrawn for safety reasons (eg organochlorines, several organophosphates, methyl bromide); w. These constraints on the implementation of microbial pesticides will be reviewed and developments in applications for rural pest control will be emphasised.

APPLE PULP SUPPLEMENTATION OFFERS PROTECTION AGAINST N'-NITROSODIETHYLAMINE-INDUCED LIVER DAMAGE IN WISTAR RATS

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With the growing consumer demand of friendly nutritional supplements, the modern researches are tilted to find out alternatives with least side-effects against the risk posed by synthetic medication and adulterated food. In this context, the present study was undertaken to demonstrate protective effect of Cloudy Apple Juice (CAJ) in model disease, hepatic fibrosis. Hepatic fibrosis in rats was induced by N'-Nitrosodiethylamine (NDEA) administered in 100 mg kg⁻¹ b.wt, once intraperitoneally. CAJ was given orally after 2 hrs latency period in 10ml kg⁻¹ b.wt, daily for 14 days to rats. HPLC chromatogram and antioxidant assay indicated the presence of rich polyphenolic contents in CAJ. Hepato-somatic index (HSI), Liver function indices (LFT), biochemical antioxidant assays and histopathology were also carried out in control, fibrotic and CAJ-supplemented animals. LFT showed deranged values; raised lipid peroxides, Hydroxyproline, Collagen and membrane-bound ATPases levels due to NDEA-intoxication. Further, declined levels of SOD, GST and Catalase were observed in NDEA-treated liver specimen indicating disturbed antioxidant system. Alteration in the lobular anatomy in experimental animals was identified by the histopathological assessment *via* H&E, MT, Picro-sirus stainings of liver biopsies. The changes at cellular levels were examined by SEM and TEM analysis of liver specimen. This study demonstrates that CAJ refurbishes hepatic architecture significantly within fourteen days of its treatment and restores the antioxidant status. Therefore, daily intake of CAJ may be recommended to combat chemical-induced liver injury.

INFLUENCE OF NITROGEN FIXING AND PHOSPHORUS SOLUBILIZING BACTERIA ON THE PERFORMANCE OF KULTHI (*DOLICHOS BIFLORUS*)

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The present investigation was carried out in green house of Department of Agricultural Microbiology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during the year 2015-16. It comprised of Sand culture experiment especially to observe nodulation behaviour at 45 DAS and Pot experiment for evaluation of different combinations of native *Rhizobium* and PSB isolates especially with reference to quality and quantity of grain yield on maturity of the crop. Plants were allowed to grow up to 45 days under sand culture, data of plant biomass revealed that the highest dry shoot weight was (0.156 gm/plant) associated with combination of Rhz-10+PSB-142 followed by isolate Rhz-10+PSB-184 (0.137 gm/plant). Similarly, highest dry wt. of nodules was observed 1.70 mg/plant due to combinations of Rhz-10+PSB-142 followed by isolate Rhz-10+PSB-118 (1.52 mg/plant), while the highest number of nodules (6.33 per plant) associated with combination of Rhz-10+PSB-142 followed by Rhz- 10+PSB-118 (5.66 per plant). The shoot N accumulation study of the same sand culture experiment indicated that highest shoot N-uptake associated with combination of Rhz- 10+PSB-142 (4.57 mg/plant) followed by Rhz-10+PSB-184 (3.94 mg/ plant). Further, findings of pot experiment also revealed that highest grain yield of kulthi was obtained (2.120 gm/plant) from plants raised from seeds inoculated with combination of Rhz- 10+PSB-142 followed by Rhz-10+PSB-118 (2.108 gm/plant). Similarly, highest grain N and P-uptake was associated with combination of Rhz-10+PSB-142 (101.97 mg N /plant, 28.12 mg P /plant) followed by Rhz-10+PSB-118 (99.07 mg N/plant, 21.92 mg P/plant), respectively. It was also observed that the highest excess amount of accumulated N and P over uninoculated control was 64.55 and 23.45 mg/plant, respectively due to inoculation of promising native isolate combination i.e. Rhz-10+PSB-142. Soil enzymes (dehydrogenase and acid phosphatase) and microbial population (*Rhizobium* and PSB) dynamics study also supported the effectiveness and superiority of these combinations. Hence, is concluded that combination of Rhz-10+PSB-142 is the most potent N₂ fixer and P solubilizer for kulthi cultivation in acidic soils of Chhattisgarh.

IMPORTANCE OF DNA BARCODING AND ITS APPLICATION IN AGRICULTURE CROPS AND PESTS**¹DHARMENDRA SINGH LAGORIYA, ²AWANEESH KUMAR, ¹NABARUN ROY, ³UTPAL ROY,**¹*Dept. of Agricultural Biotechnology, Assam Agricultural University, Jorhat*²*Dept. of Entomology, Assam Agricultural University, Jorhat*³*Dept. of Plant Breeding and Genetics, Assam Agricultural University, Jorhat*

Agriculture is one of the key sectors of the global economy having a wide source of food, fibre and fuel. Diversity of crop plant, beneficial insect and micro-organism make help sustainable agriculture development, but the un-favourability of environment, change in climate and global warming affect the biodiversity of agricultural ecological system. In such a condition identification and conservation important crop plant, insect and micro-organism is necessary, in the same time identification of harmful pest and micro-organism required for the efficient, fast management. Therefore, for need a specific system, that can be used for identification of organisms and differentiation of very closely related species in its any form of life stage from eggs and seeds to till it last stage of life. Molecular techniques like DNA barcoding, genome sequencing and identification of conserved genomic sequence used in the classical taxonomical system for the identification of the huge population diversity in the agriculture sector. Use of barcoding in the agriculture system will be helpful in the authentication of different high value crop and crop pest. The data base developed after barcoding help in easy identification of crop and pest species this make the efficient management of intraspecific and congeneric species across the world. DNA barcoding uses short gene sequences which are well classified portion of the genome. In this technique, complete information of the crop and pest species can be obtained from a single specimen irrespective to morphological or life stage characters. This makes the fast and automatable system of species identification in the lab as well at the field label.

Keyword: - DNA barcoding, identification, Species, and Taxonomy.

STUDIES OF FISH BIODIVERSITY AND FISHING GEARS NETS AND BOATS OF SARYU RIVER FROM KAISERGANJ DISTRICT BAHRAICH**DHARMRAJ VERMA* TABREZ AHMED ** VIVEK KUMAR DIXIT*** AND U.B. SINGH*****Department of Zoology, P B PG College Pratapgarh,****PG Department of Zoology BSNV PG College, Lucknow, U.P*****Department of Zoology, University of Lucknow, Lucknow UP.*

Aquaculture is the cultivation of aquatic organisms such as fishes ,crustaceans ,molluscs and aquatic plants under controlled conditions .Saryu river is of Ancient significance mention is the vedas. The present study was evaluated has shown that studies Saryu river supported 42 fish species belonging 9 orders, 13 families and 32 genera. The order *Cypriniformes* was dominant with 7 family followed by *Siluriformes* and *Perciformes*. The prevalence rate is 36.92% for family cyprinidae. Seasonal water quality such as pH, Temperature ,DO, Hardness ,Chloride and Phosphates has been recorded and found suitable for fish culture .The fishes were catches by local fishermen to the help of fishing ,gears, nets and boats in different stations of the of this river. Dongri boats are used by local fisherman and also local traditional and advance fishing gears, nets used by fishermen through out the year .There are 17 different types of nets and 6 different types of gear and different types of boats were recorded during the study period. The present study shows the recent data of different fishes along with fishing gears, nets and boats for fishing in the river and it's impact on the saryu river fishing.

Key words: Saryu River, fish Biodiversity, fishing, gears nets and boat, *Cypriniformes*, *Siluriformes*, *Perciformes* and *Beloniformes*.

LONG-TERM CONSERVATION TILLAGE EFFECT ON SOIL ORGANIC CARBON AND AVAILABLE PHOSPHOROUS CONTENT IN MUNG BEAN AND SORGHUM- WHEAT CROPPING SYSTEM**DHINU YADAV* AND SNEH GOYAL***Department of Microbiology, CCS Haryana Agricultural University, Hisar-125004*

Long-term field experiments can provide relevant information regarding soil organic carbon sequestration under different soil tillage systems. Especially, conventional tillage has been proved to be a practice that highly contributes to improve soil quality. The present study examined profile distribution of soil organic carbon (SOC) and available phosphorous under long-term (10 years) imposition of different tillage systems, namely conventional tillage (CT) and no tillage (NT). Soil organic carbon (SOC) significantly increased from 0.43 to 0.52% and from 0.33 to 0.38%, respectively in sorghum and mung bean surface soil samples while in sub-surface soil samples, SOC was increased from 0.45 to 0.48% and from 0.22 to 0.36%, respectively at two sampling sites. The highest available phosphorus was recorded in surface soil samples under no tillage as compare to conventional tillage system. The study concluded that no tillage with SOC was found to be suitable for soil health under the mung bean- wheat and sorghum- wheat cropping system.

Keywords: conventional tillage, no tillage, available phosphorus and soil organic carbon.

TO STUDY THE MEDICINAL QUALITIES OF *STEVIA REBAUDIANA*

DIKSHA MUWAL

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Stevia rebaudiana Bertoni is an herb originated in South America that has found a great potential of use, primarily in the production of natural Sweetener with emphasized sweetness. The sweetening compounds, found milli in the leaves of plants, are steviol glycosides, with stevioside being the most abundant, followed by rebaudioside. It has a sweetening comparable to that of artificial sweeteners presently marketed and consumed in several food and beverages. *Stevia* leaves contain diterpene glycosides that are low calorie sweeteners, with stevioside being there most abundant. *Stevia* has been consumed for centuries as a natural low calorie sweetener without any adverse effects on human health which is contrary to artificial sweeteners, which are determined by low caloric characteristics and a large percentage of carcinogenicity. It offers advantages over other artificial sweeteners as an ingredient for the food industry, thereby making *stevia* a more suitable substitute for saccharose in different drinks, beverages and bakery products. It can be concluded by saying that *S. rebaudiana* has a great potential a new agricultural crop since consume demand for herbal foods is increasing. The different drying method did not have an effect on the primary nutrients and fibre composition of *Stevia rebaudiana* leaf powder. *Stevia* is found susceptible to water stress results in severe cell damages and growth reduction. The antioxidative capacity is also suppressed under severe stress. *Stevia* plant will alleviate the future threats for paper growth of *Stevia* plants in water deficit areas.

Keywords :- *Stevia*, glycosides, stevioside, carcinogenecity

TRANSGENIC RICE-INTERACTION BETWEEN PHYSIOLOGICAL PROCESSES AND GENE ACTION

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Rice is one of the most important crops as the staple food for more than half of the world's population. Rice improvement has achieved remarkable success in the past half-century, with the yield doubled in most parts of the world and even tripled in certain regions, which has contributed greatly to food security globally. Rapid population growth and economic development pose a constantly increased food requirement. However, rice yield has been hovering in the past decade, which is mainly caused by the absence of novel breeding technologies, reduction of genetic diversity of rice cultivars, and serious yield loss due to increasingly severe occurrences of insects, diseases, and abiotic stresses. A number of attempts such as mutation breeding, conventional plant breeding, tissue culture, molecular breeding, genetic engineering etc. have been made for genetic improvement of rice. Among the various methods of genetic improvement, transgenic approach seems to be the easiest one. Scientists from different parts of the world have developed transgenic rice for insect and disease resistance, drought-tolerance, nutrient-use efficiency and finally quality and yield improvement. For instance drought stress is one of the serious environmental threats and the main constraints to rice productivity. It affects rice at morphological, physiological, biochemical and molecular levels such as delayed flowering, reduced dry matter accumulation and decreased photosynthetic capacity as a result of stomatal closure, metabolic limitation and oxidative stress. Some of the physiological parameters that are affected during drought stress are root system, root/shoot ratio, stomatal frequency, leaf weight, leaf water potential, tissue water storage, water permeability, thickness of cuticle, leaf chlorophyll content and finally the yield. To withstand drought stress, plants needs to be manipulated at the genetic level for improved metabolism processes like water absorption, stomatal conductance, transpiration, photosynthesis and finally seed development.

Keywords: Breeding, Genetic improvement, Drought stress, Stomata

ARTIFICIAL SWEETENERS PREVENT THE ACCUMULATION OF ADVANCED GLYCATION END PRODUCTS

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Diabetes has become a major health issue for the world population in general and especially for India as it has topped the list with highest number of people with diabetes mellitus. Persistent hyperglycemia leads to the accumulation of deleterious compounds which are commonly known as advanced glycation end products. They are produced in the body as a result of an interaction between sugars and proteins. Reducing sugar intake is one of the major preventive mechanisms of diabetes. As a result the consumption of sweeteners has increased several folds. Sweeteners are also being preferred in the food and beverages industry because of their sweetness and cost. This study was designed to study the involvement of artificial sweeteners (Acesulfame potassium, aspartame, sucralose and neotame) in the process of glycation. Several established methods like fructosamine assay, determination of carbonyl content, protein aggregation, and measurement of fluorescence

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were used to measure the content of early and advanced glycation products in the presence and absence of artificial sweeteners in an *in vitro* glycation system consisting of BSA and glucose. The results indicate that most of the sweeteners have antiglycating role. However the most significant decrease in the glycation products content was observed in the presence of Acesulfame potassium. Some of these sweeteners could also reduce the extent of aggregation of proteins. This study is significant in understanding the probable role of artificial sweeteners in the process of glycation and the subsequent effect on macromolecular alteration.

Keywords: Advanced Glycation end products (AGEs), Amadori products, Artificial sweeteners, Browning, Carbonyl content, Protein aggregation

CONSERVATION OF ENDANGERED AND VULNERABLE WILDLIFE IN NORTH EASTERN REGION OF INDIA

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North eastern region of India is a hotspot for wildlife diversity. India is one of the 17 mega diverse countries of the world. It is estimated that the North Eastern part of India houses 250 species of mammals, 900 species of avian, 315 floral species among others. But these are under 'Critically Endangered', 'Endangered' and 'Vulnerable' categories (IUCN, 2002). Of the 11 'Critically Endangered' species of mammals listed for India, 7 have been recorded in this region. Of the 57 'Vulnerable' species of birds in India, 42 have been recorded in the Northeast. Among reptiles, 10 species in India are included in the 'Vulnerable' category. Overall, 54% of threatened mammals, 68% of birds and 63% of reptiles in the country have been recorded in the Northeast region of India. North eastern India being home to around 145 tribal communities whose Social-economy is directly related with forest and its resources. They are mostly relied on shifting cultivation and hunting. Habitat loss, fragmentation, poaching are major causes for decreasing of forest, wetland and grassland and biodiversity. For decreasing the deforestation and providing the natural habitation to the endangered species of South- East Asia, some initiative were taken 'Aichi's Target Plan' Nagoya, Japan (2010) and Millennium Development Goal, United Nation (2015) was initiated. In India, Government did take effective initiatives to conserve wildlife in the country, amongst its most important initiatives is the Wildlife Protection Act (1972) which prohibits trade of rare and endangered species. Besides it, Government of India planned different schemes like 'Project Tiger' (1972), 'Project Elephant' (1992) are important. North Eastern states government has also initiated some projects and schemes like Arunachal Pradesh launches programme on conservation of Eastern Hoolock Gibbon, Tripura JICA Project (2015). If threat of deforestation and illegal activities remain same the rare wildlife whose are restricted within a particular periphery will exhaust within a short time. It will not only decrease their population but also hamper our ecosystem.

BIOCHEMICAL PARAMETERS ASSESSMENT DURING DROUGHT STRESS IN *ECHINOCHLOA FRUMENTACEA* GROWN IN KUMAUN REGION OF HIMALAYA

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The effect of drought stress in barnyard millets (*Echinochloa frumentacea*) varieties viz VL29, VL207, VL172 and VL181 was studied under in vitro environment in presence of PEG 6000 in liquid MS medium with different osmotic potential 5% w/v (-0.5MPa), 10% w/v (-0.15MPa), 15% w/v (-0.30MPa) and 20% w/v (-0.49MPa). Biochemical and enzymatic parameters were assessed in 12 days old seedling imposed to various concentration of PEG and evaluated every 24 hrs up to 7 days. Parameters of oxidative stress malondialdehyde (MDA), and hydrogen peroxide (H₂O₂) concentration, activities of stress responsive enzymes ascorbate peroxidase (APX), guaiacol peroxidase (GPX), catalase (CAT) and superoxide dismutase (SOD) and antioxidant molecules ascorbic acid (ASC) and proline were determined. Maximum response to drought stress was alleviated at 20% w/v (-0.49MPa) PEG as compared to that of control. However variety VL172 responded better among the other three varieties. The relative drought tolerant ability associated with variety VL172 due to high antioxidant enzyme activity, high proline and ascorbic acid content with low MDA content and H₂O₂ content. While variety VL29 was found to susceptible to drought stress. Due to high content of MDA and H₂O₂ and lower antioxidant activities was found in variety VL29. Data of this study clearly suggest the mechanism to limit the oxidative damaged which is important for drought tolerance for variety VL172 among the four varieties of barnyard millet.

BIOREMEDIATION: A WASTE MANAGEMENT TECHNIQUE

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Bioremediation is a branch of Biotechnology which deals with the use of living organisms such as microbes and bacteria to remove contaminants, pollutants and toxins from soil and water. It can be used to clean the environment and various problems like oil spilling or contaminated ground water. These microbes consume the contaminants converting them into small amounts of water and harmless gases like carbon dioxide. Effective bioremediation needs a combination of right temperature, nutrients and food. It can either be done in-situ, at the site of contamination itself or ex-situ, at a location away from the site. Bioremediation may not require as much equipments, labour or energy that is why it is cheaper than other method and eco-friendly as well.

Keywords: Bioremediation, Contaminants, Bacteria, Pollutants, Microbes, Eco-friendly

RESTORATION OF FLORAL DIVERSITY THROUGH PLANTATIONS ON ABANDONED AGRICULTURAL LAND IN ROHILKHAND REGION OF UTTAR PRADESH, INDIA

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Plantations have been claimed to be "monocultures", or "biological deserts". We investigated these claims in the context of a long-term study on plant diversity within plantations with different indigenous tree species, spacings, and soil types that were compared with 410 native stands of Rohilkhand region of Uttar Pradesh. Soil type had no influence on plantation species diversity or abundance, and wider spacing resulted in higher richness, lower woody plant abundance, slightly higher cover of herbaceous plants, and large increases in cryptogam cover. We also found a canopy species $\times$ spacing interaction effect, where the impact of increased spacing on understory vegetation was more pronounced in spruce than in pine plantations. The dynamic community interactions among species of feathermoss appear to be in response to the physical impediment from varying amounts of needle rain from the different tree species. High light interception and needle fall were negatively correlated with understory plant diversity, as was lack of structural diversity. This study indicates that through afforestation efforts agricultural lands can be restored to productive forests that can harbour nearly one-half of the plant species found in equivalent natural forests within the same geographic region in as little as 10 years. We recommend applying afforestation using common conifer species such as *Pinus*, *Araucaria*, *Juniperus*, *Thuja* and *Cupressus* as a first step towards rehabilitating conifer forests that have been converted to agriculture and subsequently abandoned.

Keywords: *Pinus*, *Araucaria*, *Juniperus*, *Thuja*, *Cupressus*, Rohilkhand region.

BIOTIC AND ABIOTIC STRESS MANAGEMENT

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Biotic stress factors have a major impact on plants and cause extensive losses to crop production. Plants possess a range of defenses that can be actively expressed in response to pathogens. The timely activation of these defense responses is important and determines whether plant is able to cope or succumb to the challenge of a pathogen. Plant defense mechanisms which are involved in biotic stress management are classified as innate and induced plant response. Systemic acquired resistance (SAR) and induced systemic resistance (ISR) are two forms of induced resistance; in both types of resistance, prior infection or treatment preconditions plant defenses leading to resistance (or tolerance) against further challenge by a pathogen. Identification of a number of biological and chemical elicitors has to a great extent helped in unraveling the understanding of the biochemical and physiological basis of ISR and SAR. Combining SAR and ISR can provide protection against a number of pathogens including the pathogens that resist through both pathways. The use of pesticides for the control of crop diseases and pests is however inefficient and not eco-friendly. Genetic engineering has enabled the cloning of genes and their insertion into the crop plants to make them resistant to different biotic stresses.

STUDY ON GENOTOXIC EFFECTS OF CITRIC ACID AND BAKING POWDER USING SORGHUM ROOT TIPS AS A TEST SYSTEM

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Food additives are the substances that are intentionally added to modify visual appearance, taste, texture, processing or the storage life of food. There has been significant controversy associated with the risks and benefits of food additives. The effect of different concentrations of food additives like baking powder, citric acid, on the chromosomes of *Sorghum* is investigated.

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Four concentrations of these food additives (0.01%, 0.05%, 0.1% and .50%) are used for 1.5, 2, 2.5 and 3 hours, respectively. A cytological study was done by mitotic index with an increase in concentration of the food preservatives when compared with the control. All these concentrations of food additives showed mitoinhibitory effect in root tips of *Sorghum* and increase in chromosomal aberrations. Various types of metaphasic and anaphasic aberrations were scored and it is found that metaphasic aberrations are more prominent than the anaphasic aberrations. Most frequent cytological abnormalities observed were bridges, multinucleate, stickiness, polyploidy, laggards. The total percentages of abnormalities were also increased with increasing concentration and time duration. The result of present study clearly establishes the genotoxic behavior of food additives used.

PROSPECTIVE ROLE OF *SPIRULINA PLATENSIS* IN AQUACULTURE**DR.GARIMA PUNDIR***Department of Zoology, R.G.P.G. College, Meerut*

Spirulina platensis has gained considerable attention due to its dietary composition used in many countries of Asia as a protein supplement and popular health food. It holds important relevance as Aquafeed and as a complementary dietary ingredient of feed for fish and shrimp due its protein and vitamin source. *Spirulina* is blue green algae which have drawn world wide attention due to its nutritional profile rich in 70% protein, minerals, vitamins, aminoacids and phycocyanin. The prospects of *Spirulina* are very bright in the feed applications in aquaculture practices. It is widely used in aquaculture and can promote the growth of cultured species, improve health provide disease resistance, and increase the survival rate of larvae in aquaculture. The aquafeed supplemented with *Spirulina* is potentiated with many ingredients in highly balanced nutritious form which are used for enhancing the digestive mechanisms in animals used in aquaculture. *Spirulina platensis* can be used as a partial supplement or complete replacement for protein in aquafeed. As it promotes the growth, health, survival, production disease resistance and immunity in aquaculture. As natural source feed, it plays an important role in aquaculture, especially in the aquatic farming the results are quite wonderful. *Spirulina* is a cheaper feed ingredient than others of animal origin. Many countries world wide are using *Spirulina* as a partial substitute of imported feed to promote the growth, immunity and viability in aquafeeds. It grows in water and can be harvested and processed easily and has very high macro and micro-nutrient contents. Many countries like China and Japan is using this microalgae as a partial substitute of imported forage to promote the growth, immunity and viability of shrimp.

Key words: *Spirulina*, aquaculture, cyanobacteria.

A BIOLOGICAL AND ANALYTICAL OVERVIEW ON CACO-2 CELLULAR SYSTEM**GITANJALI^{1*} AND VISHAKHA SHARMA²**

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The Caco-2 cells isolated from human colorectal adenocarcinoma are widely used over the last twenty years as to screen for absorption rate of new compounds in the initial stage of drug discovery. This cell line in culture forms monolayers with an enterocyte-like phenotype and exhibits properties associated with the physical and metabolic barrier of the intestinal epithelium. During growth, Caco-2 cells go through processes of proliferation, confluency, and differentiation. They are valuable in vitro tools for studies related to intestinal cell function and differentiation. These cells can be cultured either on the base of a culture dish to measure the uptake of nutrients into the cells or on a permeable membrane in a trans-well culture plate to measure uptake by the cells and transport through the cell layer. These systems were established as an alternative to human and animal studies. This cell model has been used in a wide variety of nutritional studies, particularly in the study of mechanisms and regulation of iron absorption and iron bioavailability studies. The application of a Caco-2 cell model appears to be promising as a physiological means of measuring mucosal cell iron uptake. In vitro methods for assessing bioavailability constitute good alternatives to in vivo procedures and are generally based, in a first step, on the simulation of gastrointestinal digestion followed by the determination of micronutrients and its bioaccessibility.

It was demonstrated that the nutrients bioavailability data obtained from using caco-2 cell line models were shown to be reproducible and comparable with those of in vivo conditions for glucose, iron, phosphorus, zinc and some drugs. All in all, it seems that these models are valuable for studying the bioavailability of nutrients and also drugs. Since the use of Caco-2 cells has grown exponentially in recent years, it is particularly important to highlight these methodological aspects in order to promote the standardization and optimization of this intestinal model.

SANDALWOOD: THREATS AND CONSERVATION STRATEGIES

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Sandalwood (*Santalum album* L.) is a valuable tree associated with Indian culture. It is the second most expensive wood in the world. The heartwood of the tree is treasured for its aroma and is one of the finest natural materials for carving. Sandalwood oil is used in perfumes, cosmetics, aromatherapy and pharmaceuticals. The monopoly of sandalwood trade by the Governments of Karnataka, Tamil Nadu and Kerala and its consequences have resulted in severe exploitation and pushing Sandalwood into the vulnerable category of the IUCN Red List. Extensive research has shown that sandalwood exhibits considerable genetic diversity for different traits. However, information pertaining to heartwood and oil content is meagre mainly because of non-availability of sandalwood plantations. Carrying out further research on these two important traits is difficult as natural populations have dwindled rapidly. We strongly urge that it is essential to encourage the establishment of community/corporate sandalwood plantations in different parts of India with appropriate incentives and adequate protective measures. These plantations can form the base population sources to regain the leadership of India in the sandalwood industry for perfumery and the precious art of carving. The sandalwood resource in India is currently threatened by four factors: fire, browsing by livestock, spike (little leaf) disease, and smuggling.

Keywords: Sandalwood, importance, uses, IUCN and conservation.

BIOTECHNOLOGY: A REVOLUTION IN ORNAMENTAL CROPS IMPROVEMENT

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The horticultural industry has been revolutionized by contribution of ornamental plants. Nowadays, diverse ornamental plants are being widely used in home gardening, professional landscaping and cut flowers as well. Due to changing interest of consumers, ornamental plant industry requires new plant varieties with elite traits such as improved morphological attributes, floral color, pigments, stress tolerance, and disease resistance. Although we witnessed extensive employment of classical breeding strategies for developing new plant lines yet limitations and drawbacks are also evident i.e., the degree of heterozygosity. Biotechnological approach together with classical breeding methods has been used to modify floral color, appearance as well as for increasing disease resistance. Transgenic strategies possess immense potential to produce novel flower phenotypes that are not found in nature. Adoption of Genetic engineering has supported the idea of floral trait modification. Ornamental plant attributes like floral color, fragrance, disease resistance, and vase life can be improved by means of genetic manipulation. Therefore, we witness transgenic plant varieties of high aesthetic and commercial value. In spite of the great significance, a small number of genetically engineered varieties of ornamental plants have been developed. Today, novel flower colors production is regarded as the chief commercial benefit obtained from transgenic plants. Other than achievements such as novel architecture, modified flower color, etc., very few reports are available regarding the successful transformation of other valuable horticultural characteristics. There lies vast scope of improvement of floral traits in ornamental crops for successful implementation in landscaping.

Keywords: biotechnology, flower characteristics, horticulture, transgenic plants

BIOSYNTHESIS OF NANOPARTICLES AND ITS SCOPE IN PLANT PATHOLOGY

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Nanotechnology is an emerging and fast-growing branch of advanced science which has potential to revolutionize many disciplines of science, technology, medicine including agriculture. Conversion of macro materials to Nano sized particles of size ranging from 1-100nm gives rise to the characteristics that are new and different from macro materials. As the sizes of nanoparticles are smaller than bacteria and even to many of the plant viruses, they are known for their quicker, deeper penetration and accurate hitting of target sites of plant pathogens than that of chemical pesticides, which are comparatively less efficient, even when applied in greater amounts in plant disease management. Nanoparticles can be produced by different physical, chemical and biological methods. The property of the nanoparticles and efficacy of synthesis vary with procedure of synthesis. Although chemical methods proved to be highly efficient than other methods, involvement of toxic chemicals and high energy requirements of production make it difficult for them to be widely implemented. So, an alternative and safe way of synthesizing nanoparticles is by biological methods which include microbial synthesis using microorganisms like bacteria, fungi and green synthesis by various Plant extracts. In microbial synthesis of nanoparticles, different bacteria like *Bacillus licheniformis*, *Pseudomonas* spp., *E.coli*, *Stenotrophomonas* spp., *Lactobacillus* spp., *Micrococcus* spp., *Rhodospirillum* spp. etc and fungi like *Aspergillus* spp., *Fusarium* spp., *Trichothecium* spp., *Trichoderma* spp., *Penicillium* spp., *Cladosporium* spp. etc have already been reported for the synthesis of nanoparticles by the reduction of macro materials. In green synthesis,

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extracts of various plants like *Ocimum* spp., *Syzygium* spp., *Citrus* spp., *Cassia* spp., *Artemisia* spp. etc were known for the synthesis of nanoparticles of different elements like silver, copper, gold, sulphur, iron etc. Nanoparticles play a crucial role in the management of plant diseases. Different metallic and non-metallic nanoparticles have been reported for their effective inhibition of various Phyto-pathogens like *Uromyces* spp., *Botrytis* spp., *Penicillium expansum*, *Alternaria* spp., *Rhizoctonia* spp., *Sclerotinia* spp., *Macrophomina* spp., *Curvularia* spp., *Pythium* spp. etc. They are also known to act as bio-sensors for locating the exact position of pathogens in different plant parts. Hence, a great scope exists in future for the exploitation of bio-nanotechnology which is eco-friendly and effective in the plant disease management.

Keywords: Nanoparticles, Microbial synthesis, Green synthesis, Eco-friendly, Plant disease management

BEHAVIOURAL MANAGEMENT OF INSECT PEST IN IPM

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Most synthetic insecticides are toxic to all animals including human beings. Although many insecticides can be used safely, a few are persistent in the environment and a small number have mutagenic, carcinogenic and teratogenic effects on human beings and domestic animals. The possibilities of using strategies to manipulate insect behavior in agricultural systems have increased due to strict regulations imposed on the use of insecticides worldwide. Here we discuss the potential of semiochemicals, as tools to manipulate insect behaviors in (IPM) programs. Sex pheromones are widely used in agriculture for monitoring abundance and distribution of insect pest populations and predicting timing of insecticide applications. They have also been used, to a lesser extent, in insect pest control. One of the most promising concepts is the deployment of synthetic sex pheromones into a crop to disrupt insect mating. In addition to mating disruption, sex pheromones can be employed in mass trapping and attract and kill approaches for pest control. An area of increased interest among entomologists and chemical ecologists is the use of host-plant volatiles to manipulate insect behavior. Host plant volatiles can be a source of attractants and repellents, and can be implemented into monitoring and pest management practices. These volatiles can be used alone or in combination with other stimuli in control strategies such as mass trapping, attract and kill, push-pull, and disruption of host finding.

Key words: Behavioural strategy, IPM, pheromone, plant volatile.

BIOACTIVE COMPOUNDS AND MEDICINAL PROPERTIES OF POTENTIAL MEDICINAL HERB *TRILLIUM GOVIANIUM*

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Trillium govanianum (Nag chhatri) is one of the important medicinal herb of Northwestern Himalayas which is a high value medicinal herb belonging to the family Melanthiaceae locally and is mainly distributed from Pakistan to Bhutan between the altitudinal ranges of 2500–4000 metres above sea level across Himalayan region. It is a native species of the Himalayas, usually preferring shady areas in forest for its profused growth. The plant is a small herb and can be identified by its three leaves in one whorl at the summit of the stem and a solitary, purple flower in the centre. Leaves are broadly ovate, acute and conspicuously stalked. Over exploitation and uprooting of this medicinal plant from natural habitat, to meet pharmaceutical industry demands has made the made a global threat to the population of *nag chhatri* with small geographical niche. Its all due to its rhizome which contain trillarin and upon hydrolysis yield 2.5% diosgenin (a corticosteroid hormone) which is used for preparation of steroidal and sex hormones. Keeping view of its ruthless extraction and illegal trade are the major causes of extinction of these valuable gems. Present study is focused on conservation and sustainable management of this valuable medicinal plant of Himalyan region.

Key words: Melanthiaceae, . diosgenin, conservation, extinction

ADVANCES IN CHLOROPLAST ENGINEERING FOR SUSTAINABLE FUTURE

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Chloroplasts play a great role for sustained wellbeing of life on the planet. Chloroplast genetic engineering is an exciting technology and it hold a great potential to transfer transgene into chloroplast genome. Chloroplast engineering provide a greater advantage over nuclear genetic engineering in many aspects like it is an environmentally friendly approach to plant genetic engineering that minimizes out-crossing of transgenes to related weeds or crops and reduces the potential toxicity of

transgenic pollen to non-target insects. Because the plastid genome is highly polyploid, transformation of chloroplasts permits the introduction of thousands of copies of foreign genes per plant cell, and generates extraordinarily high levels of foreign protein. Beside these site-specific homologous recombination results in uniform transgene expression among transgenic lines and eliminates the position effect and gene silencing often observed in nuclear transgenic plants. High expression of recombinant protein within plastid engineered system offers a cost effective solution for using plants as a bioreactor. Moreover, marker gene elimination system facilitates biosafety of plastid transformation. Recent success in engineering the chloroplast genome for resistance to herbicides, insects, disease and drought, and for production of biopharmaceuticals, has opened the door to a new era in biotechnology.

UNDERSTANDING THE OLD WORLD CROP METAMORPHICS USING STABLE ISOTOPES AND ARCHAEOGENETICS

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Neolithic revolution or first Agricultural revolution was the wide-scale transition of many human cultures from a life style of hunting and gathering to one of agriculture and settlement making an increasingly larger population possible. In order to comprehend these differences, an understanding of both past and present cultivation dynamics is required. Currently, stable isotopes and morphological measurement techniques are used to understand the history of a given crop. The ability to measure the stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) of archaeobotanical grains and seeds, and to relate these values to those of living plants, has opened up a new field of isotopic research in archaeology. With the recent advancement in the field of genomics, one can isolate and sequence the DNA extracted from ancient charred grains and can reconstruct the genetic makeup of a given crop. The genomic information along with isotopes and morphological measurement will lead to a better understanding of the history of the crop. This will allow the reconstruction of crop management practices, such as manuring and irrigation, and environmental conditions.

ISOLATION AND CHARACTERISATION OF SALMONELLA FROM SWEET SAMPLES.

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Food borne diseases is a worldwide problem. Recent development in food production and processing techniques and the subsequent changing trends in food consumption have resulted in the emergence of new hazards. The increased contact among different nations have stimulated rapid global distribution of foods as well as food borne pathogens. The number of individuals at risk due to these hazards may rise due to increase in life expectancy. *Salmonella* is a rod-shaped gram negative bacteria. It is non-spore forming and pre-dominantly motile bacteria having Peritrichous flagella. Its diameter is about 0.7 – 1.5 micrometers and length about 2 – 5 micrometers. *Salmonella* is a member of Enterobacteriaceae from which *Escherichia coli* also belongs. Like all enterobacteria, salmonella spp. is also able to ferment glucose and other sugars (producing gas), can grow in the presence or absence of oxygen, reduce nitrate to nitrite and are oxidase negative and catalase positive. Most spp. of *Salmonella* are also able to utilize citrate as a carbon source produce hydrogen sulphide from inorganic sulphur, decarboxylate ornithine and lysine. It is these properties that allow *Salmonella* spp. to be biochemically identified and the serovars differentiated from one another. *Salmonella* causes many types of infection. One of the most common form of Salmonellosis is gastroenteritis. Most people develop Diarrhea, fever and abdominal cramps 12 – 72 hours after intake of contaminated food. Thus, it could be said *Salmonella*, like other food borne bacteria, is counted under the food borne pathogen, since it causes one or other type of disease. Data recorded in different countries have shown that the incidence of some of these food borne diseases have increased dramatically over the past few years, but because of under reporting, the data are of limited value and cannot be compared between countries. Here we have taken ten sweet samples from local area for the detection of desirable micro-organism i.e. *Salmonella* out of which six samples are contaminated with *Salmonella*.

A STUDY OF WHITEFLIES DIVERSITY FROM ARAVALLI HILL RANGES OF RAJASTHAN

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Aravalli Hill Ranges (AHR) are the oldest mountains starting from Delhi and passing through Haryana, Rajasthan and ending in Gujarat. It is, approximately, 692 kms in length. AHR has several forests which include wildlife sanctuaries and National parks. A field survey of whiteflies has been taken for two continuous years (2016-2017) seasonally in and around the wildlife sanctuaries and national parks of AHR in Rajasthan in order to record the species diversity of whiteflies in various experimental sites. 20 species of white flies belonging to different genera have been recorded from all the selected study sites.

Most of the species are found economically important as they may cause significant damage by infesting their host plants in AHR. Two species viz., *Acaudaleyrodes rachipora* and *Aleurolobus marletii*, shows the polyphagous nature among the species collected from the AHR in the present paper.

BIODEGRADATION OF ATRAZINE BY TWO *BACILLUS* SPP. ISOLATED FROM HERBICIDE-TREATED MAIZE FIELDS OF TARAI AGRO-ECOSYSTEM

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Atrazine is one of the most environmentally prevalent s-triazine–ring herbicide that is widely used to control broadleaf and grassy weeds for growing many crops especially in maize production. The widespread use of atrazine and its toxicity necessitates search for remediation technology. As atrazine is still used in India as a major herbicide, exploration of atrazine degrading microorganisms are of immense importance. In this study two gram-positive, rod-shaped, atrazine utilizing bacteria were isolated from herbicide-applied maize fields of Tarai agro-ecosystem, Pantnagar using enrichment culture technique. The phylogenetic sequence analysis based on 16S rRNA sequence revealed that the isolate could be a distinct species within the genus *Bacillus*. The bacterial isolates were close relative of *Bacillus badius* and *Bacillus encimensis* and designated as ABP6 and ABP8. The bacterial isolates showed positive reaction for oxidase, catalase, and 20 carbohydrates using KB009 Part A and B HiCarbohydrate™ Kit. Degradation experiments were conducted using 100 mg l⁻¹ initial Atrazine as a source of carbon and Nitrogen at different pH and temperatures. Maximum atrazine degradation by ABP6 and ABP8 was observed at pH 7.0 and 30 °C. Addition of Carbon and Nitrogen sources along with atrazine increased degradation rate, as compared to the atrazine degradation without Carbon and Nitrogen sources under optimum conditions. HPLC was used for detection of degradation by-products in the medium. To the best of our knowledge, there are no previous reports of Bacterial strains of both *Bacillus* spp. that degrade atrazine, Therefore present study demonstrated the atrazine metabolizing capacity of novel bacterial isolates ABP6 and ABP8 that can be a better choice for the remediation of atrazine-contaminated sites.

Keywords: Atrazine, *Bacillus badius*, *Bacillus encimensis*, Biodegradation, Herbicide.

MICROWAVE ASSISTED FLUIDIZED BED DRYING OF CAPSICUM: EFFECT ON DRYING KINETICS AND ANTIOXIDANT PROPERTIES

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The experiments were conducted to study the effect of microwave power, inlet air velocity and inlet air temperature on drying characteristics and antioxidant properties of capsicum dried by microwave assisted fluidized bed drying (MAFBD). Samples were prepared by cutting the capsicum to a uniform size (1.5 cm x 1.5 cm x 0.5 cm) to allow power fluidization at different velocities. This was done by carrying out the trials of different sizes at different air velocities to obtain proper fluidization and hence satisfactory results. Capsicum samples were then dried to moisture content of about 6% (db) at different power levels (180 W, 360 W and 540 W), inlet air velocities (15 m/s, 17.5 m/s and 20 m/s) and inlet air temperature (40 °C, 55 °C and 70 °C). Drying time was greatly reduced in MAFBD as compared to fluidized bed drying. The results obtained at the least level of parameters when compared with those obtained at extreme levels, a 50 % reduction in drying time was obtained. The increase in microwave power, inlet air velocity and inlet air temperature enhanced the dehydration of the capsicum cubes. Face centered response surface methodology was applied to obtain regression polynomial models for drying parameters. Design expert 13 was used for the optimization and work plan of the whole experimentation. The quadratic model was found to be significant for drying time and antioxidant properties of capsicum. Keeping the responses like vitamin C content, total phenolic content, total flavonoid content, total carotenoid content and drying time in consideration, the optimum values of microwave power, inlet air velocity and inlet air temperature were 540 W, 20 m/s and 70 °C respectively.

TISSUE CULTURE AND PHYSIO- BIOCHEMICAL STUDIES OF MUCUNA PRURIENS L. (DC)-AN IMPORTANT MEDICINAL PLANT

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Mucuna pruriens L. (DC.) commonly known as velvet bean is an important tropical legume found in bushes and hedges at damp places, ravines and scrap jungles throughout the plain of India. All parts of *M. pruriens* possess valuable medicinal properties. The report on the occurrence of the catecholic amino acid 3- (3,4-dihydroxy phenyl)-L-alanine (L-Dopa) attracted attention for utilization of the plant for L-Dopa production. L-Dopa, a neurotransmitter precursor, has found wide application for symptomatic relief of Parkinson's disease and mental disorder. Direct multiple shoot regeneration was achieved from cotyledonary node and nodal segment explants cultured on BA, Kin and 2-iP either alone or in combination with auxins (IAA and NAA). Among the different concentrations of cytokinins tested, BA (5.0 µM) showed the highest shoot regeneration frequency (81%) and number of shoots (8.5 ± 0.57) from nodal explants after 4 weeks of culture. Addition of NAA (0.5 µM) enhanced the shoot regeneration and MS medium supplemented with BA (5.0 µM) and NAA (0.5 µM) produced the highest frequency of shoot regeneration (91%), highest number (16.8 ± 1.50) and longest shoots (5.3 ± 0.32 cm) from nodal explants. The best condition for rooting was half strength MS medium supplemented with 2.0 µM IBA. The *in vitro* raised plantlets with well developed shoots and roots were successfully acclimatized in plastic pots filled with sterile soilrite with 100% survival rate and about 90% plantlets survived in greenhouse.

SEASONAL VARIATION IN VEGETATION OF HERB SPECIES ALONG DIFFERENT ALTITUDES OF BENHAMA, GANDERBAL, KASHMIR

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The study entitled "Seasonal Variation in vegetation of herbaceous species along different altitudes of Benhama, Ganderbal, Kashmir was conducted at Faculty of forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Benhama, Ganderbal, Jammu and Kashmir during the year 2015-2016 with the aim to assess the seasonal change in floristic composition and phytosociology of herbaceous species at the site. The vegetational analysis was done by harvesting sampling plots. Study site was divided three altitudes. At each altitude, five quadrats of size 1.25m x 1.25m were laid for herbaceous species. The floristic surveys conducted in the study area during the study period resulted in the identification of 64 plant species belonging to 18 families. The phytosociology of the different elevations revealed that *Cynodon dactylon* dominates all the three altitudes at the site. The phytosociological attributes of herbaceous species decreased along the altitudinal gradient. There is an increasing trend in the number of species mostly during spring and summer season and declining trend towards autumn season.

Key Words: Altitude, Phytosociology, Season, Vegetation

ROOT BORDER CELLS AND SECRETIONS AS CRITICAL ELEMENTS IN PLANT HOST DEFENSE

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The adaptation of plants to land ecosystems involves complex rhizosphere interactions between organic matter and microbial communities. Border cells (BC) constitute the first living boundary in plant-soil ecosystems and play an important role in environmental sensing and signaling in response to different biotic and abiotic conditions. Border cells and border-like cells are released from the root tip as individual cells and small aggregates, or as a group of attached cells. These are viable components of the root system that play a key role in controlling root interaction with living microbes of the rhizosphere. As their separation from root tip proceeds, the cells synthesize and secrete ahydrated mucilage that contains polysaccharides, secondary metabolites, antimicrobial proteins and extracellular DNA (exDNA). This exDNA-based matrix seems to function in root defense in a way similar to that of recently characterized neutrophil extracellular traps (NETs) in mammalian cells. Both cell types export a complex of extracellular DNA (exDNA) and antimicrobial proteins that neutralize threats by trapping pathogens and thereby preventing invasion of host tissues. Extracellular DNases (exDNases) of pathogens promote virulence and systemic spread of the microbes. In plants, adding DNase I to root tips eliminates border cell extracellular traps and abolishes root tip resistance to infection. Mutation of genes encoding exDNase activity in plant-pathogenic bacteria (*Ralstonia solanacearum*) results in reduced virulence. Engineering the rhizosphere to increase plant resistance to pathogens could be achieved through breeding, which potentially selects for novel root and root border cells' architecture and function.

SOME BRIEF OF ABIOTIC STRESS**JASVEER SINGH* AND RAJA RAM BUNKER****

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Abiotic stress is defined as the negative impact of non-living factors on the living organisms in a specific environment. The non-living variable must influence the environment beyond its normal range of variation to adversely affect the population performance or individual physiology of the organism in a significant way. Whereas a biotic stress would include living disturbances such as fungi or harmful insects, abiotic stress factors, or stressors, are naturally occurring, often intangible and inanimate factors such as intense sunlight, temperature or wind that may cause harm to the plants and animals in the area affected. Abiotic stress is essentially unavoidable. Abiotic stress affects animals, but plants are especially dependent, if not solely dependent, on environmental factors, so it is particularly constraining. Abiotic stress is the most harmful factor concerning the growth and productivity of crops worldwide. Research has also shown that abiotic stressors are at their most harmful when they occur together, in combinations of abiotic stress factors.

Keyword: Abiotic stress, organisms, environment etc.

DETERMINATION OF EFFICACY OF BIOAGENTS AGAINST DRY ROOT ROT OF LENTIL (LENS CULINARIS MEDIK).**JASWANT SINGH, GAMBHIR SINGH AND RAHUL KUMAR**

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In this study, biocontrols effects of *Trichoderma* isolates alone and in combination were evaluated against *F. oxysporum* pathogen. This study shows the ability of *Trichoderma harzianum* isolates which had been isolated from soil and as such, lentil roots were compared to the combination of the three fungal lentil *Fusarium* root. Twenty four- rhizobacterial isolates obtained from lentil rhizospheric soils from 34 locations were characterized and found belonging to genera *Bacillus* (12), *Pseudomonas* (12) and *Tricoderma harzianum*(4). The isolates were evaluated for their plant growth and antagonistic traits. 18 of the isolates produced siderophore as evidenced on Chrome-azurol-S agar, maximum catechol-type siderophore being produced by B-40 (97µg/ml), while maximum hydroxamate-type siderophore by B-20 (85.5µg/ml). Phosphorus solubilization was recorded with 39.5% isolates and the relative efficiency of P-solubilized in liquid medium ranged from 3.5-44mg/100ml. All these isolates produced the phyto stimulator Indole-acetic-acid which ranged from 3-106.1µg/ml. Nine of the isolates were able to utilize ACC as the sole N-source, their ACC-metabolizing rate was measured as optical density (OD496) ranged from 0.42-1.39. The antagonistic ability against *Fusarium oxysporum* ranged from 1.3–12.6%, maximum being recorded with P-1 (12.6%), followed by B-36 (9.3%) and B-40 (1.3%). Similar trend was recorded in liquid medium. On the basis of their PGP traits B-40 and P-1 were selected for field studies. These isolates showed compatibility with *Rhizobium leguminosarum* under axenic conditions and also promoted root/shoot growth in lentil seedlings. The effect of selected PGPR and *Rhizobium* sp. along with check strain KBB-133 was studied on lentil crops in the field.

BIODIVERSITY RESOURCE AND THEIR CONSERVATION**JAY PRAKASHVERMA AND JAY PRAKASH SHAHI**

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The conservation of natural resources and biodiversity is a primary tenet of organic production. For instance, native vegetation interspersed throughout a certified organic operation provides food, cover, and corridors for beneficial organisms such as pollinators, slows water down for erosion control and groundwater recharge, and filters pollution. Nature provides us with the basic needs for our survival such as food, shelter, clothes, etc. We use air, water, soil, minerals, coal, petroleum, animals, plants etc. in our daily life. But do you ever think, how long these precious materials of nature will last? The growing population, rapid industrialisation and– urbanisation have created heavy demand on natural resources. This lesson deals with means of conservation of natural resources through prevention of resource over exploitation and sustainable development. It is considered at three main levels including species diversity, genetic diversity and ecosystem diversity. Relative to the variety of habitats, biotic communities and ecological processes in the biosphere, biodiversity is vital in a number of ways including promoting the aesthetic value of the natural environment, contribution to our material well-being through utilitarian values, maintaining the integrity of the environment through; maintaining CO₂/O₂ balance, regulation of biochemical cycles, absorption and breakdown of pollutants and waste materials through decomposition, determination and regulation of the natural world climate, protective services, e.g. by acting as wind breaks and acting as indicators of environmental changes. To ensure intra and intergenerational equity, it is important to conserve biodiversity. Some of the

existing measures of biodiversity conservation include; zoological gardens, botanical gardens/arboretums, seed banks and national parks and game Reserves.

EVALUATION OF POTENTIAL NUTRIENTS IN *CITRULLUS LANATUS* L. AND ITS WILD SPECIES

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Watermelon is a major cucurbitaceous vegetable containing several important health-related compounds including lycopene, citrulline, arginine, and glutathione, carotenoid, flavonoid, mineral and nutrient composition is one of the most important that plays a role in our day to day life. Therefore it is becoming an important component of the healthy diet among Indian consumers due to increasing awareness about presence of many healthful compounds and its fruits are now available round the year across the country. Its fruit contains about 93–95% water, 5% carbohydrate, 0.5–1% protein, and 0.2% fat. The potential nutrient composition of potassium, sodium, copper, iron, manganese, calcium, magnesium and zinc content in watermelon was carried out in eighty different genotypes of watermelon including two wild species *Citrullus lanatus* var. *citroides* and *Citrullus colocynthis*. The potential nutrient contents of the pulp, seeds and rind of watermelon were evaluated. The study was carried out in dried samples. K^+ and Na^+ was estimated by using Systronics flame photometer 128, India Limited with facility of internal calibration. The other micronutrients like Cu, Fe, Mn, Ca, Mg and Zn content in plant sample were estimated from diacid digested fruit samples by using Inductively Coupled Plasma Mass Spectrometry or ICP-MS (Model NexION 300X, Perkin Elmer, USA). Results of the investigation revealed that potassium (369.93–8326.2), sodium (38.00–728.17), and zinc (0.03–18.11) has high amount in the most of the genotypes. Although some other minerals were also evaluated but then lower amount as compared to those nutrients. There is a huge variation in the nutrient composition in watermelon genotypes and content reflecting the high selection prospects for these traits to improve the performance through breeding programme.

THE ISOLATION AND CHARACTERIZATION OF ENDOCHITINASE GENE FROM ISOLATE OF TRICHODERMA SP.

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Chitinases have been reported to be capable of hydrolyzing chitin by splitting their β -1,4-glucosidic bonds. The chitinases are divided into the exo and endochitinases. The aim of this study was to isolate and characterize an endochitinase gene from a local isolate of *Trichoderma* spp. that was isolated from the Malaysian soil samples. In total, six highly antagonistic *Trichoderma* isolates were screened for chitinolytic activity via dual plate method and greenhouse studies. *Trichoderma* isolate T2 was identified as a target for isolation of an endochitinase gene due to its high chitinolytic enzyme activity by observing the degradation of chitin substrates. The genomic DNA of *Trichoderma* isolate T2 was extracted, amplified and sequenced. The putative endochitinase gene, ChitT2 was then subjected to in silico analysis to obtain physico-chemical, evolutionary and structural information of this protein. The ChitT2 protein sequence had 352 amino acids and showed 99% homology to *Trichoderma harzianum* endochitinase Chit36Y. The maximum parsimony analysis showed that ChitT2 protein was clustered into Group V with other fungi. Ultimately, the in silico analysis of ChitT2 implicated the involvement of this gene/protein in chitin catabolism.

EVALUATION OF *SESBANIA* RHIZOBIAL ISOLATES FOR SIDEROPHORE AND BACTERIOCIN PRODUCTION

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Plants of *Sesbania* species naturally grow in wet or flooded soils and fix large amount of nitrogen. They are used widely as green manure crop. These plants can withstand extreme conditions in soil like salinity, waterlogging and alkalinity. PGPR can be used to improve plant growth in many ways. Keeping in view the benefits of isolating efficient PGPR from *Sesbania* plants, total 22 rhizobial isolates were isolated by using spread plating and streaking methods from nodules and soil samples collected from different locations of India by plant trap method. All these isolates were screened for bacteriocin and siderophore production. Siderophore production was detected by CAS (Chrome Azurol S) assay and bacteriocin production was detected by growing log phase cells on lawn of bacteriocin sensitive culture spreaded on YEMA medium plates and zone of inhibition on plate was recorded. The biochemical characterizations of these showed that 36% of the isolates were bacteriocin producer and 45% were siderophore producer. Selected rhizobial isolates possessed good ability of siderophore and bacteriocin production and can be exploited as biofertilizers for better yield. These isolates will be further characterized for other plant growth promoting traits.

VALORIZATION OF GRAPEFRUIT PEEL FOR THE RECOVERY OF PHENOLICS: OPTIMIZATION AND COMPARISON OF NON-CONVENTIONAL EXTRACTION METHODS**JYOTI NISHADA*, CHARANJIT KAURA***Division of Food Science and Postharvest Technology, ICAR-Indian Agricultural Research Institute, New Delhi India*

Grapefruit (*Citrus paradisi*) in India is exclusively used for fresh juice preparations generating huge quantity of byproducts (peel, pulp and seeds) every year. These byproducts, mainly peel have found limited utilization in processing industries for making marmalades, candied peels, pectin extraction and animal feed. These peel are reported to have flavanones aglycones, flavanones glycosides and polymethoxylated flavones, possessing anti-inflammatory and anti-carcinogenic activities and could find application in food, nutraceutical, cosmetic, and pharmaceutical industries as functional ingredients. However, due to improper processing facilities these functional byproducts goes waste and cause environmental havoc. Numerous studies have been conducted for utilizing these functional ingredients, where extraction of phytochemicals showed a major role in valorization of the peel. Extraction of nutraceuticals through non-conventional extraction techniques such as ultrasound (UAE) and enzyme assisted extraction (EAE) provides advantage over conventional solvent extraction (CSE) by yielding high recovery in short time. However, no comprehensive study is available on comparison of EAE with UAE and CSE for phytochemical recovery from grapefruit peel of Indian origin. Hence, in this study, EAE and UAE of phenolic compounds from grapefruit (cv. Red blush) peel have been optimized by maximizing the recovery of total phenolic compounds (TPC) and total flavonoids (TFC) using response surface methodology. The optimized extracts were then compared with CSE for their TPC, TFC, antioxidant activity and phenolic compounds. The best optimized conditions for UAE was obtained at 33.12 min extraction time, 71.11% amplitude and a solvent–solid (SS) ratio of 39.63 mL/g. The optimized parameters for EAE were 4.81 h extraction time, 0.9% enzyme concentration and 40 mL/g SS ratio. Additionally, similar experimental and predicted values for TPC and TFC at optimized conditions indicates the suitability of the quadratic model in optimizing the extraction parameters. Further characterization of extracts suggested EAE as most efficient method for extraction of bioactive compounds.

Keywords: Antioxidant activity, Conventional and non-conventional extraction, Enzyme/ultrasound extraction, Grapefruit, Phytochemicals, Response surface methodology

STUDIES ON BIOLOGICAL ATTRIBUTES OF MANGO SHOOT GALL PSYLLA, APSYLLA CISTELLATA BUCKTON**JYOTI RAINA* AND POONAM SRIVASTAVA***GBPUAT, Pantnagar, Uttarakhand*

Apsylla cistellata Buckton (Psyllidae: Homoptera) is a serious pest of mango, causes the formation of hard conical green shoot galls in place of buds, which directly hinder the formation of inflorescence and fruit set. In order to generate information on its management in Uttarakhand, studies were anticipated on its life history and developmental stages of mango shoot gall psylla. For this, periodic observations were made in the laboratory as well as in the orchard on 25-30 year old mango trees c.v Dashehari, infested heavily with shoot gall psylla during 2016 and 2017 at Horticulture Research Centre, Patharchatta, G. B. Pant University of Agriculture and Technology, Pantnagar. It was found from the observations that pre-oviposition, oviposition and post-oviposition period of shoot gall psylla female varied from 10-22, 1-5 and 0-3 hours, respectively. Females, which emerged during the month of March and April, after mating, oviposited on the ventral surface of tender new flush of leaf midrib in two parallel row fashion. A single female laid 45-182 eggs and incubation period of the eggs varied from 138-177 days. It was observed that egg hatching started around the mid of August. Nymphs after emergence started feeding *in situ* in ovipositional slits without proper egg hatch. However, nymphal development completed in 5-6 months and lasted for 163-205 days. Sex ratio of mango shoot gall psylla was calculated to be 1: 1.64 -1.79 (male: female), which indicated that females outnumbered males. Observations on adult survival period stated that 58.51 and 52.60 per cent adult females and 45.67 and 51.92 per cent adult males survived for 12 hours, during both the years of investigation. However, only 3 per cent females were survived for 48 hours, while, no alive male adult was recorded at 48 hours. Hence, such studies on biological attributes of mango shoot gall psylla help in knowing the particular stages of infestation, further, makes designing and planning of management practices easier at those stages.

Keywords: *Apsylla cistellata*, Gall, Management, Oviposition, Sex-ratio

OPTIMIZATION AND CHARACTERIZATION OF SIDEROPHORE PRODUCING PLANT GROWTH PROMOTING BACTERIA FOR ENRICHMENT OF IRON CONTENT IN WHEAT

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More than two billion people are affected from micronutrient deficiencies of iron, vitamin A, iodine and zinc and it leads to important health consequences. To reduce the level of micronutrient deficiency it is required to biofortified our staple food crops. Implication of potential rhizobacteria for biofortification is a novel approach, can lead to augment micronutrient concentration in food crops along with significant yield and growth. In this context, present study was carried out for isolation and screening of plant growth promoting rhizobacteria from rice rhizosphere, Chiplun, Maharashtra, India and examined for their plant growth promoting abilities such as zinc solubilization, siderophore, ammonia, indole-3- acetic acid (IAA), hydrogen cyanide (HCN), exopolysaccharide and 1 aminocyclopropane 1-carboxylase (ACC) deaminase production potential. The potential bacterial isolate was further examined for optimization and characterization of siderophores. The results of optimization revealed that bacterium was able to produce siderophore (58 to 75% units) in the optimum condition of pH 8.0 at 36°C with sucrose and glucose as a C source. Furthermore, the characterization was done by means of spectrometric analysis which unveiled that type of siderophore produced by potential bacterial isolate was catecholate. The effectiveness of bacterial isolate was further analyzed through *in situ* plant growth promoting study in wheat (*Triticum aestivum* PBW-373) and assimilation of iron content in plant shoot and grains through AAS (Atomic absorption spectrophotometer), which showed significant influences on plant growth and productivity as well as iron assimilation in shoot and grains over control. Thus, the bacterial isolate can be developed as a potential bioinoculant reducing malnutrition intended for sustainable agriculture strategies after further evaluation and validation.

MOLECULAR MARKER BASED IDENTIFICATION OF RICE RESTORES AND THEIR VALIDATION IN TEST CROSS HYBRID

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The study of hybrid rice and their evolutionary system is based on the fertility restoration system. Keeping this view of fertility restoration system of hybrid rice, the present study was carried out with the objective of molecular marker based identification of rice restorer and their performance in test cross. In this study the marker RM 6100 was used for the allele specific identification of rice restorer. 60 rice germplasm have been testing for the identification of rice restorer and out of 60 24 were found to be positive for the fertility restoration gene *Rf* . These *Rf* gene positive rice germplasm were crossed with cytoplasmic male sterile line (CMS line) and developed 24 hybrids for yield and yield components in comparison to commercial check hybrid PA6444. From these 24 test cross hybrids, the spikelet were ranged from 53.5 to 95.4 per cent with an average spikelet fertility of 74.4 per cent. The single plant yield were also calculated as 18.5 to 24.6 gm with an average single plant yield of 21.5 gm. The extent of heterosis in the test cross for yield and yield components were computed over the performance of the pollinator parents and standard heterosis over the commercial check PA6444. Out of 24 test cross hybrid 4 showed superiority of 16.8 per cent over the commercial check PA6444. However, this findings concluded that the identified rice restorer play a major role in hybrid rice production technology in respect to spikelet fertility and other major yield attributing components.

ARMENIAN CUCUMBER –A TRADITIONAL SALAD VEGETABLE FOR SUSTAINABLE FOOD SECURITY AND LIVELIHOOD (*CUCUMIS MELO* VAR. *FLEXUOSUS*)

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Armenian cucumber or Longmelon (*Cucumis melo* var. *flexuosus*) is one of the most important short duration crop commercially grown as refreshing salad vegetable that can be eaten fresh, pickled or cooked at the immature fruit stage, like cucumber and squash. It probably signifies an early stage in melon domestication, where fruits have become non-bitter, but not yet sweet. Armenian cucumber grown all over the country throughout the year especially *zaid* season in north western region. Long melon is rich source of minerals, dietary fibres, and antioxidants and also having medicinal properties which very helpful in curing diabetes and the leaf juice is used for the treatment of blindness. It has a wider opportunity for further exploitation considering not only various breeding objectives (crispiness, medium size, tenderness, better keeping quality and straightness) but also income generation to the farming community. Mostly, consumers prefer slender fruits with deep grooves, tender and light green outer skin colour, this situation which may threaten the biodiversity among the local cultivated landraces which ultimately hampers the fully exploitation of its genetic potential of this crop. Therefore, priority

was given for collection of germplasm, systematic characterization and evaluation for important horticultural traits along with screening against biotic and abiotic stresses. In view of the importance of crop, thirty diverse genotypes of long melon were characterized for important horticultural traits. Early flowering was observed in VRLM-28 (25 days after sowing) followed by VRLM-01 (28 days after sowing), VRLM-2, and VRLM-21. Maximum fruit length was recorded in VRLM-01 (50 cm) followed by VRLM-40, VRLM-28 and minimum in VRLM-11-1 (25 cm). Fruit yield per plant ranged between 6-8 kg. From the present study, the genotypes VRLM-01, VRLM-40, VRLM-28 and VRLM-3 were found to be superior for yield and quality attributes and can be used as parents in further improvement programme. Armenian cucumber, a short duration crop hold immense potential to generate better economic returns to growers from marginal land holdings with high production.

BIODIVERSITY (PLANTS & ANIMALS) RESOURCES & THEIR CONSERVATION

K. VEENA

Biodiversity is a variety of all the genes, species & ecosystem which are found on our planet. It ensures the sustainable utilization of life support system on the earth and also serves as insurance policy for the future. Genetic diversity of plants & animals is also preserved. Biological extinction has been a natural phenomenon in Geological history. But the rate of extinction was perhaps one species every 1000 years. Natural causes for loss of biodiversity includes floods, earthquakes, landslides, etc. But the man's intervention has speeded up extinction rates all the more. Therefore, it needs to be conserved. Conserving biodiversity outside the area where they naturally occur is known as Ex-situ conservation. Eg.: Seed banks, Botanical, Horticultural, Recreational gardens are some important centres for their conservation. Conserving the animals & plants in their natural habitat is known as In-situ conservation. It includes National parks & Sanctuaries, Biosphere reserves, etc. Maintaining a wide diversity of species in each ecosystem is necessary to preserve the web of life that sustains all living things. Sustainability highlights the idea that the current status of biodiversity should not diminish the options for future generations & maintaining it is clearly one of the requirements for meeting the goal.

REPRODUCTIVE POTENTIAL OF *HETERORHABDITIS INDICA* AGAINST LEPIDOPTERON PESTS

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Heterorhabditis indica (isolateDH3) was isolated from the soil around the rhizosphere of mango plants of District Meerut of Uttar Pradesh, India and was used to find out the efficacy against two insect pests *Galleria mellonella* and *Helicoverpa armigera* infected with four different concentrations of 3rd stage infective juveniles (IJs) viz. 25, 50, 100, 200 IJs/larva. Mortality was observed in all the concentrations of both insect larvae after 24h post infection period (PIP). Present isolate showed 40%, 60%, 60%, 80% mortality from lower to higher concentration in *H. armigera* larva bioassay whereas it was 20%, 30%, 40%, 70% in *G. mellonella* larvae bioassay after 24h PIP. No mortality was observed in control group. LC₅₀ were calculated at three different time viz. 24h, 36h, and 48h, of both insect and recorded as 40 IJ/larva, 13 IJ/larva and 8 IJ/larva in *G. mellonella* and 110 IJ/larva, 18 IJ/larva and 13 IJ/larva in *H. armigera* respectively. A good number of progeny productions were also counted in the insect pests in all the respective doses applied. The highest IJs production was shown in *G. mellonella* with $21.94 \pm 1.16 \times 10^4$ IJs/larva at the dose of 200 IJs/larva dose whereas it was highest in 50 IJs/larva in *H. armigera* with a number of $5.90 \pm 1.96 \times 10^4$ IJs/larva. Study shows that the present isolate of *H. indica* was enough virulent to both the insects and also produced good number of IJs.

Keywords: Insect pest, pathogenicity, reproductive potential.

RESISTANCE GENE ANALOGUES IN PLANTS

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Plants have developed efficient defence mechanisms to recognise and give response to infections or symptoms caused by pathogens. Resistance gene analogues (RGAs), are resistance genes which follow gene for gene interaction with pathogen. Lucien Rich Repeats (LRR) which is a region of the R genes is involved in the recognizing pathogens and they evolve very fast as resistance (*R*) gene candidates. These genes have conserved domains and motifs that play significant and specific roles in pathogen resistance. Nucleotide binding site leucine rich repeats, receptor like kinases, and receptor like proteins, pentatricopeptide repeats and apoplastic peroxidases are some of the well known RGA's. These can be identified using tools of bioinformatics based on their conserved structural features. Thousands of RGAs were identified from sequenced genomes of plant species. Resistance Gene Analogs are the amplification products got through the PCR amplification of genomic DNA using primers designed from the conserved sequences of known disease resistance genes. RGAs are putative or

tentative disease resistance genes identified on the basis of their structure. In order to know their exact function they need to be characterized and linked with the genes actually conferring resistance phenotype. High-density genome-wide RGA genetic maps are more useful for designing markers for diagnosis and identifying quantitative trait loci (QTL) or markers linked with disease resistance in plants. Bioinformatics tools and well designed pipelines will help in the identification and characterization of RGA's. Number of RGAs have been identified from several genome sequences of plant species. These identified genome-wide RGAs have enormous scope for their applications in genomics and bioinformatics such as protein signature profiling, GWAS, linkage mapping, and clustering will support traditional methods to improve marker development, cloning of plant resistance genes, QTL mapping, and resistance breeding.

GREEN NANOTECHNOLOGY AND ITS APPLIATIONS

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Green nanotechnology refers to the use of nanotechnology to enhance the environmental sustainability. It has been described as the development of clean technologies, "to minimize potential environmental and human health risks associated with the manufacture and use of nanotechnology products, and to encourage replacement of existing products with new nano-products that are more environment friendly throughout their lifecycle." To achieve these goals various strategies have been devised like green synthesis, green manufacturing etc. NPs are used in a large number of fields such as health care, cosmetics, food and feed, drug-gene delivery, environment, mechanics, energy science, catalysis etc. These are produced by a variety of methods like physical, chemical and biological. Among these, green synthesis is the method of choice because of its rapid, eco-friendly, non-pathogenic and economical protocol. Nanomaterials like Carbon Nano Tubes, graphene, titania, Zero Valent Ions' cores etc. can clean hazardous waste sites, desalinate water, treat pollutants, or sense and monitor environmental pollutants. Nothing that starts with wrong toxic materials could be suitable to produce correct results of a general applicability at clinical or industrial scale. Consideration of simple practical and successful results to their complementarity with environmental effects is needed right now.

MECHANISM OF LANTANA CAMARA LEAF EXTRACTS IN THE MANAGEMENT OF MELOIDOGYNE INCOGNITA ON TOMATO.

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Plant parasitic nematodes are recognized as the cause of serious yield losses on a wide range of crops. The most destructive species is root knot nematode, *Meloidogyne incognita* which causes serious problems in number of economically important agricultural crops. It is one of the most harmful nematode pests in both tropical and subtropical regions and cause extensive economic damage worldwide. This nematode is an obligate root-parasite and about 2000 plants are susceptible to this nematode causing approximately 5 per cent of global crop loss. An avoidable loss in yield of 13.20 per cent on tomato due to *M. incognita* was recorded in Assam. Although application of chemical nematicides have been found to be most effective measure for the control of this nematode, due to its high toxic residual effect and toxicity to beneficial flora and fauna in the soil, there is need to develop alternative and cost effective nematode control strategies. One of the outstanding alternative control measures against the nematode is the application of plant extracts. Plant extracts have been shown to contain various bioactive compounds (allelochemicals) like phenolics, organic acids, terpenes and terpenoids, coumarin-like compounds and other secondary metabolites and reported to have nematocidal activity. These allelochemicals that inhibit the growth of some species at certain concentrations might in fact stimulate the growth of the same or different species at different concentrations. It has been documented that allelopathy play an important role in plant-plant interference by those chemical compounds. A wide variety of plant species, representing 57 families have been shown to have nematocidal compounds. Among them, *Lantana camara* L. belonging to family the Verbinaceae have been shown to have allelopathy. The biochemical assay indicates that *Lantana camara* leave extracts increase the enzymatic activity and *L. camara* contains phenolic compounds and hydrogen cyanide which showed nematocidal activity. However, allelopathic plants at higher concentrations may well produce phytotoxic symptoms. Before application of these plants under field conditions to suppress the plant parasitic nematodes, it is necessary to determine the optimal concentration that is toxic to nematodes but neither to the plant to be protected neither from nematodes nor to any associated beneficial microorganism such as those possessing bio-control and growth promoting properties.

Key words: Root-knot nematode, *Lantana camara*, leaf extract, egg plant, Nematostatic activity, allelopathy, allelochemicals, biochemical activity.

STUDY ABOUT SOCIAL BEHAVIOR OF HONEY BEES**KAPIL SONI¹, PRAKHAR KUMAR SHRIVASTAVA¹, ANKITA SINGH² AND SACHIN KUMAR JAISWAL¹**¹Department of Entomology, College of Agriculture, Rewa, JNKVV-Jabalpur, MP, India²Department of Extension Education, College of Agriculture, Tikamgarh, JNKVV-Jabalpur, MP, India

Wilson (1971) defined a society as an "a group of individuals that belong to the same species and are organised in a cooperative manner". The eusocial insects can be distinguished as a group by the possession of three characteristics, viz., are cooperation among individuals of the same species in the care of young, a division of labour in which more or less sterile individuals assist fecund individuals and an overlap of generations so that offspring are able to assist their parents. Michener (1974), based on the above criteria, classified social behavior in insects, viz., are Eusocial, Semisocial, Quasisocial, Communal, Subsocial and Solitary. An overlap of generations of that offspring belonging to the worker caste assists their parents in the care of young known as Eusocial. Semisocial is defined as a worker caste of the same generation as the reproductive caste cares for the young. Adults of the same generation use the same nest and cooperate in the care of young known as Quasisocial. Communal is described as adults of the same generation use the same nest but do not cooperate in the care of young. The adults care for their own immature offsprings for a period of time known as Subsocial. Solitary is defined as Insects possess none of the three traits involving cooperative care of the young division of labour and assistance to parents.

STUDY OF GENES INVOLVED IN RICINOLEIC ACID PRODUCTION**KAUSHIK KR DHAR DUBEY, K C UPADHYAYA, A KUMAR***Molecular Genetics Lab, Amity Institute of Biotechnology, Amity University, Noida, Uttar Pradesh*

Hydroxy fatty acids (HFAs) have various industrial applications as raw materials as well as in pharmaceutical products. Studying the genes involved in the biosynthetic pathway is an important step to utilize this wild species as a genetic source of HFAs biosynthesis. Castor plant accumulates around 90% ricinoleic acid in its seeds. Oleate hydroxylase gene which is involved in the ricinoleic acid production pathway was first time cloned from castor plant. Due to presence of highly toxic compound ricin in castor, there is increasing interest in the biosynthesis of these unusual FAs in other oil crops and their bioengineering for large scale production. *Hiptage benghalensis*, a tropical plant of malpighiaceae family accumulates high level of ricinoleic acid in its seeds. Mature seeds of *Hiptage* from different geographical regions of India were collected and fatty acid analysis performed using GCMS. Developing seeds were collected at different developmental stages for fatty acid as well as expression pattern analysis. The gene for hydroxylase was cloned and sequence analysis shows two different variants of fatty acid hydroxylase, FAH12-1 and FAH12-2. Full length gene sequence was obtained using 3'RACE and 5'RACE. The DNA sequences of both the variant were transferred to pYES2.1 TOPO® TA expression vector. These gene constructs were transferred to yeast, *Saccharomyces cerevisiae* and the hydroxylase activity in the transformants was induced using appropriate induction media.

Keywords: Hydroxy fatty acid, Ricinoleic acid, *Hiptage*, FAH, GCMS, RACE, Yeast

RESPONSE OF TWO FINGERMILLET GENOTYPES TO DIFFERENT NITROGEN TREATMENTS WITH RESPECT TO AGRO-MORPHO-PHYSIOLOGICAL PARAMETERS AND QUALITY OF SEED STORAGE PROTEINS**KAVITA GURURANI, DINESH PANDEY, AJAY KUMAR CHANDRA, SUPRIYA GUPTA AND ANIL KUMAR***Department of Molecular Biology and Genetic Engineering, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand-263145, India.*

Finger millet (*Eleusine coracana*), commonly known as Madua (ragi) is a minor small seeded annual cereals grown mainly in arid, semi-arid and tropical regions of the world as staple food crop. It harbors many important agronomic and nutraceutical properties, which makes it a wonder grain of nutritional importance in Indian and African sub continentals. Being highly nitrogen use efficient and stress resilient crop, it can sense and differentially respond to available nitrogen in soil leading to significant influence on various agro-morpho-physiological characters and accumulation of quality proteins in seed. In view of the above background the present study was conceptualized to study the effects of different nitrogen treatments on agro-morpho-physiological parameters and quality of seed storage proteins of two finger millet [GE-1437 (low protein) and GE-3885 (high protein)] genotypes. In order to check the effects of different nitrogen treatments on quality of seed storage proteins, the experiment was laid out in completely randomized design (CRD) for seven agro-morpho-physiological traits with three replications at GBPUAT, Pantnagar. Among all the treatments, both genotypes treated with 60 kg/ha N fertilizer showed maximum shoot length, fresh and dry weight of the plants, number of leaves/plant and number of spikes/plant along with two fold increase in grain yield as compared to control. The statistically non-significant variation was observed for traits like % N and total seed protein content. However, % N and total seed protein content gradually increased in response to nitrogen treatment as compared to untreated plant. Since, most of the agro-morpho-physiological characters showed better

performance at 60 kg/ha as compared to others, hence 60 kg/ha dose could be used for further investigation. As we know nitrogen is a building block of amino acid so the differential expression analysis of regulatory enzymes of essential amino acid biosynthetic pathway is being investigated under the influence of different N treatment. This would open up new vistas for future nutri-agricultural research. Therefore, optimization of N doses through various agro-morpho-physiological traits expressed for both quantity and quality of seed proteins is substantiated by molecular studies could help to understand the consequences of N fertigation not only on nutritional quality of plant but also on soil ecosystem.

INCORPORATING DROUGHT TOLERANCE IN PEA AND CHICKPEA THROUGH BREEDING AND BIOTECHNOLOGICAL APPROACHES: A REVIEW

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Drought is one of the foremost abiotic stress in agriculture in the world. It is a multidimensional stress that causes changes in the physiological, morphological, biochemical and molecular traits in plants. Though, both pea and chickpea are known for their better drought tolerance than most other cool season food legumes, drought lowers their yield and can even lead to total crop failure. This necessitates the plant breeders to focus on drought related objectives, while framing a crop improvement programme. During the last century, although plant breeders have made ample progress through conventional breeding in developing drought tolerant lines/cultivars of some selected crops, the approach is, in fact, highly time-consuming and labour- and cost-intensive. Alternatively, marker-assisted breeding (MAB) is a more efficient approach, which identifies the usefulness of thousands of genomic regions of a crop under stress conditions, which was, in reality, previously not possible. With the development of comprehensive molecular linkage maps, marker-assisted selection procedures have led to pyramiding desirable traits to achieve improvements in crop drought tolerance. Thanks to the advance of next generation sequencing (NGS) technology for obtaining a large amount of molecular markers at a relatively low cost and a relatively small genome size, chickpea has well-developed genomic resources. But due to the larger genomic size of pea, the research on this area is still in pipeline. In this review, we will discuss about both the breeding as well as biotechnological interventions made so far, for incorporating drought tolerance in pea and chickpea.

Keywords: abiotic stress, biotechnology, breeding, chickpea, drought, NGS and pea

DETERMINATION OF VIRULENCE PROFILE OF WATER BORNE EMERGING PATHOGENS USING PHENOTYPIC SCREENING ANALYSIS

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Major factors contributing to virulence include toxins, proteases, hemolysins, lipases, adhesins, agglutinins, exotoxins, cytotoxins, endotoxins, siderophores, invasions, adhesions, S-layers flagella (Kirov 2003). These virulence factors are useful in distinguishing potentially pathogenic and non-pathogenic strains using phenotypic screening. In current studies, morphologically and biochemically characterized waterborne pathogens (*E.coli*, *Enterococcus*, *Klebsiella*, *Aeromonas*, *Yersinia*, *Campylobacter*, *Staphylococcus*, *Listeria*, *Vibrio* and *Salmonella*) has been exploit for their pathogenicity using phenotypic marker test. Congo red and crystal violet binding test can help in determination of biofilm forming and virulent plasmid bearing potential of isolates. DNase (deoxyribonuclease) catalyzes the hydrolytic cleavage of phosphodiester linkages in the DNA backbone. Pathogenic isolates producing DNase have a growth advantage by enlarging the pool of available nucleotides by DNA hydrolysis, also has been hypothesized to play a role in the dissemination and spread of infecting bacteria by liquefying pus. Furthermore pyrazinamidase enzyme, which hydrolyses pyrazinimide to pyrazinoic acid, is a confirmatory test for exotoxin producing human pathogenic isolates. Lipase and protease activity evident the invasion capability by distorting lipopolysaccharide and protein layer of host cell. In addition, haemolysis, bile esculin and antibiotic sensitivity test are marker test to determination of pathogenicity. Bacterial isolates have also been tested for swimming swarming and twitching motility, positive results show their capability to invade blood, serum, lymph and tissues. Phenotypically characterized virulent strains confirmed molecularly for the presence of virulent genes. It has been analysed that the above simple, rapid and inexpensive phenotypic marker tests are promising tool to differentiate virulent strain from avirulent ones.

FIELD EFFICACY OF CERTAIN CHEMICALS AND NEEM PRODUCTS AGAINST SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE) ON BRINJAL (*SOLANUM MELONGENA* L.) IN TRANS YAMUNA REGION OF ALLAHABAD

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A field experiment was conducted during kharif 2016 at Central agriculture field, SHUATS (Sam Higgin bottom University of Agriculture, Technology and Sciences), Allahabad, Uttar Pradesh (India), to determine field efficacy of certain chemicals and neem products against shoot and fruit borer (*Leucinodes orbonalis* Guenee) on brinjal (*Solanum melongena* L.) in trans yamuna region of Allahabad. The result showed that the carbosulfan 25 EC @ 0.05% was found most effective and showed (6.50%) shoot infestation, per cent fruit infestation (8.70%), followed by Quinolphos 20 EC @ 0.05% (7.96%) and (9.75%), Cypermethrin 25 EC @ 0.05 (8.02%) and (10.29), Chlorpyrifos 20EC @0.05% (8.07%) and (11.42%), Neem oil @ 2% (8.61%) and (11.62%), NSKE @ 5% (10.94%) and (12.58%) and Neem leaf extract @ 5 % (12.11%) and (16.45%) respectively.

Keywords: *Leucinodes orbonalis*, insecticides, neem products.

TRICHODERMA SPECIES AS BIOCONTROL AGENTS

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Plant diseases play a direct role in the destruction of natural resources in agriculture. In particular, soil-borne pathogens cause important losses, fungi being the most aggressive. The aggressive of these fungus shows drastic impact on crop production and productivity. The phytopathogenic fungi, such as *Pythium*, *Phytophthora*, *Botrytis*, *Rhizoctonia* and *Fusarium*, has spread during the last few years due to changes introduced in farming, with detrimental effects on crops of economic importance. The breeding of resistant crops is time-consuming and difficult as often new races of pathogens evolve and crops become susceptible. The use of agrochemicals in controlling the disease has been ineffective and cause environmental hazards. By contrast, the use of microorganisms that antagonize plant pathogens (biological control) is risk-free when it results in enhancement of resident antagonists. Antagonists of phytopathogenic fungi have been used to control plant diseases, and 90% of such applications have been carried out with different strains of the fungus *Trichoderma*. Most of these strains are classified as imperfect fungi since they have no known sexual stage. Strains of *Trichoderma* are increasingly being used to control soil borne plant pathogens. The most frequently suggested mechanisms of biocontrol by *Trichoderma* include mycoparasitism, antibiosis, competition for nutrients, or all of the above. *Trichoderma* can inhibit the pathogen by means of antibiotics or cell wall-degrading enzymes (CWDEs) such as chitinases, 6-1, 3-glucanases, proteases, mannanases, and other hydrolases. The relative importance of these two mechanisms in the antagonistic process depends on specific pathogenhost interactions. Several genes encoding to hydrolytic enzymes (chitinases, 8-1, 3-glucanases) have been isolated and characterized from *Trichoderma* spp. The genes from *Trichoderma* species have been transferred and expressed in plants for improving biotic and abiotic stress tolerance. Endochitinase and endoglucanase genes can serve as a useful source for resistance incase of some important diseases like sheath blight of rice, where resistant germplasm is not available in the wild relatives. Crops can be transformed with endochitinase and endoglucanase genes to develop resistance against various plant pathogens.

BIOLOGICAL MANAGEMENT OF BASE ROT OF *ALOE BARBADENSIS*

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Aloe vera (*Aloe barbadensis*) Miller, is a perennial drought resisting succulent plant belongs to the family Liliaceae with its believed to have originated in African continent specifically in Egypt (Daodu, 2000). There are over 300 species of Aloe, but it is the *Aloe barbadensis* (*Aloe vera* or "true Aloe") plant which has been most use to mankind because of the medicinal properties. Fully grown, the plant stands 30-36 inches high, and a mature leaf is 2.5-3.1 inches wide. The plant, being a cactus plant, contains 95-96% water and they are not habitat for cold region. The over 75 other constituents which include vitamins, minerals, enzymes, sugars, phenolics compounds, saponins and amino acids etc. (Joshi, 1998). Because, these constituents of the plant. It is highly employed in professional medicine and cosmetics industries. A leaf rot diseases caused by *Fusarium oxysporum* were reported from the USA. In India, leaf rot is one of the most serious fungal diseases affecting the commercial cultivation of *Aloe vera* in North India. These are the leaf rot disease of *Aloe vera* caused by fungal and most destructive disease under field conditions. Among the botanicals maximum percent disease control were recorded T₄= Neem

leaf extract @5% PDC (55.26, 56.33) followed by T₅= garlic bulb extract @5% PDC 52.27, 52.58 and T₆= Tulsi leaf extract @5% PDC 43.94, 44.70 control leaf rot of *Aloe vera* caused by *Fusarium oxysporum*.

THE ROLE OF HONEY BEES IN POLLINATION

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The pollinators and flowering plants form an interdependent compatible system, where the former derive their nourishment in the form of pollen and nectar and later in the process receive the benefits of cross pollination. Out of 95 per cent of the flowers which are cross pollinated, more than 85 per cent depend on insect for pollination and amongst 300 commercial crops about 84 per cent are insect pollinated. Amongst 80,000 species of insect pollinators, 17,533 species of bees are identified as pollinators worldwide. Pollination done by honey bees is called melittophily. Of the 160 million hectares of the cropped area, more than 55 million is under bee dependent crops. At present four or more species of honeybees are found in the Indian sub-continent viz. *Apis cerana*, *Apis dorsata*, *Apis florea* and *Apis mellifera*. They can enhance 11-79 per cent yield in different crops through pollination and improve quality of fruits and seeds. Increase in yield under open pollination depends upon natural densities of bees in the local context and as such cannot be used as a yard-stick for comparison of yield. Moreover, a worldwide decline of pollinator densities has been noticed due to indiscriminate use of pesticides, deforestation and monoculture. Here arises need of planned honey bee pollination. The requirement of honey bee colonies varies from crop to crop. At blooming period, requirement of *A. cerana* and *A. mellifera* colonies vary from 2-25 and 1-15 colonies in different fruit crops, respectively. However, in oilseeds, the requirement varies from 4-10 and 3-5 colonies of respective honey bee species. Apple growers of Himachal Pradesh during the bloom period, a minimum of 2-3 strong colonies per hectare being recommended in mature orchards having sufficient level of pollinizer level (33%). The number must increase to eight colonies per hectare if pollinizer level is low. Besides recommended number of colonies, the planned honey bee pollination also has some other prerequisites like they must be placed in apple orchards when the flowering has started (5%), avoiding further short distance shifting of colonies, avoiding insecticidal sprays during blooming period and need based use of pollen dispenser. The conservation of natural pollinators by using selective and reduced risk insecticides and creating awareness amongst farmers and growers can also solve the problem of declining pollinators.

ISOLATION, BIOCHEMICAL CHARACTERIZATION AND IDENTIFICATION OF *BACILLUS* ISOLATES FROM DIFFERENT SOIL SAMPLES FOR PHOSPHATE AND POTASSIUM SOLUBILISATION.

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Soil microorganisms play a vital role in maintaining the ecological balance by active participation in Carbon, Nitrogen, Sulphur, Phosphorus and Potassium cycles in nature. Phosphate solubilising microbes plays an important role in plant nutrition through increase in phosphate uptake by plants and is used as bio fertilizers of agricultural crops. Phosphate is second most vital macronutrient required for the growth and development of plants. The potassium solubilising microorganisms (KSMs) are rhizospheric microorganism which solubilises the insoluble potassium (K) to soluble forms of K for plant growth and yield. K-solubilisation is carried out by a large number of saprophytic bacteria.

The aim of this study was to isolate ten different *Bacillus* isolates from various soil samples and their identification on the basis of Gram staining, colony morphology and biochemical tests. Gram positive rod shaped bacteria showing large, circular, opaque colonies having white or greyish white appearance were preserved on Nutrient agar slants for further identification tests. All the isolates showed positive results for Catalase, Urease, Oxidase and motility tests. For other Biochemical tests mixed results were obtained. Phosphate solubilisation and Potassium solubilisation activities of different isolates was performed. Out of ten isolates, none of the isolates solubilised phosphate on Pikovskaya's agar medium at 30°C after 15 days of incubation. Potassium solubilising activity was shown by two isolates (Sample code 3 and 9) out of ten. Among these two isolates, Sample code 3 showed highest potassium solubilisation and the clear zone measured on Aleksandrov agar medium was 9mm and that of Sample Code 9 was 5mm after 10 days of incubation at 30°C.

ISOLATION AND IDENTIFICATION OF *BACILLUS* ISOLATES FROM DIFFERENT SOIL SAMPLES FOR AMYLASE PRODUCTION.

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Amylase is an enzyme that catalyzes the breakdown of starch into sugars and plays a pivotal role in variety of areas such as production of ethanol, high fructose corn syrup, detergents, modified starches and paper recycling. Plants, animals and microbes can produce amylases. Microbial amylase have a broad spectrum of industrial applications as they are more stable with great genetic diversity, high enzymatic activity in a wide range of condition and (extreme pH, temperature, osmolarity, pressure etc) simple and cost effective production and easy manipulation to obtain enzymes of desired characteristics.

A total of ten different *Bacillus* isolates was isolated from various soil samples for their identification on the basis of Gram staining, colony morphology and biochemical tests. Gram positive rod shaped bacteria showing large, circular, opaque colonies having white or greyish white appearance were preserved on Nutrient agar slants for further identification tests. All the isolates showed positive results for Catalase, Urease, Oxidase and motility tests.

The isolates were screened for the production of amylase and its assay has been performed. Seven isolates displayed zone of clearance in starch hydrolysis test except Sample code 5, 7 and 8. Sample code 5, 7 and 8 were the only isolates that gave negative results for TSI tests among all ten isolates. The isolates were subjected to amylase activity test. Maximum amylase was produced by Sample code 9 i.e. 3.90 mg/ml after 24 hours of incubation. Sample code 10 showed least amylase production i.e. 0.86 mg/ml.

DROUGHT-RESPONSIVE REVERSIBLE AND IRREVERSIBLE CHANGES IN THE CYTOPLASMIC PROTEINS: COMPARATIVE PROTEOMICS OF RICE GENOTYPES WITH CONTRASTING TOLERANCE

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Drought is one of the common and crucial environmental conditions among abiotic factors, which adversely effects the plant growth, development, and productivity of agricultural crops worldwide. Plants have been adapting different mechanism to respond to this stress at physiological to molecular levels for their survival. Studies on genetic variations for dehydration tolerance in plants is crucial because divergent cultivars with contrasting traits aid the identification of key cellular components that confer better adaptability. The cytoplasm serves as the main repository for important signaling components including proteins for building defence system. To better understand drought tolerance mechanism, a proteomic study was performed on the cytoplasmic proteins of Kiran, drought susceptible rice genotype and compared with another contrasting Heena, a tolerant genotype. The proteome was generated using two-dimensional gel electrophoresis (2-DE). The MALDI-MS/MS analysis led to the identification of 81 drought induced proteins. Many genotype-specific differentially expressed proteins revealed their involvement in variety of cellular functions like BEM, CDR, PBS and cell signaling and differing ability to recover from drought-induced damage. Drought sensitive cultivar Kiran the largest percentage of the identified proteins was involved in bioenergy and metabolism (34%), cell defense and rescue (20%), biogenesis and storage (15%), and miscellaneous (22%). The expression patterns of some of the corresponding genes were further analyzed at the mRNA level using real-time RTPCR.

STEINERNEMA SURKHETENSE (NEMATODA STEINERNEMATIDAE) , SHORT JUVENILES FROM BAHADRABAD ,UTTARAKHAND.

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India is an agricultural diverse country but every year there is a great loss to the productivity because of entomic fauna that destroyed these agricultural crops. One of the way to combat this destruction is the use of biopesticides which on one hand destroy the pests on the other hand increase productivity of the soil and are safe to the environment in all aspects. EPNs are one among the most successful biocontrol agent to fight the pesky insect pests. To get efficacious strain, soil sampling was done from different areas of Uttarakhand. During soil baiting technique isolates were recovered and were identified as *Steinernema*. Their species level characterization on the basis of morpho-taxometrical and molecular studies confirmed to be conspecific to *S. surkhetense*. Morphologically, isolates CS41 and CS44 are found more or less the same as that of the original described species but showed little variations morphometrically . Furthermore the strains were characterized by the sequence length of the ITS regions (740bp), ITS1 (277 bp), ITS2 (306bp) and also by the nucleotide composition and pairwise distance between related species. The analysis of ITS-rDNA sequences revealed nucleotide differences at 376, and 713 positions in aligned data. No difference was observed in D2-D3 domain.

Key words: biocontrol, EPNs, ITS-rDNA and D2D3.

GEL ELECTROPHORESIS FOR THE IDENTIFICATION OF CROP VARIETIES

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The use of various types of gel electrophoresis for distinguishing between and identifying plant varieties is well established. This review describes how different electrophoretic techniques [native polyacrylamide gel electrophoresis (PAGE), sodium dodecyl sulphate PAGE, isoelectric focusing and two-dimensional methods] have been utilised in a wide range of crop species. The fact that there are different types of plant variety, varying in genetic structure, is emphasized, and the way in which this influences the choice of technique is discussed. Other factors which need to be borne in mind when discussing identification in its broad sense are also outlined. Some practical applications of electrophoresis in this area are mentioned and finally future trends for the use of electrophoresis in plant variety identification studies are considered.

Keywords: Electrophoresis, PAGE, genetic, variety

PHENOTYPIC PLASTICITY IN PLANTS

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Climate change is altering the availability of resources and the conditions that are crucial for plant performance. Plants respond to these changes by inducing shifts in phenotype. A single genotype can produce different phenotypes in different environments. This fundamental property of organisms is known as phenotypic plasticity.

Based on the duration of the change both long term and short term plasticity have been reported. Abiotic factors such as light, temperature, water, salt stress, CO₂ and biotic factors such as neighbouring plants and herbivory influences the phenotypic plasticity. Functional traits are those that help to describe the ecology of species. To assess plasticity in plants, a few easily quantifiable variables have been identified the plant functional traits. Functional types are widely used in global climate models to group species according to their function in the ecosystem or community. Evolution of adaptive plasticity requires that plastic genotypes have the highest global fitness averaged over the environments rather than the highest fitness in each environment separately.

The plastic molecular responses to environmental signals can occur in many ways. An external stimulus must first be perceived at the cell surface by a receptor that then initiates a signaling cascade. The evolution of plasticity may be constrained by costs and limits of plasticity, and that as a consequence specialist genotypes or intermediately plastic ones may evolve instead of highly plastic generalist genotypes.

ROLE OF ENDOSYMBIONTS IN INSECT NUTRITION, GROWTH AND DEVELOPMENT

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The symbionts play a key role in nitrogen management, synthesize a range of essential amino acids and in aphids and beetles they up grade non essential amino acids to essential amino acids. In aphids, sterols are supplied by symbionts. Yeasts associated with some aphids, plant hoppers and beetles produce sterols. Most mycetocyte symbionts are prokaryotes. None has been cultured *in vitro* and their taxonomic position is obscure. Yeasts have been reported in Cerambycidae and Anobiidae (Coleoptera) and a few plant hoppers. They are culturable and those in anobiids have been assigned to the genus *Torulopsis*. The mycetocyte cells may be associated with the gut, lie free in the abdominal haemocoel or be embedded in the fat body of the insect. The mycetocytes are large polyploid cells which rarely divide and the symbionts are restricted to their cytoplasm. The mycetocyte symbionts are transmitted maternally from one insect generation to the next. In many beetles (Anobiidae, Cerambycidae, Chrysomelidae and Cuckulionidae), the microorganisms are smeared onto the eggs and consumed by the hatching larvae. In other insects, they are transferred from mycetocytes to oocytes in the ovary, a process known as transovarial transmission. Within an individual insect, the biomass of symbionts varies in a regular fashion with age, weight and sex of the insect. The symbionts of beetles and haematophagous insects may provide B vitamins and those in cockroaches and Homoptera essential amino acid. The role of symbionts in the sterol nutrition of insects is equivocal. Mycetocyte symbionts may have evolved from gut symbionts or guest microorganisms. The association is monophyletic in

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cockroaches but polyphyletic in many groups, including the sucking lice, beetles and scale insects. The mycetocyte symbioses are commonly regarded as mutually beneficial but the selective advantage to the microbial partner is unclear.

Keywords: Endosymbionts, Mycetocytes, Yeasts, prokaryotes and microbial.

EFFECTS OF INTERCROPPING ON RHIZOSPHERE SOIL BACTERIAL COMMUNITIES IN AMORPHOPHALLUS KONJAC.

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Soft rot disease causes heavy loss in konjac production every year, which caused by the genus *Pectobacterium* has been recognized as a major reason why konjac industry has not boomed in worldwide. However, intercropping with economically important trees can effectively control affect soft rot disease epidemics. Consequently, we conducted a rhizosphere bacterial diversity study to assess how intercropping affects soft rot disease using next-generation DNA sequencing. The results demonstrate the Shannon diversity index and Chao 1 index for soil bacteria were relatively steady under intercropping conditions, but changed greatly for the konjac monocrop with the increase in the number of cropping years. Of the 44 bacterial genera with relative abundance ratios of >0.3%, 11 were significantly affected by the duration of continuous cropping and the cultivation mode. *Luteolibacter* and *Bacteroides* showed highly significant differences between the monocrop and the intercrop for three continuous years. *Pseudomonas* was significantly affected by the different cultivation modes, while *Myroides* was significantly affected by planting age. Intercropping altered the structure and composition of the soil bacterial community, which led to a relative balance of beneficial bacteria, and the relative balance of beneficial bacteria is helpful to reduce the incidence of soft rot.

CORRELATION OF MICROBES WITH PROGRESSION AND CONTROL OF NEUROLOGICAL DISORDERS

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Dementia is an acquired disorder of the brain, designating an impairment of established mental functions due to various aetiologies, representing a decline from premorbid level which is severe enough to impair normal daily functioning. Seen in old people, but dementia is not a part of normal aging process. The increasing cases of cognitive impairment worldwide is a matter of concern keeping in mind the tremendous amount of social and economic burden it imposes on affected individuals. Dementia is a chronic and rapidly progressing phenomenon with no treatment that ensures complete recovery.

Neuromicrobiology is the field of science that encompasses the interaction between the Central Nervous System and the microbiome. The microbiome has a tremendous amount of impact on human health. It is one of the major environmental factors that affect the physiology and functioning of the host system. In this report, I have reviewed the impact microbiome imposes on host behavior and brain development.

The use of Psychobiotics, which are the probiotics that help overcome psychiatric disorders, have been found to improve cognitive behavior in animal models.

If not a treatment that completely cures the disorder, Psychobiotics are a promising alternative to drugs and help to delay the multi deficit effects dementia causes.

BIOTECHNOLOGICAL INTERVENTIONS FOR THE BROADENING OF GENE POOL: A CASE STUDY OF RAPESEED MUSTARD

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Application of biotechnology for increasing crop productivity is imperative as conventional approaches are either inefficient or unable to overcome constraints limiting crop productivity. In particular, strengthening of hybrid technology through development of novel genetic stocks for efficient turnout of improved varieties could enhance crop productivity. The availability of a genetic diversity in a genepool is the first requirement of crop improvement. The genetic variation determines further improvement of a crop with respect to the yield, quality and stress tolerance. The wide hybridization is the primary way to broaden the genetic diversity of native genepool which requires biotechnological interventions, techniques and skills to achieve the goal in a prescribed time frame. As we know *Brassica juncea*, commonly known as Indian mustard, is an amphidiploid crop evolved in nature through intercrossing of parental diploid species *B. rapa* and *B. nigra*. The genetic diversity present in the native genepool of *B. juncea* is not effective for further improvement of yield, quality and stress tolerance. So, there is a need to broaden the genetic variation by developing new gene combinations from the wild as well as the distantly related species. The resynthesis of *B. juncea* using its diploid progenitor species as well as the introgression of

gene(s) from the other related and wild species will be an effective tool for broadening of the gene pool which will help in the mustard improvement program and lead to the development of novel genetic stocks, and ultimately the development of the new varieties with the agronomical/economical important traits.

Keywords: genetic diversity, introgression, Indian mustard, resynthesis.

BIOTIC AND ABIOTIC STRESS MANAGEMENT IN PULSES CROPS

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Pulses being rich in protein, minerals and vitamins, play a significant role in the nutritional security of many people, especially those below poverty line. The poor productivity of pulses in India is attributed primarily to poor spread of improved varieties and technologies. These crops being grown as rain fed (87%) on marginal and sub-marginal lands are frequently prone to biotic and abiotic stresses. Among the abiotic stresses, drought and heat stress may reduce seed yields by 50%, especially in arid and semiarid regions. Poor drainage, water logging during the rainy season causes heavy losses to pulse crops. Another major problem is salinity and alkalinity of soils, which is extensive both in semi-arid tropics and in the Indo-Gangetic Plains (IGP). Biotic stress occurs as a result of damage to plants by other living organisms, viz. weeds, insect-pests, causal organisms of diseases, nematodes, allelopathic chemicals, etc. Many chemicals have though proved effective in controlling biotic stresses, but these are not cost effective. Various non-monetary inputs/ techniques, viz. selection of crops, selection of drought-resistant, drought tolerant, early-maturing, short-duration varieties, healthy and disease-free seeds, seed treatment need to be adopted for mitigating abiotic and biotic stress for maximizing productivity and profitability of the dry land farmers. Better crop management practices like nutrient, water and weed management, insect-pest and disease management are essential to withstand these stresses. It is concluded that biotic and abiotic stresses are the major barriers in enhancing the productivity of pulse crops in India. There is an urgent need to minimize the adverse effects of these stresses on the pulse crops to enhance the productivity and production of pulses to meet the challenge of nutritional security in the country.

FISH FARMING: BASIC PRINCIPLES, MAINTENANCE AND MONITORING

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The term 'aquaculture' covers all forms of cultivation of aquatic animals and plants in fresh-, brackish- and saltwater. Aquaculture has the same objective as agriculture, namely, to increase the production of food above the level that would be produced naturally. Today, aquaculture is responsible for an ever-increasing share of global aquatic food production, which has increased from 3.9 percent in 1970 to 31.9 percent in 2003 (FAO, 2005). This paper focuses on the small-scale cultivation of mainly freshwater fish species. As in agriculture, fish farming techniques include: Removal of unwanted plants and animals, Replacement by desirable species of fish, Improvement of these species by crossbreeding and selection, Increase of nutrient availability by the use of fertilisers and feeds. Fish farming can be combined with agriculture, animal husbandry and irrigation practices, which can lead to better utilisation of local resources and ultimately to higher production and net profits. This practice is called 'integrated fish farming'. To achieve a high production of fish in the pond, regular maintenance and monitoring is vital. Daily management includes: Checking the water quality (oxygen, pH, colour, transparency, temperature, etc.), Checking the pond for possible water leaks, Cleaning the screen of the water inlet and outlet.

Keywords: Fish farming, Aquaculture, integrated fish farming, maintenance and monitoring.

BETALAINS – ROLE IN CARDIOVASCULAR DISEASES AND THALASSEMIA

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Betalains are water-soluble nitrogen containing pigments, which are synthesized from the amino acid tyrosine and consist of two structural groups: red-violet betacyanins and yellow-orange betaxanthins. (Azeredo, 2009). Betalains are used for food coloration in products such as ice cream, candies, and processed meat and the quantity in these foods rarely exceeds 50mg/kg due to their strong pigment coloration (Vargas *et al.*, 2000). The majority of plants containing betalains are in the *caryophyllales* family (Moreno *et al.*, 2008). Betalains strongly reduce oxidized LDL cholesterol and protect against cardiovascular diseases. Betalains can bind to LDL and the oxidation of LDL appears to be inhibited by both betanidin and betanin (Guzman-Maldonado *et al.*, 2010). The Regular ingestion of *Opuntia robusta* (500g/day) is able to significantly reduce LDL in a group of patients suffering from hypercholesterolemia (Tessoriere *et al.*, 2004). Betalains assist the body in

a total transformation by neutralizing toxins and supporting the cell's natural detoxification process. They prevent toxins from accumulating and preserve the integrity of the cell and control chronic inflammation. They also reduce the enzymes responsible for causing inflammation, thus protect against CVDs. Betalains protect the thin lining of blood vessels and this helps to reduce the inflammation that makes your blood sticky and leads to clots. Betalains provide significant protection from toxins that directly affect liver (Stintzing *et al.*, 2004). Thalassemia is a blood disorder passed down through families (inherited) in which the body makes an abnormal form of hemoglobin. The disorder results in large numbers of red blood cells being destroyed, which leads to anemia. Betalains play indirect role in thalassemia minor by inhibiting the hemolysis of RBCs and increasing the life of cells. (Tessoriere *et al.*, 2005).

Key words: Betalains, Cardiovascular disease, hypercholesterolemia and Thalassemia

SECONDARY METABOLITES AND THEIR ROLE IN BIOTECHNOLOGY

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Certain plant specific compounds which do not take part in normal growth and development processes of that plant are called secondary metabolites. Commercial value of secondary metabolites is very high as many of these are used as pharmaceuticals, agrochemicals, fragrances, pigments, cosmetics, food additives etc. Although some of these compounds are synthesized chemically due to their complex chemical structures and complicated synthetic pathways, most of them are obtained from plants. Based on their origin plant secondary metabolites are divided into three major groups - Terpenoids, Alkaloids and Phenylpropanoids or phenolics. Secondary metabolites serve: (i) as competitive weapons against other bacteria, fungi, amoebae, plants, insects, and large animals; (ii) as agents of symbiosis between microbes and plants, nematodes, insects, and higher animals. Biotechnology offers a valuable tool to produce these compounds of interest in a desired amount and in an eco-friendly way. The evolving commercial importance of secondary metabolites has in recent years resulted in a great interest in secondary metabolism, particularly in the possibility of altering the production of bioactive plant metabolites by means of tissue culture technology. Different strategies, using an *in vitro* system, have been extensively studied to improve the production of plant chemicals. For plant cell culture techniques to become economically viable, it is important to develop methods that would allow for consistent generation of high yields of products from cultured cells. *In vitro* production of secondary metabolite in plant cell suspension cultures has been reported from various medicinal plants, and bioreactors are the key step for their commercial production. Careful selection of productive cells and cultural conditions result in accumulation of several products in higher levels in cultured cells. In order to obtain yields in high concentrations for commercial exploitation, efforts have to be focused on the stimulation of biosynthetic activities of cultured cells using various methods. The focus is to highlight the various strategies to increase the quality as well as quantity of secondary compounds.

KEY WORDS: Secondary metabolites, Cell suspension culture, Bioreactors and Synthetic pathway.

ANALYSIS OF IMPACT OF ANAEROBIC CONDITION ON THE AFLATOXIN PRODUCTION IN *ASPERGILLUS PARASITICUS* SPEARE

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Aflatoxins are the group of natural carcinogens that are the best- characterized fungal secondary metabolites till date. These mycotoxins are greatly influenced by weather, geographical locations, and agronomic practices. Aflatoxigenic fungi have a strong association with humans and agricultural products. *Aspergillus parasiticus* is exclusively involved in this toxicity as also the *Aspergillus flavus*. Environmental factors like aeration, temperature and substrates favor the fungal growth, proliferation and their toxigenicity. The biosynthesis of aflatoxins can be controlled by obstructing the signal transduction mechanisms. Present study aimed to check any alteration in quantification of conidial spores and assessment of dry mycelial growth under anoxic stress in different time interval. The monosporic strains of *Aspergillus parasiticus* was grown in two different Erlenmeyer conical flasks containing Czapek Dox Broth and Czapek Dox Agar under both aerobic and anaerobic condition. The Anaero Bag System was used to maintain anaerobic. Aflatoxin was isolated after 3, 5, 7, 9 and 11 days, and quantitative estimation was done by using High Performance Liquid Chromatography (HPLC). Various parameters have been used other than HPLC. The experimental outcome showed that maximum percentage inhibitory in growth and proliferation of *Aspergillus parasiticus* had seen after 9th day of anoxic condition.

Keywords: Aflatoxin, Anaerobic, Anaero Bag System, *Aspergillus*, HPLC

STUDY ON PHYTOCHEMICAL CHARACTERIZATION AND ANTIBACTERIAL ACTIVITY OF FRUIT TREES OF CHAMOLI DISTRICT, UTTARAKHAND

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Rubus ellipticus, *Berberis aristata* and *Ziziphus mauritina* are perennial herb from the Himalayas, found to grow on damp, old walls in chamoli. Ethanobotanically, juice of the plants are sore the fruits and applied to food, like a small size red, blue berry and golden pulp. The present study was carried out on the phytochemical characterization and antibacterial activity of the local fruit yielding plants in Chmoli Gharwal. Plant material was subjected to extraction using ethanol solvent. Phytochemical screening of the extract showed the presence of alkaloids, proteins, carbohydrates, cardiac glycosides, tannins and phenolic. The extract of the plants were assayed for antibacterial activity against the pathogenic bacterial strains. Out of the extracts assayed, the ethanol extracts was most active against the four gram positive and one gram negative bacterial stain while the ethanol extract was most active against. Maximum zone of Inhibition against (Antibacterial activity) *E. faecalis* strains and minimum inhibitory concentration also *E. faecalis* showing zone of inhibition. Therefore, minimum inhibitory concentration (MIC) of these extracts was determined against the selected bacteria showing zones of inhibition. The MIC for different strains range between 12mg/ml to 17mg/ml. So, it can be concluded that ethanol extract of possess good antibacterial activity that can be enhanced if the phytoactive components are purified and adequate dosage is determined for proper administration.

INVESTIGATION OF NEMATODE RELATED FACTORS THAT REGULATE PLANT ORGAN FOR ADVANCING NEMATODE INFECTION

MANISH KUMAR

Plant-parasitic nematodes (PPN) inflict considerable damage to a wide range of plant species. Based on their economic importance, most harmful nematodes are cyst nematodes (*Heterodera* and *Globodera* spp.) and root-knot nematodes (*Meloidogyne* spp.), which are sedentary endoparasitic in nature and cause vast economic losses in agriculture worldwide. Second-stage juvenile (J2) nematodes penetrate the plant root at the elongation zone and move towards the root stele where they manipulate pathways implicated in root development to induce feeding sites called syncytia (for CN) or giant cells (GC; for RKN). GCs induced by RKNs are most commonly derived from parenchymatic cells within the stele that surround the nematode head during parasitism. Based on histological observations, it is believed that giant cells (GCs) induced by RKNs are most commonly formed from parenchymatic cells within the stele that surround the nematode head and that the primary effector molecules stimulating GC formation are esophageal gland secretions. Galls and syncytium could be considered as a de novo originated pseudo-organ in roots with similarities with the formation of post-embryogenic organs, e.g., LR, adventitious roots (ARs) or nodules induced by rhizobia. It is documented that the nematode secretions contain phytohormones, such as auxins and cytokinins, and small peptides that could interfere with basic developmental pathways leading to the hypertrophy and/or hyperplasia of cells in the vascular cylinder, endodermis and cortex that form a knot or gall, which contains the GCs. There are parallelisms between lateral root (LR) development, RKN gall formation based on similar expression patterns of genes encoding transcription factors and cell cycle regulators. This, together with the common activation patterns of tagged lines in LRs and galls, similar molecular components to those processes were identified in galls, such as crucial transcription factors (IDA, CLAVATA, CLE41, CLE44, TDIF, AUX1, MONOPTEROS, PIN3, ATHB8, WOX4, PHAN, KNOX, LBD16 and WRKY23). Procambium associated genes have more role in galls and syncytium formation than other vasculature genes. These plant roots secreted peptides, mimics of which are also found in nematode esophageal secretions make fool of plant roots defense system and involve in advancing of giant cells and syncytium formation. In this respect, understanding how the RKNs interfere with basic developmental pathways leading to proliferation of cells and differentiation of new root cell types, should be a prerequisite to design new effective biotechnological tools (RNAi- gene silencing) for their control.

MITRAGYNA PARVIFOLIA (ROXB.) KORTH. - AN INDIAN MEDICINAL PLANT

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Mitragyna parvifolia (Roxb.) Korth is an economically useful and highly endangered deciduous tree found in well drained deep soil of Indian Thar Desert belonging to the family Rubiaceae. The Indian Thar Desert comprises about 70% part of the Western Rajasthan, incorporating districts. It would become well prove crucial for any attempts of re-establishment and

Environment has been an advanced supply of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources, many based on their use in traditional medicine. The use of herbal drugs for the prevention and treatment of different health ailments has been in practice from time immemorial. Several species of genus *Mitragyna* are extensively used in traditional medicine for treating opium addicts and as stimulant and pain reliever. *Mitragyna parvifolia* is recommended in Ayurveda texts for prevention and treatment of Anti-arthritis, Antipyretic, Anticonvulsant, Anthelmintic, and Anti-microbial, Anti-inflammatory, Anti-nociceptive, Ant proliferative and Antioxidant activity. A collection of Mitrephylline, Isomitrephylline, Pteropodine, Isopteropodine, Speciohylline are the major oxindolic alkaloids isolated from plant leaves. Important variations in the nature and quantity of alkaloids present in different parts of the plant are visible with change in geographical locations. In addition, various parts of the tree such as fruit juice, leaves and stem bark have been used in the traditional system of medicine by the natives and tribal since times immemorial. In some parts of India, bark and roots used for fever colic, gynecologic problems. Fruit juice used to enhance breast milk secretion in lactating mothers. In Andhra Pradesh, fresh leaf juice used to treat jaundice. In Karnataka, India, stem bark used for biliousness. Bark paste applied externally for muscular pains. Bark decoction used for fevers. Powdered bark boiled with fruits and inhaled through the mouth for toothache.

Keywords:- *Mitragyna parvifolia*, Indian Medicinal Plant and Rubiaceae.

ANTIHYPERLIPIDEMIC EFFECT OF *CHENOPODIUM ALBUM* IN RATS

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Incidence of Cardiovascular diseases increases day by day globally. A high level of blood lipids is major risk factor for the cardiovascular diseases. Hyperlipidemia is associated with elevated total cholesterol and triglycerides level in serum. Herbal medicines are relatively cheaper and safe alternative treatment for various diseases. *Chenopodium album* belongs to the family Chenopodiaceae. It is also known as bathua, vastukah, fat-hen and goosefoot. The aim was this study to explore antihyperlipidemic activity of hydroethanolic extract of *Chenopodium album* (CAHE) after 28 days administration in albino rats. Antihyperlipidemic effect was evaluated by conducting the biochemical test viz. total cholesterol, LDL-Cholesterol, HDL-Cholesterol and triglyceride level in serum. Thirty six adult Sprague Dawley albino rats were randomly divided into six groups each containing six animals was used in this study. The first group was served as a control, group II rats were administered cyclophosphamide as a standard lipidemia causing drug, in group III was administered CAHE @ 400 mg/kg b. wt. and in group IV CAHE @ 400 mg/kg b. wt. was given along with cyclophosphamide @100mg/kg b wt. on 9th and 16th day of study. The result showed that giving of extract of *Chenopodium album* reduced the triglyceride, total cholesterol, LDL-Cholesterol levels, and increased of HDL-cholesterol levels significantly ($P < 0.05$) in rats.

EVALUATION OF DIVERSE BARLEY GERMPLASM FOR DROUGHT TOLERANCE BASED ON MORPHO-PHYSIOLOGICAL TRAITS AND ROOT STRUCTURE ARCHITECTURE

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Barley is an important multipurpose crop subjected to moisture stress and about 44% area under barley is rain-fed in India. In the present study, a diverse set of 220 germplasm accessions of barley comprising of 134 Indigenous collections and 86 exotic lines including 7 accessions of wild barley belonging to *H. marinum*, *H. murinum* and *H. vulgare* ssp. *spontaneum* was evaluated for drought tolerance. PowerCore (v.1.0) software was used to select this diverse set on the basis of agro-morphological and phenological variation present in a large collection of 5000 barley germplasm accessions maintained at National gene Bank of NBPGR, New Delhi. The present set was evaluated for induced osmotic stress using polyethylene glycol (PEG 15%) at seedling stage to study variation in root structure architecture and same set was sown in augmented block design with five checks (RD2660, RD2624, HBL113, Geetanjali and BH902) under rain-fed conditions in the field at NBPGR farm, New Delhi. Physiological parameters like chlorophyll concentration index (CCI), canopy temperature (CT), membrane stability index (MSI), relative water content (RWC) and proline content were recorded at post-anthesis stage and yield and its attributes were measured at physiological maturity. A panel of 17 contrasting accessions viz. IC582699, EC123148, EC578255, EC578279, EC578711, EC578717, IC113045, EC578521, EC492318, EC328981 (drought tolerant) and EC578829, EC578822, EC493921, EC492202, EC578707, IC79456, IC542206 (drought susceptible) was prepared based on stress susceptibility index, an indicator of relative performance under stress and control conditions. The panel is being used for identifying functional genetic variant responsible for variation in drought tolerance in barley using

candidate gene approach. The tolerant accessions identified in this study can be used in barley breeding program for improving the yield potential under rain-fed areas.

Keywords: barley germplasm, candidate genes, drought tolerance, root traits.

GENETIC FIDELITY ASSESSMENT IN MEDIUM-TERM MICROPROPAGATED SHOOT CULTURES OF SUGARCANE (*SACCHARUM OFFICINARUM* L.) AS REVEALED BY DNA BASED MOLECULAR MARKERS

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The presence of genetic variations among plantlets is often encountered as a major problem when micropropagated cultures are maintained under *in vitro* conditions for medium-term and long-term time periods. Therefore, micropropagated plantlets of an early maturing high yielding sugarcane genotype Co 0239 established from axillary buds as explants about five years ago were tested to detect the presence of somaclonal variations by using three different types of DNA based molecular markers i.e. random amplified polymorphic DNAs (RAPDs), inter simple sequence repeats (ISSRs) and simple sequence repeats (SSRs). In the present study, a total of one hundred micropropagated plantlets were established in soil under ambient environmental conditions of which five to six plantlets were randomly selected to assess genetic variations by using above mentioned molecular markers. Out of 17 RAPD, 14 ISSR and 7 SSR primers used for initial screening, only 6 RAPD, 6 ISSR and 4 SSR primers produced respectively 37, 33 and 17 clear, reproducible and scorable bands, with an average of 5.44 bands per primer ranging in size from 110bp to 1305bp. However, no polymorphism was detected among medium-term micropropagated sugarcane plantlets maintained under *in vitro* conditions for five years on full strength basal MS media supplemented with 0.5 mg/L of each BAP and Kinetin. The absence of genetic variations among micropropagated plantlets confirms the true-to-type nature of *in vitro* regenerants. The results presented here demonstrate the reliability of protocol thus established for multiplication of sugarcane genotypes at commercial scale over medium to long time periods for micropropagation, germplasm management and conservation practices.

Keywords: Genetic fidelity, micropropagation, molecular markers, sugarcane, somaclonal variations

MOLECULAR AND BIOTECHNOLOGICAL APPROACH IN PLANT DISEASE MANAGEMENT

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All the agricultural crops are being threatened by diverse variety of biotic and abiotic stress from which the production and productivity of food grains has gone down. About 42% of the world's total agricultural crop is destroyed yearly by disease and pests. Plant diseases are the major challenge in crop production. Crop losses caused by plant pathogens manifest in the form of reduced yield, poor quality produce and reduced post-harvest storage. Due to continuous and excess application of different chemical pesticides against plant diseases control, the level of pesticides is increasing day by day in agricultural commodities and in food chain which promotes the biomagnification process resulting from the negative impact on human health, plant health, animal health and also environment point of view. Plant diseases are increasing in severe form due to change in climate change. Currently, farmers are advised to combine several plant disease management strategies, known as integrated plant disease management. Such strategies include crop rotation, disease free planting materials, field sanitation, resistant variety, biological control and chemical controls. However, some of these methods are quite expensive and ultimately increase the cost of cultivation. But due to advancement in the field of molecular biology, plant biotechnology and plant pathology have made significant role in detection and diagnosis of plant pathogens and management of plant diseases. To develop genetic resistance to diseases in crop plants several techniques of genetic engineering are being used including plant tissue culture, viral coat protein mediated resistance, antisense RNA technology, RNA interference (RNAi), satellite RNA, ribosomal inactivation protein (RIP) and cross protection have been used against plant viruses. The DNA microarray and PCR technology, originally designed to study gene expression and generate single nucleotide polymorphism (SNP) profiles, is currently a new and emerging pathogen diagnostic technology. Genome editing is now a novel approach for plant disease resistance i.e. CRISPER/Cas9 generally regarded as 3rd generation genome editing tools. It was discovered as prokaryotic immune system. Genome editing is used for gene deletion/insertion/replacement, precise base editing, and DNA labeling and transcription modulation. Currently available tools for genome editing include meganuclease, Zinc Finger Nuclease (ZFNs), Transcription Activators Like Effectors Nucleases (TALENs), CRISPER/Cas9 and CRISPER/Cas12a. Exploration of full potential of these technologies and their wide use will help to meet the increasing demand for food and ensure global food security.

HEPATOTOXIC EFFECTS OF SUB LETHAL CONCENTRATION OF CADMIUM CHLORIDE ON LIVER OF CHANNA MARULIUS (HAM.)**MANU VARMA & SEEMA JAIN***Department Of Zoology R.G.P.G. College Meerut*

Heavy Metal contamination exerts an extra stress on metabolically active tissue and organs. The liver is an important organ performing vital functions including biotransformation, migration of lipids, glycogen storage and release of glucose into the blood. Moreover liver contain many enzymes and protein, heavy metal chelation may disrupt the liver tissue by disintegrating the functional and structural properties of the cells. Considerable interest has been shown in recent years in histopathological study while conducting sub lethal tests in fish. Tissue changes in test organisms exposed to a sub lethal concentration of toxicant are a functional response of organisms which provides information on the nature of the toxicant.

The present study has been conducted to understand the hepatotoxic effects of sub lethal concentration of Cadmium chloride (0.8ppm) on the histology of the liver of the fish *Channa marulius*. The histopathological changes induced in the liver were cytoplasmic vacuolization of the hepatocytes, blood vessel congestion, inflammatory leucocytic infiltration and necrosis. All these alterations in liver histology can be considered to monitor the water contaminated with heavy metal salts.

ADVANCES IN BIOLOGICAL SCIENCES AND BIODIVERSITY CONSERVATION**MANZOOR R. KHAN* AND GHAZALA PARVEEN***Section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh.*

This work was carried out to examine the effect of some biocontrol agents (*Trichoderma viride*, *T. harzianum* and *Pseudomonas putida*) both alone and in soil supplemented with some botanicals (*Ricinus communis*, *Lantana camara*, *Cannabis sativa*) on growth, yield and stem gall disease of coriander (*Coriandrum sativum* L.) caused by *Protomyces macrosporus* Unger in a pot experiment. Plants inoculated with *P. macrosporus* caused significant reduction in growth and yield attributes as compared to untreated control. Stem gall intensity was recorded 59% in plants treated with pathogen alone. The results revealed that, application of biocontrol agents / botanicals both alone and in soil supplemented with botanicals caused significant reduction in stem gall intensity (23.43 – 87.51%) as compared to control. Among the tested biocontrol agents, *T. viride* was found superior in enhancing the growth and yield as well as reduction in stem gall intensity (47.32%). Application of biocontrol agents in soil supplemented with botanicals was found more beneficial in enhancing plant growth and yield attributes as well as reducing stem gall intensity (54.47 - 87.53%). Among various combinations tested *T. viride* + *Ricinus communis* and *T. viride* + *Cannabis sativa* caused maximum enhancement in plant growth and yield characters both in pathogen inoculated as well as uninoculated plants.

Key words: Biocontrol agents, Botanicals, Stem gall, Plant growth

IN SILICO ANALYSIS OF IMMUNOMODULATORY POTENTIAL OF BENZYL GLUCOSINOLATE (GLUCOMORINGIN) IN CHICKEN**MAYURI AGARWAL AND SONU AMBWANI***Department of Molecular Biology and Genetic Engineering, C.B.S.H., G. B. Pant University of Agriculture and Technology, Pantnagar 263145, India*

Ethano-veterinary practices are followed for treatment of different health conditions in India as well as in other parts of the world. Many reports have shown that inclusion of herbs in poultry diet can lead to improved health condition of birds. Several plants are reported to possess immunomodulatory activity. However there is paucity of studies proving molecular mechanism responsible for immunomodulatory potential of plants. Cytokines play crucial role in modulation of immune response. Herbal plants exhibit their therapeutic potential due to the presence of various phytoconstituents that may cause immunomodulation through directly interacting with cytokines. *Moringa oleifera* (drum stick) of family *Moringaceae* is known for its medicinal properties. It can act as cardiac stimulants, possess antitumor, immunomodulatory, antipyretic, antiepileptic, anti-inflammatory, antiulcer, properties. Glucosinolates are secondary plant compounds typically found in members of the *Brassicaceae* and a few other plant families like *Moringaceae*. Thus the present study was carried out to explore immunomodulatory potential of one of the phytoconstituent benzyl glucosinolate of *Moringa oleifera* in chicken by conducting *in silico* interaction studies with different cytokines viz., IL-1 β , IL-2, IL-4, IL-5, IL-10, and Interferon gamma of *Gallus gallus*. The protein sequence of interleukin genes were retrieved from NCBI and 3D structures were predicted through Swiss Model tool. The 3D structure of the phytochemical was retrieved from pubchem. Docking studies were performed by using PatchDock server between benzyl glucosinolate and receptors (IL-1 β , IL-2, IL-4, IL-5, IL-10 and Interferon gamma) and the results were analyzed. Benzyl glucosinolate showed maximum ACE with IL-1 β followed by IL-10. Thus it could be predicted from the *in silico* analysis conducted that binding of benzyl glucosinolate with cytokines may be responsible for its

active role for its immunomodulatory potential. However there is need to further explore its immunomodulatory potential through suitable *in vitro* and *in vivo* analyses to confirm these findings.

Keywords: Immunomodulation; *Moringa oleifera*; Benzyl glucosinolate; *Gallus gallus*; molecular docking; cytokines.

INTERACTIVE EFFECT OF SIMULATED ACID RAIN AND AUXIN ON CARBOHYDRATE CONTENT OF CAPSICUM FRUTESCENS VAR. CALIFORNIA WONDER

MEENAKSHI SHARMA, ASSISTANT PROFESSOR, MKP PG COLLEGE, DEHRADUN

Carbohydrate is thought to be a metabolic fuel but it also plays an important role in plant growth and development. Ribose, a form of carbohydrate, plays an important role in DNA and RNA structure and function. They are found in close association with proteins and are involved in many vital activities such as blood clotting, prevention of infection, healing, fertilization etc. The quality and level of carbohydrate depends upon the species of the plant and the environmental conditions in which the plant grows. Carbohydrates are the compounds produced during photosynthesis. Some are used to provide energy and some do the function of cell wall constitution, for e.g. cellulose. The rest are changed to a different chemical form such as starch. In plants, carbohydrate is stored in the form of starch and is stored in fruits seeds and roots for later use.

The carbohydrates formed by plants also provide energy to animals. When animals consume these plants, the energy stored in plants in the form of carbohydrates is released in the process of respiration. Glucose, another form of carbohydrate, is also used by animals to produce other substances for the purpose of growth. In the present study *Capsicum frutescens* (var. california wonder) is taken for the experiment. In one group, one set of plants of *Capsicum frutescens* were treated with normal water, second set of plants with acid water of pH 3, third set with pH 4 and fourth set with pH 5 concentration. In the second group, plants were treated with auxin solution of 10^{-5} , 10^{-6} and 10^{-7} ppm concentration. In the third group, plants were treated with pH3, pH4 and pH5 concentration of acid rain and auxin solution of 10^{-5} , 10^{-6} and 10^{-7} ppm concentration to see if auxin has overcome any detrimental effect done by acid rain. The testing was carried out by anthrone method. The tests were done after 45 days, 60 days, 75days, 90days and 105days respectively. The maximum amount of carbohydrate was found in 45 days old plants treated with auxin of 1×10^{-5} ppm auxin concentration.

Key words: carbohydrate, acid rain, auxin, *Capsicum frutescens*, interactive effect

BIODIVERSITY OF NEMATODES ASSOCIATED WITH SAFFRON FIELDS IN J&K

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Nematodes are ubiquitous in almost every environment all over the world. They have adapted themselves in every ecosystem from marine to fresh water, to soils, colder to hotter regions and from the highest to the lowest elevations. They help the ecological processes of decomposition and nutrient cycling that indirectly affects the primary production hence known as micro faunal gazers. Nematodes monitor ecological changes in soil conditions caused by human interference or natural disturbances. They are the most important attributes of bio-indicator. The present work deals with the study of diversity of nematodes associated with saffron fields. During this study, samples were collected from saffron fields of two different regions. Nematodes were isolated by modified Cobb's decanting & sieving and modified Baermann's funnel techniques. For light microscopy, the extracted nematodes were heat- killed and fixed in FG fixative, dehydrated by slow evaporation method, mounted in anhydrous glycerine and viewed under Olympus BX-51 DIC microscope. Nematodes belonging to three different orders viz. Dorylaimida, Tylenchida and Rhabditida were identified. Several nematodes i.e., *Hoplolaimus*, *Helicotylenchus*, *Dorylaimellus*, *Punguntus*, *Acrobeles*, *Acrobelloides*, *Pratylenchus*, *Cephalobus*, *Ecucephalobus*, *Eudoryulaimus*, *Mesodorylaimus*, *Miodorylaimus*, *Tylenchorynchus*, *Axonchium*, *Dorylaimus*, *Teratorhabditis*, *Laimydorus*, *Ecumenicus*, *Enchodelus*, *Filenchus*, *Psilenchus*, *Discolaimus*, *Allodorylaimus*, *Longidorella*, *Microdorylaimus*, *Heterodera*, *Dorylaimoides*, *Tetylenchus*, *Microdorylaimus*, *Aphelenoides*, *Tylenchus*, *Aphlenchus* and *Pseudacrobeles* were identified. It was found that the genera belonging to the order Dorylaimida were abundant when the field was left undisturbed and in order Tylenchida and Rhabditida some of the genera were common in both the winter and summer seasons. The present study was conducted to investigate nematode diversity of saffron fields which provide a good tool for diagnosis of the complexity and status of food webs.

Keywords: Diversity, Habitat, Nematodes, Saffron fields.

ISOLATION OF NATIVE AZOTOBACTER ISOLATES FROM DIFFERENT RHIZOSPHERE FOR ANALYSIS OF PHYSIOLOGICAL PARAMETERS, PHOSPHATE SOLUBILISATION, AND ANTIBIOTIC SENSITIVITY PROFILING**MEHUL MISRA, KUMARISHAMHAVI¹, RAVINDRA KUMAR¹, B.P. DHYANI², PURUSHOTTAM¹, AKASH TOMAR¹***College of Biotechnology¹ and College of Agriculture², SVPUA&T, Meerut.*

Bio-fertilizers play a very significant role in improving soil fertility by adding nutrients through the natural processes of nitrogen fixation, solubilising phosphorus, and stimulating plant growth through the synthesis of growth-promoting substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization. One of the limiting factors is providing plant nutrients, particularly nitrogen (N) and phosphorous (P) to crops. So the improvement of crop yield by inoculation with diazotrophs like *Azotobacter*, *Rhizobium* and *Azospirillum* has been suggested as an eco-friendly technology. Plant growth promoting rhizobacteria present in the soil employ different strategies to make use of unavailable forms of phosphorus and in turn also help in making phosphorus available for plants to absorb.

Azotobacter belongs to family *Azotobacteriaceae*, aerobic, free living, and heterotrophic in nature. In the present study a total 30 native *Azotobacter* isolates and one microbial culture from IARI were isolated and analysis of Physiological parameters, phosphate solubilisation and antibiotic sensitivity profiling for these isolates were performed. Isolation of the bacteria was done on *Azotobacter* agar (Mannitol) medium showing milky-white, creamy, translucent, mucoid, and circular colonies. These *Azotobacter* isolates were tested on different temperatures (28°C, 33°C, 38°C, 43°C, 44°C and 45°C) and pH (6, 7, and 8). The maximum temperature at which *Azotobacter* grew was 44°C. None of the isolates grew on 45°C. All isolates grew well on alkaline medium of pH value 8. But isolates A-19 and A-20 did not show any growth at pH 6 and 7. Some other isolates such as A-13 and A-17 were found negative to grow at pH 7 and A-15 was unable to grow at pH 6. None of the *Azotobacter* isolates were able to solubilize phosphate, and gave negative results on PVK medium being used. In antibiotic sensitivity profiling, all the isolates were found resistant to Amoxycylav and Erythromycin and all the isolates were inhibited by the Ciprofloxacin by forming a clear zone of 15mm.

THE POTENTIAL APPROACH OF FLY ASH IN THE IMPROVEMENT OF PLANT GROWTH AND THE MANAGEMENT OF ROOT-KNOT NEMATODE OF SOYBEAN**MOHAMMAD HARIS*, ADNAN SHAKEEL, GUFRAN AHMAD, TAUSEEF HUSSAIN AND ABRAR AHMAD KHAN***Section of Environmental Botany, Department of Botany, Aligarh Muslim University, Aligarh-202002, UP, India*

Global demand for food supply has been climbing with increasing population. The global human population may increase by 9 billion people by 2050. The availability of sufficient food resources is one of the major reasons for poverty and hunger. In this regard, the production rate of food must be increased according to the demands. Fly ash (FA) is one of the good substances for improving the agricultural productivity. It is a solid waste by product that is discharged in large quantities from coal power plants. The present study investigates the potential use of fly ash as a biofertilizer for improving soil quality and productivity of soybean crop and also for the management of root-knot nematode (*Meloidogyne incognita*). The pot experiment was conducted with different levels of FA with soil in the greenhouse at Department of Botany, Aligarh Muslim University, Aligarh, India. Seeds of soybean were directly sown in pots amended with different levels of FA (10-60%). After termination of the experiment, it was found that low levels of FA (10-40%) enhanced plant growth and yield of soybean, which was greater at the 30% level. However, at higher levels (50 and 60%) FA played the phytotoxic role for soybean. Gradually suppression of galls and egg mass production was observed at all levels of FA. But at (30-60%) levels of FA was inhibitory for the nematode and no gall formation.

Keywords: Fly ash, growth, nematode, population, soybean, yield

POLYANILINE-BASED NANOCOMPOSITES AND THEIR APPLICATIONS IN VARIOUS FIELDS**^{1,2}MOHAMMAD SHAHADAT*, ¹S.Z. AHAMMAD, ²S. W ALI***¹Department of Biochemical Engineering and Biotechnology, ²Department of Textile Technology, Indian Institute of Technology, Delhi, New Delhi-110016, India*

Doping of polyaniline with CNT/biopolymer and metal oxide nanoparticles is considered as significant promising alternative to improve the functionality of conventional composites. Polyaniline (PANI), Poly-lactic acid (PLA) and Multiwall Carbon Nanotube (MWCNT) supported nanomaterials (MCNT/PANI-Ti, PANI-PLA-TiO₂) have been prepared via in-situ oxidative polymerization method. The synthesized materials have been characterized by various chemical, morphological and thermal analysis techniques. The existences of the functional groups and the morphology of nanocomposite were exposed based using Fourier transform infrared spectroscopy (FTIR), thermogravimetric-differential thermal analysis analysis (TGA/DTA), X-ray

diffraction (XRD), and scanning electron microscopy (SEM) analyses. The nanocomposite materials showed good ion uptake capacity for Na^{2+} ion (2.9 meq g^{-1}). The adsorption behaviour of PANI-MWCNT-Ti towards solvents (CH_3CN , ACOH) and surfactant (CTAB) verified its selective behavior for heavy metal ions (Ni^{2+} , Cd^{2+} , Cu^{2+} and Fe^{3+}). The samples of Polylactic acid-polyaniline (PLA- PANI) and PANI-PLA- TiO_2/AgO prepared by incorporating a fixed content of metal oxide nanoparticles (TiO_2 and AgO) and different loadings of PANI (2, 5, and 10 %) demonstrated noteworthy EMI shielding and UV-protection by guarding the passage of UV-visible light. Thus, PANI-MWCNT and PLA-PANI-supported metal oxide nanoparticle composites could be effectively used as an adsorbent, a UV protector, and EMI shielding material for various sustainable applications.

IMPORTANCE OF QUALITY ANALYSIS OF BUCKWHEAT GENOTYPES

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Fagopyrum esculentum, common/sweet buckwheat and *Fagopyrum tartaricum*, tartary/bitter buckwheat is a gluten-free pseudocereal which has potential as functional food due to high biological value. Buckwheat occupies a special place amongst cultivable crops due to its nutritional, dietetic and therapeutic properties. Buckwheat has attracted increasing attention from food scientists for its healing effects over chronic diseases because of its higher phenolic contents. Grains and other parts of the plant are applied in the food, pharmaceutical, cosmetic and feed industry. Buckwheat has favourable composition in terms of a high biological value of proteins, trace elements and dietary fibre. The grain is generally used as human food and as animal or poultry feed, with the dehulled groats being cooked as porridge and the flour is used in the preparation of pancakes, biscuits, noodles, cereals, etc. The protein of buckwheat is of excellent quality and is high in the essential amino acid lysine, unlike common cereals. This, coupled with the plant's ability to do well on poorer soils, probably accounts for its widespread usage. Faced with acute problem of protein energy malnutrition in present days in many countries, the content and quality of pseudocereal proteins in general and buckwheat in particular have become a pertinent point of consideration. There is a large pool of promising germplasm available in the country which can be utilized for nutritional security of the vulnerable population groups. The study highlights the biochemical constituents and bioactive compounds present in different varieties of buckwheat genotypes. The study also evaluates the nutritional and antioxidant potential of Indian buckwheat grains and demonstrates that a grain of *Fagopyrum* species under study possesses high protein, carbohydrates, phenolic contents and antioxidative potential.

Key words: *Fagopyrum esculentum*, biochemical, bioactive, pseudocereal.

NANOBIOTECHNOLOGY: CHANGING HORIZONS OF SUSTAINABILITY

NUPUR SINGH

Scientists worldwide are continuing to discover unique properties of every day materials at the submicrometer scale. This size domain is better known as nanometer domain and technology concerned with this is known as nanotechnology that involves working with particles at nano level. One of the most important emerging fields of sustainability in this century is Nanotechnology. It deals with designing, construction, investigation and utilization of systems at the nanoscale. The interface between nanotechnology and biotechnology is nanobiotechnology, which exploits nanotechnology and biotechnology to analyse and create nanobiosystems to meet a wide variety of challenges and develops a wide range of applications. Biotechnology gives us a way to understand biological system and to utilize our knowledge for industrial manufacturing. Nanotechnology has great potential and by the help of its application it can enhance the quality of life through in various fields like agriculture and the food system. Around the world, it has become the future of any nation. Important tools used in nanotechnology and application of nanobiotechnology in agriculture sector will be discussed in this review.

ISOLATION OF LICHEN ACIDS IN *EVERNIASTRUM CIRRAHTUM* FOR THERAPEUTIC USE

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Objective: Isolation, purification and identification of lichen acids as chemical markers for medicinal use.

Hypothesis: Lichens belong to lower plant group and formed by symbiotic association of fungi and algae. Lichens have ability to produce a great variety of secondary metabolites with various biological activities including anti-microbial, anti-pyretic, analgesic, anti-tumor, antioxidant, anti-inflammatory and anti-diabetic. Lichen secondary metabolites are known for many products like spices, condiments, perfumes, dyes, deodorants, sunscreen products and also mainly as food which make them significantly important for prospection. Lichen compounds of natural origin are safer and may be utilize as herbal

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medicine for human health. Method: *E. cirratum* was extracted in non polar to polar solvents viz. chloroform, acetone and ethanol by different methods. Result: Studies reveal that extract yield varied significantly in various extracting solvents and it was found to be maximum in ethanol i.e. 4.828%. Two major along with some minor lichen acids as marker were purified and identified using chromatographic methods. Implication: Studies prospect useful chemo markers from lichen specie and establish standard protocols to utilize as natural compounds for pharmaceutical industries.

Key words: *Everniastrum cirratum*, Human health, Lichen acids, Therapeutics.

TRANS KINGDOM RNA EXPRESSION IN CHLOROPLAST FOR IMPROVING INSECT RESISTANCE IN PLANTS

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Plants are always facing a constant competition from insects for their co-existence in nature. Every year farmers spend billions of dollars in plant protection chemicals/insecticides to deal with the control of crop pests. The majority of agronomically important insects fall within the orders of Lepidoptera, Coleoptera, and Hemiptera. However, insects are continuously developing resistance to these insecticides. Genetically modified crops, expressing insecticidal proteins from *Bacillus thuringiensis* (Bt) also control many economically important insect pests. But, this is also not a foolproof strategy as all the insect species are not equally sensitive to Bt toxins and insects have already started developing resistance against Bt. Therefore, there is an urgent need to develop sustainable alternative strategies for the control of insect pests. Trans Kingdom RNA interference (TK-RNAi) in chloroplast, which is the production of double-stranded RNAs (dsRNA) in a plant affecting the viability of an insect, could be one of the promising tools for developing target specific insect pest management methods. Chloroplast transformation has extraordinary potential than nuclear transformation for high-level expression of transgene and accumulation of foreign proteins. It utilizes the production of small interfering (si) RNA in an organism of one kingdom to cause an exogenous effect by guiding the RNAi machinery in an organism of another kingdom. When dsRNA targeting essential insect genes are ingested by pests feeding on the plant, downregulation of these genes by RNAi pathway result in reduced growth or death of the pest. The protection of maize plants from western corn rootworm and protection of *Arabidopsis thaliana* plants from the cotton bollworm are two early examples of plant-insect TK-RNAi.

Keywords: Insecticides, *Bacillus thuringiensis*, Trans Kingdom RNA interference, Chloroplast, Double-stranded RNA, Small interfering RNA

STUDY OF COMPARATIVE EFFECT OF DIFFERENT PESTICIDES ON CYTOLOGY OF FABA BEANS

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Over all effects of insecticide *Malathion* and fungicide *thiram* along with the biopesticides *Azadirachta indica* and *Pongamia pinnata* and type of chromosomal aberration at different exposure periods 2, 4 & 6 hrs. analysis of chromosomal aberration showed significant ($p < 0.5$, $p < 0.01$) frequencies of chromosomal aberration in the meristem of *Vicia faba* L. exposed to higher concentration (500 & 750 ppm) at 6 hrs of exposure period. Chromosome breaks and stickiness were found to be frequent aberration in all the treatment group. The highest chromosomal aberration of *Malathion* (20.15 %) were reported with 750 ppm at 6 hrs of exposure and *Thiram* also show the significant chromosomal aberration (18.03 %) at 750 ppm of 6 hrs. The biopesticide *Pongamia pinnata* induced the significant chromosomal aberration at higher concentration 750 ppm at 6 hrs (16.1 %) but *Azadirachta indica* show less chromosomal aberration (9.89 %) at higher concentration 750 ppm at 6 hrs. Both insecticide and fungicide induce meiotic in regularities like precocious separation, non-orientation, stickiness and univalent in metaphase and chromosomal bridges, laggards micronucleus and multipolarity in anaphase in meiosis I & II. The toxic effects with the biopesticides were comparatively low concentration and generally not significant except the higher concentration (750 ppm) of *Pongamia pinnata*. Biopesticide, including microbial pesticide, plant derived pesticide and insect pheromones as alternative to chemical pesticide and as key components of integrated pest management (IPM) systems.

BIOLOGICAL CONTROL OF PLANT PARASITIC NEMATODES

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In biological control of plant parasitic nematodes can be accomplished either by application of antagonistic organisms, conservation and enhancement of indigenous, or a combination of both strategies. Several nematicides have been withdrawn from the market because of health and environmental problems associated with their production and use. Second, it has been

demonstrated in several soils that nematophagous fungi and bacteria increase under some perennial crops, and under those grown in monocultures and so may control some nematode pests, including cyst and root nematodes. The most studied example of natural control of a plant parasitic nematode concerns the decline of populations of the cereal cyst nematode, *Heterodera avenae*, and root knot under monocultures of susceptible cereals vegetables and pulses in many soil throughout northern Europe. The biological agents are applied in high concentrations as inundative treatments to a readily accessible site of action and protection from the diseases for a relatively short period provides long term control. The initial exploitation of biological control agents for nematodes may be developing countries. A range of control measures, including crop rotation, partial soil sterilization, soil amendments, and nematicides that could be combined to increase the activity of naturally occurring biological control agents. In this method different types of organic and biological inputs like various manures, compost, botanicals and microbes like fungi, bacteria nematode etc. Are presently used at commercial scale to keep the plant parasitic nematode population below the damaging level for enhancing the crop yield.

THERAPEUTIC USE OF INSECTS AND INSECT'S PRODUCTS

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Insects, one of the most dominant creatures on the earth are in constant biological warfare against microbial diseases. Chemicals synthesized by the insects provide immunity or protection against various biotic stresses. Such chemicals can be exploited for the human health. Since early times, insects and the substances extracted from them have been used as therapeutic resources in the medical system of many cultures. Several authors have surveyed for the therapeutic potential of insects documented from traditional medical practices or by testing insects and their products in the laboratory. Termites are used by tribes of Sub Saharan Africa to cure ulcer, rheumatic diseases, anaemia and various skin diseases. Maggot Debridement Therapy is a therapy in which curing of wound is done by utilisation of maggots specifically of those species which are restricted to feed on decaying tissue like the green bottle fly, *Lucilia sericata*. About 80 to 95 per cent of the cases, a complete or significant debridement of the wound is achieved. The venom of honey bees are used to ameliorate, inflammatory and autoimmune conditions. Bee venom is also utilised for curing multiple sclerosis, arthritis, rheumatism, chronic pain, neurological diseases, asthma and dermatological conditions. Similarly honey, propolis and royal jelly also had greatest medicinal value. The insects as well as the products obtained from them had high value both in terms of money as well as medicine. The worried thing is even though they had a significant medicinal property which was proved by several researchers after carrying experiments on traditional practices and some modern studies also proved that they had antimicrobial, antiviral, anticancer properties but still commercial exploitation is not there. So, efforts towards standardizing the methods for practical exploitation of the insect and insect derived products should made for better mankind.

EFFECT OF SODIUM CHLORIDE SALINITY ON SEED GERMINATION AND EARLY SEEDLING GROWTH OF OKRA (*ABELMOSCHUS ESCULENTUS*)

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Salinization of soils or water is one of the world's most serious environmental problems in agriculture. Worldwide, more than 45 million hectares of irrigated land have been damaged by salt and 1.5 million hectares are taken out of production each year as a result of high salinity levels in the soil. It is necessary to determine the environmental factors under which medicinal and aromatic plants give higher yields and better quality. The present project work was designed to study effect of salt stress on okra seeds (*Abelmoschus esculentus*). Here, we estimated the influence of NaCl stress on various growth parameters such as germination percentage, seedling length, vigour index, fresh and dry weight and biochemical factors including protein content, sugar content, amylase activity, chlorophyll content and lipid peroxidation. Seeds were subjected to salinity stress at a concentration of 0 mM (Control), 25 mM, 50 mM, 75 mM, 100 mM, 125 mM and 150 mM. All the experiments were conducted in three replicates. The results show that the growth parameters decreases significantly according to the increase in salt stress. Reduction in seedling length is in harmony to reduced fresh and dry weight. Similarly, various biochemical factors such as protein, starch and sugars also shows a declining order. However, the amylase activity increases with increased salt concentration thus correlated with the decrease in starch concentration. The experiments on okra and the results of different parameters observed proved that the plant shows negative feedback with the salt stress.

Key words: Biochemical analysis, germination percentage, okra, salinity, seedling vigour.

EFFECT OF NUTRITIONAL COUNSELLING IN CHRONIC RENAL FAILURE PATIENTS (CKD-5) UNDERGOING HEMODIALYSIS**NEELESH KUMAR MAURYA¹, DR. PRATIBHA ARYA², AND PROF. N. S. SENGAR³***Institute of Home Science, Bundelkhand University, Jhansi**(D.M Nephrology), Department of Medicine, MLB Medical College, Jhansi Uttar Pradesh*

The present investigation was carried out in MLB, Medical College, Jhansi, India during the year of 2016-17 with 60 CKD-5 consecutive CKD stage -5 patients the aim to assess and analyze the effect of dietary counselling the nutritional value addition of patients (>19yrs) undergoing haemodialysis at least 2 month and in CKD -5 stage for last three months. In this study (48 males and 12 females) introduced in two groups first group proper taken medication and dialysis therapy and second additional diet counselling we suggested soy and paneer like high biological protein. The different parameters like that, blood urea, creatinine, albumin along with amount of calorie and protein intake were compared pre and post nutritional counselling and protein dietary recommendation 60 days during ongoing haemodialysis and patent Proper dietary counselling along with high biological protein (20 gm)given during haemodialysis superior in the nutritional status of undernourished chronic kidney disease patient. In taking proper diet counselling of patients showed positive response (<0.005) while the only medication and dialysis therapy showed a undergoing undernourished in their nutritional status. In this study the result showed that the patients undergoing haemodialysis frequently developed protein-energy malnutrition which is related with morbidity and mortality rate increases. Special nutritional care is required for the dialysis patient to improve the net protein anabolism.

*Keywords: Chronic Kidney Disease, Nutritional Status, Malnutrition, Hemodialysis, High Biological Protein***BIOTIC AND ABIOTIC STRESS MANAGEMENT****NEELU KUMARI^{1*}, SOHAN LAL KAJLA² AND PRIYANKA³***Plant breeding and Genetics, RARI, Durgapura, SKNAU Jobner, Jaipur Rajasthan (302018), India**Plant breeding and Genetics, SKRAU, Bikaner, Rajasthan India**Plant Pathology RARI, Durgapura, SKNAU, Jobner, Rajasthan (302018), India*

Environmental stresses play crucial roles in the productivity, survival and reproductive biology of plants as well as crops. Plants are subjected to many forms of environmental stress, which can be included into two broad areas: abiotic (physical environment) and biotic (e.g. pathogen, herbivore). However, plants evolve different mechanisms of tolerance to cope with the stress effects. These mechanisms comprise physiological, biochemical, molecular and genetic changes. This abstract represents a general overview of the major mechanisms developed by plants to tolerate environmental stresses, both abiotic (drought, high temperature, chilling and freezing, UV-B radiation, salinity and heavy metals) and biotic (herbivory, pathogen and parasite and allelopathy). The efficiency of a plant to fight various stresses depends upon the numbers of intrinsic factors, such as genotypic and phenotypic constitutions, developmental circumstances, and extrinsic factors like severity and duration of the stresses. Plant hormones in addition to playing key roles in plant growth and development explicitly orchestrate stress management in plants. Management of stresses at the molecular level controls the competence and speed at which plants recognize the stressors, generate stress signal molecules, and activate stress-protective mechanisms. Concerted actions of the plants competence at the morphological, physiological, metabolomics, and molecular strata regulate numerous adaptive responses to biotic and abiotic stresses. With the advancement in research era, genetic manipulations of endogenous hormonal profiles and their respective signaling networks have been widely used to improve yield under stressful conditions. Overexpression or silencing of hormonal biosynthetic and/or signaling genes either individually or in combination is the target of scientists to improve plant performance under normal and stressful regimes.

*Keywords: biotic stress, abiotic stress, stress management, plant hormones silencing,***PATTERN OF ANTIMICROBIAL RESISTANCE OBSERVED IN ESCHERICHIA COLI ISOLATES FROM NAINITAL LAKE****NEHAGIRI* AND DEEPAK KUMAR ARYA***Department of Zoology, D.S.B. Campus, Kumaun University, Nainital - 263002, Uttarakhand, India*

The knowledge of resistivity pattern has been the global necessity especially for developing countries like India to control the emergence of resistance to antimicrobial agents. *E. coli* is used as an indicator of faecal contamination of water and is used worldwide to monitor water quality. The aim of this study is to investigate the resistance pattern of *E. coli* isolates from Nainital Lake. Isolation and identification of *E. coli* was done by using microscopy and by IMVIC test. All *E. coli* isolates were screened against 15 antibiotics to determine the prevalence of Multi Drug Resistance among isolates by Kirby Bauer Disk Diffusion method on Muller Hinton Agar. The Antimicrobial Susceptibility Pattern has demonstrated that highest level of resistance to Ampicillin, Cefixime, Erythromycin, Penicillin; there was a low level of resistance to Cefotaxime, Co-

Trimoxazole, Cefuroxime, Tetracycline, Norfloxacin. The data showing the presence of multidrug resistance in *E. coli* are of great concern for future. There is an urgent need of community education for health care providers and general population regarding careful utilization of antibiotics.

Keywords: Water, *E. coli*, Antimicrobial Resistance, Health risk.

UTILIZATION OF WEED BIOMASS

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Weeds are the plants growing where it is not desired. Weeds adversely affect the plant productivity but many of them also cause health hazards in human-beings and animals. They also affect seriously the biodiversity. Apart from this, they may have numeral beneficial properties in one way or the other and have immense potential as food and fodder, medicinal, aromatic, phyto-remediation, industrial, soil and water conservation resource, and raw material for household and media for mushroom.etc. Weeds show tremendous growth potential having a capacity to produce huge biomass viz., 5-20 kg/m² in *Parthenium*, 9.3 kg/m² in *Chromolaena*, 3 kg/m² in *Cassia*, 1-1.5 kg/m² in *Lantana* and 10-11.5 kg/m² in Water hyacinth with higher plant nutrient content. In order to maintain ecological balance it is necessary to utilize the weed biomass generated in and around our ecosystem very effectively. Utilization of these weeds biomass for various purposes certainly gives a better substitution of the certain resources, which are under scarcity. So that better conservation of resources will be meet in long run. Weeds produce huge amount of biomass, which can be utilized as a rich source of nutrients which enrich the soil fertility through green manure and compost. Thus, serve as alternative source for synthetic fertilizers weed biomass extract can also be used to control weeds, pest and diseases which helps in reducing use of synthetic insecticides and herbicides. Generally in India, Availability of organic manures like FYM & green manures is continuously declining in Indian agriculture, Supply of nutrients through inorganic fertilizers is costly & unsustainable in the long run, Synthetic agro-chemicals & fertilizers have caused adverse effects on the environment leading to loss of biodiversity and diminish soil health & sustainability. Weeds are natural source of great potential value and the utilization of weeds for compost preparation is very beneficial for organic farming. Balanced application of compost & chemical fertilizers is essential to obtain optimum yields & to maintain soil fertility. So weed can be managed by utilization.

EFFECTS OF SOME MEDICINAL PLANT EXTRACTS AGAINST MULTIDRUG RESISTANCE HUMAN PATHOGENIC BACTERIA

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Antibiotics provide the main basis for the therapy of microbial (bacterial and fungal) infections. Since the discovery of these antibiotics and their uses as chemotherapeutic agents there was a belief in the medical fraternity that this would lead to eventual eradication of infectious diseases. However, overuse of antibiotics has become the major factor for the emergence and dissemination of multi-drug resistant strains of several groups of microorganisms. The worldwide emergence of *Escherichia coli*, *Klebsiella pneumoniae*, *Haemophilus* and many other β -lactamase producers has become a major therapeutic problem. Multi-drug resistant strains of *E.coli* and *K. pneumoniae* are widely distributed in hospitals and are increasingly being isolated from community acquired infections. Alarming, the incidence of nosocomial candidemia has risen sharply in the last decade (Kao AS et al., 1999). All this has resulted in severe consequences including increased cost of medicines and mortality of patients. With the widespread use of antibiotics and other antimicrobial agents, more and more of the clinical multidrug-resistant (MDR) pathogen appeared, and the degree of resistance has become increasingly serious. At the same time, because of the difficulty in developing chemical synthetic drugs and because of their side-effects, scientists are making more efforts to search for new drugs from plant resources to combat MDR microbial infections. Presently there has been an increase in the use of plant microbicides because of the necessity of finding safer agents and the need for preventing environmental degradation.

KEYWORDS: Antibiotics, Antibacterial resistance, Plant extract, MDR strains.

ROLE OF ENZYMES IN SOIL

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Soil enzymes play a key role in the energy transfer through decomposition of soil organic matter and nutrient cycling, and hence play an important role in agriculture. These enzymes catalyze many vital reactions necessary for the life processes of

soil microorganisms and also help in stabilization of soil structure. Although microorganisms are the primary source of soil enzymes, plants and animals also contribute to the soil enzyme pool. Soil enzymes respond rapidly to any changes in soil management practices and environmental conditions. Their activities are closely related to physio-chemical and biological properties of the soil. Some enzymes like urease are constitutive and routinely produced by cells other such as cellulase are adaptive or induced and formed only in the presence of a susceptible substrate. Soil enzymes are not only associated with proliferating cells but also with humic colloids and clay minerals as extra cellular enzymes. Hence, soil enzymes are used as sensors for soil microbial status, for soil physio-chemical conditions and for the influence of soil treatments or climatic factors on soil fertility. Understanding the possible roles of different soil enzymes in maintaining soil health can help in the soil health and fertility management, particularly in agricultural ecosystems. In this entry, we describe the major soil enzymes and their role in nutrient cycling, soil fertility, and yield sustainability. The effects of cropping systems, crop management, and nutrient management practices on soil enzyme activities are discussed. We further discuss the reports on the effect of climatic factors like elevated carbon dioxide, temperature, and drought on soil enzymes activities. Advancements in enzyme activity assay tools are also discussed, followed by prospects in the field of soil enzymes. To conclude, soil enzymatic activity is a useful tool for assessing and managing productivity of an ecosystem.

Keywords: Soil enzyme, nutrient cycle, physico-chemical properties, soil health, ecosystem

FOOD CONSUMPTION AND CASTING ACTIVITY OF EARTHWORM METAPHIRE POSTHUMA IN FIELD SOIL AND BUFFALO MANURE

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Food consumption rate by the earthworm *Metaphire posthuma* expressed as mg dry food day⁻¹ was 23.34 ± 1.12 mg day⁻¹ for field soil and 27.68 ± 0.54 mg day⁻¹ for buffalo manure. Weight specific consumption expressed as mg g⁻¹ day⁻¹ was 53.34 ± 2.82 for field soil and 64.13 ± 3.47 for buffalo manure. In both the food substrates (field soil and buffalo manure) surface cast was produced. Mean pH of the cast (7.54) was not significantly different from field soil (7.78). Organic C showed an increase of 55.5% in cast than the non ingested soil. Increase in N was 60% in casts in comparison of field soil. P showed an increase of 30% in casts than that of the non-ingested soil. C:N ratio of casts produced under laboratory experiments (58.33) was lower than that of the non ingested soil (80.95). K showed an increase of 20% in casts than that of non-ingested soil. Lower ratio of casts produced under laboratory conditions (58.33) in relation to the non-ingested soil (80.95) is probably due to the mineralization of plant derived organic material during passage through the intestine of earthworms.

GRAFTING OF PAPAYA FOR ENHANCING ITS INDUSTRIAL APPLICATIONS

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Papaya an important tropical fruits which flowers and yield throughout the year belongs to the family Caricaceae with a small genome size of 372 Mbp. In some parts of the world, it is commonly known as pawpaw which is a large, tree-like plant, with a single tall stem growing deeply palmately lobed, with seven lobes that spread out from the base of the leaves. Because of high nutritive value, wide distribution and substantial production in the tropical countries, papaya becomes important for agriculture and world's economy. Papaya is polygamous species with three sex types: male, female and dioecious. Among these sex types, dioecious plants are preferred for commercial cultivation in tropical regions due to their pyriform shaped fruits. Male plants are not useful for economic purposes as they do not produced fruits and hence they should be removed from the field which increases production cost. One unique thing about the dioecious papaya is that it has both male and female organisms. Normally, papaya is propagated by seeds for commercial production but its vegetative propagation through seed results in constraints of inherent heterozygosity, dioecious nature and susceptibility to a large number of viral diseases. So, to overcome these problems propagation of papaya by cutting or grafting would be of great benefit. The purpose of propagation by grafting is the maintenance of desirable traits. The application of asexual propagation in papaya by grafting would be of great help to the papaya industries.

Keywords: Asexual propagation; Papaya; Dioecious; Grafting; Heterozygosity

SEASONAL VARIATION IN DNA CONTENT OF WILD AND CULTURED LABEO BATA (HAMILTON, 1822)

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The present study was conducted on DNA extraction and determination of DNA content of wild and cultured *Labeo bata* using Nanophotometer, to analyse the seasonal variation in DNA content and its purity level. The results revealed that the

value of DNA concentration in wild *L. bata* in March–May was 63-68 ng/μl during June- August the concentration was 76-89ng/ μl, September- November 64-70 ng/μl and in case of those samples collected during December – February the DNA concentration was 52-62 ng/μl. The value of DNA concentration in cultured *L. bata* in March –May was 66-68 ng/ μl, in case of June-August the concentration was 78-98 ng/μl, September – November 78- 88 ng/μl and in case of those samples collected in December- February the DNA concentration was 60-68 ng/μl. The results revealed that the highest concentration was reported in cultured fishes in the month of July-August.

Keywords: *Labeo bata*, Nanophotometer, DNA Content, seasonal variation.

ASSAY OF GENETIC ARCHITECTURE OF RESYNTHESIZED *BRASSICA JUNCEA* USING MICROSATELLITE MARKERS

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Brassica juncea or Indian mustard, belongs to family *Brassicaceae* with amphidiploid genome (AABB, 2n=36) and evolved *de-novo* from a few chance crosses between its progenitors species *B. rapa* (AA, 2n=20) and *B. nigra* (BB, 2n=16). Resynthesis of *B. juncea* utilizing diverse germplasm lines of the parental species could lead to enhancement of valuable diversity in the genepool. The resynthesized *Brassica juncea* lines were primarily evaluated for yield and yield contributing traits and several lines were identified for different important agronomic traits viz. plant habit, plant height, maturity duration, no of primary and secondary branches, number of siliqua per plant, number of seeds per siliqua and test weight. For genetic diversity, a set of total 120 genotypes was evaluated using microsatellite markers which comprise ninety-two resynthesized *B. juncea* lines, ten popular varieties, twelve *B. rapa* lines and six *B. nigra* lines. Total eight clusters (Group A to Group H) were obtained by analysis the binary data of 67 amplified alleles from 20 polymorphism microsatellite markers. The results showed the diversity or gene combination developed through resynthesizing *B. juncea*, is significant and the dissimilarity coefficient value is also very high between these new lines and other lines used for the present study. Thus, the resynthesis of *Brassica juncea* using the diploid parental species will enrich the genetic diversity of native gene pool and can further give new combiner for heterosis breeding and development of high yielding varieties.

ERROR PREVENTION AND MITIGATION AS FORCES IN THE EVOLUTION OF GENES AND GENOME

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Faithful transmission of information is crucial for life. This is perhaps most evident when genetic instructions are passed on from parents to their offspring. If the information is corrupted at this stage, the result depending on the sequence affected may be lethal. Arguably the most extensive support for a role of error prevention in the evolution of gene anatomy comes from the study of synonymous codon usage, and also the the translation error (TE) model for evolution of the codon catalogue deals reveals about the necessity of minimizing the effects of translation errors. The genetic code has the remarkable property of error minimization, whereby the arrangement of Amino acids to codons is highly efficient at reducing the deleterious effects of random point mutations and transcriptional and translational errors. The elucidation of nonsense-mediated decay (NMD) as an RNA surveillance system is a relatively recent event. Studies in yeast and other model organisms have enumerated specific molecular details that provide some insight into mechanisms whereby a transcript that contains a premature termination codon (PTC) is recognized by NMD factors and rapidly degraded, thus eliminating abnormal transcripts. Frame-shifting errors are the major type errors costs of mis-elongation and frame-shifting errors, that differences in translational robustness between the 5' and 3' ends of genes should be less pronounced in genomes with higher GC content. In the meanwhile the Chaperons type molecular protein (GroEL protein) affects codon usage and prevents both newly synthesized polypeptide chains and assembled subunits from aggregating into nonfunctional structures.

Key words: Mitigation, Translation error, PTC, NMD, Chaperons

MULTIVARIATE ANALYSIS OF GENETIC DIVERSITY IN CHRYSANTHEMUM GERMPLASM

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Sustainable production of food crops relies on germplasm improvement and genetic diversity. The use of multivariate techniques is an important strategy for germplasm classification and study of genetic relationships among genotypes. The data collected for 97 genotypes of chrysanthemum germplasm from All India Coordinated Research Project on Floriculture

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report 2016-17 were evaluated for eight quantitative traits through cluster and principal component analysis. The first three PCs with Eigen values >1 contributed 83.01% of the variability amongst genotypes. The characters contributing more positively with PC1 were plant height, no of branches and bud appearance. The cluster analysis sequestered 97 genotypes into 4 clusters based on between-group linkage method in which euclidean distance has been used as dissimilarity measure. The cluster III and IV were more clearly separated than cluster I and II. The cluster analysis revealed that considerable variation existed in few genotypes that could be implicated in selection of chrysanthemum for the development or improvement of cultivars and germplasm.

Keywords: Genetic Diversity, chrysanthemum germplasm, cluster analysis and principal component analysis

EFFECT OF CONSORTIUM OF NITROGEN FIXING ENDOPHYTIC BACTERIA ON NUTRIENT AND JUICE QUALITY IN SUGARCANE (*SACCHARUM OFFICINARUM*)

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Sugarcane is cultivated throughout the Indo-Gangetic plains of South Asia and Maharashtra is second largest producer. The leaf samples were collected at different stages of crop growth from PGI farm and CSRS, Padegaon and were evaluated for nitrogen, phosphorous, nitrate content and juice quality. The experiment was laid out in Randomised Block design with four replications and six treatments. Nitrogen fertigation was given as 100 % N through urea (T₂), 50 % N + *Acetobacter diazotrophicus* (T₃), 25 % N + consortium endophytic bacteria (T₄), 0 % N + consortium endophytic bacteria (T₅), 0 % N + without consortium endophytic bacteria (T₆) with absolute control (T₁). The results of the experiment revealed that nitrogen, phosphorous, nitrate content by sugarcane crop was significantly higher in T₄ treatment (25 % N + foliar application of consortium of endophytic bacteria) followed by RDF treatment and 0% N with foliar application of consortium of endophytic bacteria. The juice quality the T₄ treatment (25 % N + foliar application of consortium of endophytic bacteria) recorded minimum POL and CCS % at both locations. The differences in quality attributes at both the locations could possibly be due to crop management practices. Hence, the use of foliar spray of consortium of N fixers @ 25 % concentration can save 75 % of nitrogen without affecting the yield.

Key words: Sugarcane, Nitrogen fixing endophytic bacteria,

MUSHROOM- THE FUTURE FARMING

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Agriculture continues to be the main strength of Indian economy. With the variety of agricultural crops grown today, the country has achieved food security by producing about 260 million tonnes of food grains. However, the struggle to achieve nutritional security is still on. In future, the ever increasing population, depleting agricultural land, climate changes, water shortage and need for quality food products at competitive rates are going to be the vital issues. To meet these challenges and to provide food and nutritional security to our people, it is imperative to diversify the agricultural activities in areas like horticulture. Mushrooms are one such component that not only uses vertical space but also help in addressing the issues of quality food, health and environmental sustainability. Moreover, its enormous population could support the large scale consumption of nutritious mushrooms by a significant health conscious urban population as well as the rural masses struggling with hunger and malnutrition, particularly vegetarians who rely heavily on a cereal based diet. In view of these unique strengths, the FAO (Food and Agriculture Organization) emphasized the adoption of mushrooms as an ideal food for the protein hungry masses of developing countries. There is need to promote both mushroom production as well as consumption for meeting the changing needs of food items. Fortunately, mushroom trade has gained importance in recent years possibly for the global shift towards vegetarian food and recognition of mushroom as a functional food. Mushroom cultivation offers an added advantage to recycle agro-waste as carbon pool into good quality protein, much of which otherwise is wasted in the field. This hi-tech horticulture venture has a promising scope to meet the food shortages without undue pressure on land. Mushroom cultivation is the labour intensive and offer vast employment opportunities in rural areas, where mushroom industry can be developed as cottage industry and source of additional income. The mushrooms are grown indoors, where the environment factors can be controlled to desired level.

INFLUENCE OF SOLVENT TYPES ON POLYPHENOLIC CONTENT AND ANTIFUNGAL ACTIVITY OF JUNIPERUS SQUAMATA BUCH. – HAM EX D. DON.**PARIKSHIT KUMAR* AND S.C. SATI***Department of Botany, D.S.B. Campus, KumaunUniversity, Nainital, India.*

In an approach toward the development of eco-friendly antifungal compounds for controlling major plants fungal diseases, different extracts of *Juniperussquamata* leaves, a Kumaun Himalayan gymnosperm, were tested against eight fungal strains (*Alternariaalternata*, *Botrytis cinerea*, *Colletotrichumfalcatum*, *Fusariumoxysporum*, *Pyricularia oryzae*, *Rhizoctoniasolani*, *Sclerotiniarolfii* and *Tilletiaindica*) using agar-well diffusion method. Polyphenol contents of five extracts of *J. squamata* leaves were determined employing spectrophotometric technique. The value of total phenolic content (TPC) was expressed as milligram gallic acid equivalent (mg GAE)/g of extract on the other hand total flavonoid content (TF-1) and total flavonol content (TF-2) were calculated in terms of mg quercetin equivalents/ g of extract. Among all the extracts tested the highest antifungal potential was recorded for methanol extract. The methanol extract was found very active towards all the pathogens tested (Percent inhibition, 22-57%) followed by chloroform extract (Percent inhibition, 27-48%), ethanol extract (16-40%) and hexane extract (16-37%). The aqueous extract of *J. squamata* leaves was found less active against all the tested strains (18-22%). The extraction yield of different fractions of its leaves varied from 5.1 to 23.2%. The highest TF-1 and TF-2 values were found in methanol extract, 304.5 and 152.7 mg QE/g extract respectively, while highest TPC was found in ethanol extract, 186.9 mgGAE/g. It is interesting to note that in many instances the methanol and chloroform extracts showed better inhibitory activity than the positive control Clotrimazol which was used as standard antifungal agent. We suggested that polyphenolic compounds of high altitude *J. squamata* could potentially be used as new fungicide leading compounds.

Keywords: Antifungal activity, *Juniperussquamata*, plant extracts, polyphenols, Kumaun Himalaya

HIBISCUS – AN ORNAMENTAL PLANTS WITH IMMENSE ETHNOBOTANICAL USES**PARASHURAM. M.^{1*} PAVAN KUMAR. P.² AND CHANDRASHEKAR. K.G.³**

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Hibiscus is a perennial shrub found in each and every home gardens of India. It is a vigorous growing shrub that flowers throughout the year. A wide range of flower color starting from red to violet and varied growth habit viz., tall and dwarf types are available in hibiscus. Flower forms like single, double, multi-petaled and with modified styles are adding beauty of home gardens. *Hibiscus rosa-sinensis* is one of the most widely cultivating ornamental shrub throughout the tropics and prominently found in India, China, South-East Asia and South-Indian Ocean Islands. Other species like *H. syriacus*, *H. sinosyriacus*, *H. paramutabilis*, *H. moscheutos* and *H. militaris* are also distributed into tropical and temperate regions of the world. Apart from its ornamental value, hibiscus evoke a special interest in us because of their distinctive uses in traditional medicines. Its leaves, barks, roots and also flowers have been used in the Indian traditional system as medicine to treat various diseases. Scientific research studies proved that the different parts of *Hibiscus rosa-sinensis* plants possess Antioxidant, Antimicrobial, Antidiabetic, Antiulcer, Hepatoprotective, Antifertility, Antigenotoxic and Antiinflammatory properties, which helps in treatment of many diseases. Leaves of *H. acetosella* Welw. and *H. surattensis* are used as medicines to cure stomach ailments. The petal extracts of *H. rosa-sinensis* have been used as food colorants and for their antioxidant properties, have been shown in a number of rat and mouse based studies to protect against the cancer promoting effects of benzoyl peroxide and ultraviolet radiation. The species also used to inhibit the diabetes promoting effects of streptozotocin and alloxan to confer cardio protective effects. In India hot water extract of stems and flowers of hibiscus are used in traditional medicine to treat the Abortion, Antifertility, Contraceptive, Diuretic, Menorrhagia, bronchitis, Emmenagogue, Demulcent, Cough, and Abortifacient. Thus, Hibiscus have got the special attention to Indian traditional system of medicine.

RESPONSE OF NANOZEOLITE ON MAIZE CROP AND BIOFUNCTIONALITY OF RHIZOSPHERIC SOIL**PARUL CHAUDHARY*, ANITA SHARMA, PRIYANKA KHATI**

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Nanoparticles ranging in size from 1 to 100 nm possess specific physico-chemical properties due to smaller size, large surface area and high reactivity compared to their bulk counterparts. Ion-exchange properties of zeolites can be utilized in agriculture because of their large porosity and high cation-exchange property. Zeolites can be used as a carrier of nutrients in the agriculture system. Present study was conducted to test the beneficial effects of Nanozeolite (size- 80 nm) on the different growth parameters of maize plants, bacterial community and on the activities of soil enzymes of the rhizospheric soil of

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maize crop under field condition. Effect of Nanozeolite was observed on plant height (root and shoot length), leaf area, fresh and dry weight of shoot/ root, chlorophyll content and protein content of maize plants. Effect of Nanozeolite on NPK solubilizing bacteria and soil enzymes (FDA and Arylesterase) were also evaluated. Two fold increase in the values of various parameters was observed in the treated plants as compare to control. Number of colony forming unit of nitrogen, phosphorus and potassium solubilizing bacteria was high in treated soil as compare to control. Level of activities of various soil enzymes increased upto three fold as compared to the control. It is deduced from the experiment that Nanozeolite has a positive impact on the soil microbial community, plant vigour and biochemical characteristics of the soil.

Keywords: Nanozeolite, Maize, Plant Vigour, Soil Health

GROWTH PERFORMANCE OF ERI SILKWORM (*SAMIA CYNTHIA RICINI*) ON ARTIFICIAL DIETS

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Semi synthetic diet prepared with the flour of different commodities exhibited wide variations in their ability to support growth and development of Eri silkworm (*Samia Cynthia ricini*). Perusal of Table 1 reveals larval survival at 4 days after feeding on all test diet ranged from 0.00 to 96.60 percent. On 4DAF, 100 Percent larval mortality was recorded on castor based diet. No larva survived on linseed based diet on 8 DAF. On 16 DAF the pattern of larval survival ranged from 6.60 in Jowar based diet to 70.00 percent in green gram based diet. Hundred percent larval mortality was observed in bajra and jowar based diet on 20 DAF. Initiation of pupation started on castor leaf at 20 DAF. On 24 DAF, initiation of pupation started larval survival was highest on green gram flour diet on 28 DAF. Furthermore 100 percent larval mortality were recorded in all other flour based diet. Maximum larval period (36.00) on soybean based diet and lowest (30.33) on maize diet. Highest percent pupation (50.0) was noticed in green gram flour based diet. Mean cocoon weight (2.41) mean silk weight (1.38) were also highest on green gram flour. Highest shell ratio (56.05) was observed in green gram flour and rice flour diet (41.47) which was comparatively greater than castor leaf. The overall performance of the diet could not be compared by growth index as no adult emergence was observed in any of the tested diet. These diets can be used only to rear eri silkworm for obtaining silk during scarcity of food or adverse climatic conditions.

Key words: erisilkworm, growth performance, artificial diets

MEDICINAL USES OF *DALBERGIA SISSOO* STEM

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The traditional medicines usually derived from medicinal plant, mineral and organic matter, but the herbal drugs are only prepared from the medicinal plants. *D. sissoo* is an important medicinal plant and commonly known as sisu, shisham, tahl, jag at different parts of world and belongs to family *Fabaceae*. The heartwood of plant is strong and durable. Different medicinal uses of *D. sissoo* is like blood diseases, syphilis, dysentery, ulcers, skin diseases, larvicidal, growth inhibitor, anti-inflammatory, analgesic and antipyretic activities. The crop protectant activity of the powdered dry leaf, the insecticidal activity of the bark extract against adult mosquitoes, and the antimicrobial activity of both the leaf and bark have also been reported. Antimicrobial activity of plant kills the growth of microorganisms such as bacteria, fungi, and protozoan. The ethanolic extract of the fruits of *D. sissoo* exhibited molluscicide effect against eggs of the freshwater snail *Biomphalaria pfeifferi*. The alcoholic extract of *D. sissoo* leaves produces significant anti-inflammatory effects in different modes of inflammation without any side effects on the gastric mucosa. Leaf extract has been used to treat sore throats, heart problems, dysentery, syphilis and gonorrhea. The extract of *D. sissoo* leaves showed almost two times higher antioxidant activity than commonly used antioxidants like selenium and vitamin E and the extract of leaves contains a large amount of flavonoids. The ethanolic extract of bark of *D. sissoo* was investigated for its activity against Indian earthworms *Pheretima posthuma* and nematode *Ascardi galli*. Various concentrations (10, 20, 50mg/ml) of ethanolic extract were tested, which involved determination of time of paralysis and time of death of the worms.

IMPORTANCE OF GENETIC ENGINEERING AND ITS ROLE IN DEVELOPMENT OF SALT TOLERANCE AND CROP RESISTANCE TO INSECT PESTS

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We believe that the most significant changes in crops will come about by applying genetic engineering tools. Crops may be bioengineered to produce modified kinds of starch, oils and high-value proteins for better nutrition, medical diagnostics and industrial uses. For example, walnuts and peanuts containing healthier oils, along with oxidative stability, could become available to consumers. Seedless vegetables and other fruits should appear in the marketplace within 10 years. Oil-producing seed crops may be modified to create specialty oils for a variety of nonfood products such as detergents, lubricants, inks and dyes. Feed seeds engineered to produce higher concentrations of sulfur-containing amino acids could improve wool growth in sheep. Plants could be modified to deliver oral vaccines that prevent diseases such as hepatitis and influenza. Although the tolerance of saline conditions by plants is variable, crop species are generally intolerant of one-third of the concentration of salts found in seawater. Attempts to improve the salt tolerance of crops through conventional breeding programmes have met with very limited success, due to the complexity of the trait: salt tolerance is complex genetically and physiologically. Tolerance often shows the characteristics of a multigenic trait, with quantitative trait loci (QTLs) associated with tolerance identified in barley, citrus, rice, and tomato and with ion transport under saline conditions in barley, citrus and rice. Physiologically salt tolerance is also complex, with halophytes and less tolerant plants showing a wide range of adaptations. Five possible ways, which were appropriate at that time, to develop salttolerant crops: (1) develop halophytes as alternative crops; (2) use interspecific hybridization to raise the tolerance of current crops; (3) use the variation already present in existing crops; (4) generate variation within existing crops by using recurrent selection, mutagenesis or tissue culture, and (5) breed for yield rather than tolerance. Genetically engineering inherent crop resistance to insect pest's orders the potential of a user-friendly, environment-friendly and consumer-friendly method of crop protection to meet the demands of sustainable agriculture in the 21st century. Work to date has concentrated on the introduction of genes for expression of modified *Bacillus thuringiensis* (Bt) toxins. Impressive results on the control of Bt-susceptible pests have been obtained in the laboratory and the field, and the first commercial Bt transgenic crops are now in use. A main alternative approach exploits plant-derived insect control genes. Enhanced resistance to a wide spectrum of pests has been demonstrated in laboratory trials of transgenics expressing various protease inhibitors, lectins, etc.

Keywords- Genetic Engineering, Salt Tolerance and Crop Resistance to insect pests

AGROBACTERIUM MEDIATED TRANSFORMATION IN CAULIFLOWER (*BRASSICA OLERACEA* VAR *BOTRYTIS* L.) VARIETY PUSAMEGHNA

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The diamondback moth, *Plutellaxylostella*, also known as DBM, is a serious pest of canola (*Brassica* spp.) shows resistance to most synthetic insecticide. Biologically-based efforts have been shown most promising approach to control DBM. *Brassica oleracea* var. *Botrytis* L. (cauliflower) is an important vegetable crop of cole group belonging to *Brassicaceae* family is reproduces by seed. Conventional breeding of *Brassica* is labor and resource intensive and time consuming. Incontrast, genetic transformation provides direct means to introduce a specific gene or trait into a selected genotype without adversely affecting their desirable genetic background. However, the current plant breeding programmes are limited in terms of availability of suitable genes in the germplasm base. The genetic engineering is a recent advances to develop the disease tolerance and pest tolerance. It has become of significant interest to agricultural biotechnology. Tissue culture and genetic engineering technology are ways to achieve plant improvement. Many techniques have evolved in the field of crop improvement for delivery of foreign gene i.e Particle bombardment method; *Agrobacterium* mediated transformation, Electroporation method, Microinjection etc. *Agrobacterium*-mediated transformation is widely used for gene delivery in plants. An efficient transformation system for Indian cauliflower variety Pusa Meghna was developed using *Agrobacterium tumefaciens* strains EHA105 harbouring the plasmid pPIPRA BT-1027 containing Insecticidal gene *cry* gene and selectable marker gene *bar*. Various factors affecting the transformation efficiency and subsequent regeneration such as-the age of seedlings, growth conditions, explants type, status of *Agrobacterium* suspension, pre-culture of explants, co-cultivation time, ratio between *Agrobacterium* and explants, concentration of antibiotic for removal of *Agrobacterium* from explants surface, concentration of plant selection reagent etc. were standardized and evaluated.

UTILIZATION OF LIGNOCELLULOSIC BIOMASS FOR BIOETHANOL PRODUCTION BY THE FUNGUS *C. CINEREA***POONAM MAAN AND R.S. SENGAR***Department of Agriculture Biotechnology, College of Agriculture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut-250110*

A large amount of world economy depends on agriculture which is the basic source of food. Besides the food, a large amount of agricultural wastes are also produced through agriculture all over the globe. Agro-residues are creating the major environmental pollution related problems if are not utilized them properly. Bioethanol is a renewable fuel which can be produced from agro-residues and has many advantages over conventional fuel. Ethanol production from agro-residues includes hydrolysis and fermentation processes. Hydrolysis is an enzymatic saccharification process to hydrolyze the cellulose and hemicellulose portion of the lignocellulose biomass into simple fermentable sugars. Cellulase and hemicellulase (xylanase) enzymes are used in the hydrolysis process. Ethanol production is an expensive process due to the cost of enzymes. The basidiomycete fungi have the capacity to convert cheaper organic biomass into valuable products by the production of these enzymes. We have isolated the white rot fungus *C. cinerea* RM-1 NFCCI-3086 from wood sample. This fungal strain was screened for production of xylanase and cellulase. A quite high activity of xylanase and cellulase enzyme was produced by *C. cinerea* RM-1 using different agro-residues as the substrate. It can be concluded that these fungi are good source of hemicellulolytic enzymes and may act as good converter of cellulose as well as hemicellulose into sugars; thereby increasing the total amount of sugars for fermentation which ultimately may results into enhanced production of bioethanol.

Keywords: Agro-residues, Cellulase, Fungi, Xylanase, Bioethanol.

IN VITRO PROPAGATION OF LEMONGRASS FOR CONSERVATION AND COMMERCIAL UTILIZATION**PRACHI TYAGI AND R. S. SENGAR***Department of Agricultural Biotechnology, College of Agriculture, SVPUA&T, Meerut.*

Lemongrass (*Cymbopogon citratus*) is an important perennial crop that has characteristic lemony scent. Crop has wide range of medicinal value and also has culinary importance. Essential oil produced from the plant is utilized as synthetic vitamin A and commonly used in perfumery industry. Currently India is one of the major producers of essential oil globally. Some of the major importers are North America and Western Europe for the purpose of its use in toiletries and cosmetic industry. However, Japan has accounted for about 10% of total demand. As the demand for this oil is growing, the areas of cultivation of lemongrass is also increased to meet the growing demand and other non conventional method like clonal propagation through tissue culture can also be used for the purpose. *In vitro* propagation and multiplication of lemongrass on MS – media is used for the selection of high essential oil producing lines, germplasm conservation and cryopreservation for the further use in the future. *In vitro* cultivated lemongrass can be used for commercial purpose for the multiplication of high essential oil producing varieties to which it has to be determined in advance that *in vitro* propagation resulted in the genetic fidelity. Lemongrass, as a kitchen ornamental plant, can be commercialized directly to the public for maintaining kitchen garden. Economical research on lemongrass has shown its potential as a commercially important crop in the cultivation through *in vitro* method. Present study offers an economical perspective of lemongrass tissue culture for commercial cultivation.

Keywords: *in vitro* propagation, lemongrass, essential oil, germplasm.

PHYSIOLOGICAL CHARACTER FOR IMPROVING THE SALT TOLERANCE IN CROPS**PRAFULL KUMAR, VANDANA SHARMA, ASHWANI KUMAR,, SWATI SHARMA AND M. K. YADAV***Department of Agriculture Biotechnology, College of Agriculture, Sardar Vallabhai Patel University Of Agriculture & Technology, modipuram, Meerut , Uttar Pradesh, India- 250110.*

To develop new crop varieties with improved salt tolerance have been intensified, the existence of genetic variation for salt tolerance within species, and many methods available for expanding the source of genetic variation, a limited number of varieties that have been develop improved tolerance. New varieties based upon selection for agronomic characters yield or survive in saline conditions. Characters that integrate the various physiological mechanisms responsible for tolerance. Knowledge of physiological salt responses has increased substantially. Selection and breeding method to increase salt tolerance might be more successful if selection is based on directly, the physiological mechanisms or characters conferring tolerance. These are centred around the need for genetic variation, the importance of the targeted mechanism, the ease of detection of the physiological mechanism and the breeding strategy. Mechanisms, including ion exclusion, ion accumulation, compatible solute production and osmotic adjustment have been associated with genetic variation in salt tolerance to the role of physiological criteria in the short and long term in improving salt tolerance. In legumes, physiological selection based on ion exclusion from the shoots shows promise. The integrated salt metabolism of plants, essentially as a problem in meganutrient physiology. Two critical aspects of cellular and organismal metabolism are given particular attention—those

involved in the control and integration of Na⁺ acquisition and allocation in plants and those involved in readjustment of other aspects of metabolism, especially those involving carbon as a resources. Although there are large numbers of reports in the literature mainly dealing with water relations, photosynthesis, and accumulation of various inorganic ions and organic metabolites in individual crops, as selection criteria for improving salt tolerance through selection and breeding programs.

Keywords – Selection, Salt Tolerance, Mechanism and Water Relations.

BIOTECHNOLOGY APPROACHES FOR IMPROVEMENT OF WHEAT UNDER THE ABIOTIC STRESS

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The improvement for drought stress tolerance found by the drought related genes and QTLs to modern wheat genotypes. Drought stress that the leading threat on global food supply, limited wheat yield. Environmental stresses trigger a wide variety of plant responses, ranging from altered gene expression and cellular metabolism to changes in growth and productivity. Tolerance of genotype is crucial to stabilize and increase food production. It is significant to understand the mechanism of stress tolerance along with plethora of genes involved in stress signaling network for wheat improvement. The expression are changed by different environmental components and molecular technique such as molecular markers, QTL mapping and expression patterns of genes should be applied to produce drought tolerant genotypes. Biotechnological approaches and conventional breeding methods are used to develop wheat genotypes with better grain yield under the water deficit condition during reproductive and grain filling.

Keywords- Drought stress, Mechanism, Breeding methods

EFFECT OF ADDITION OF DIFFERENT LEVELS OF LACTULOSE IN LITCHI SHRIKHAND

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Shrikhand is one of the important fermented milk product which is found in western part of our country. The curd mass known as chakka is the base material for shrikhand. It is obtained by removal of whey from dahi. The quality of shrikhand is largely influenced by physical and chemical properties of chakka. Recent trends indicate that consumers are accepting those products which embeds fruit pulp as the beneficial effects of fruit can be harvested by consumption of some routine food products. Litchi is one such delicious fruits having high nutritional and medicinal values. Dairy products are deficient in fiber. During high heat treatment of milk lactulose is formed from lactose which has a established laxative effect and is used in treatment of constipation. In the present study, buffalo milk was standardized to 6% fat and 9% Solid Not Fat for manufacturing of Chakka. Sugar and litchi pulp was added @ 35% and 5% respectively. Lactulose was added @ 3.0, 4.5, 6.0, 7.5 and 9.0 per cent respectively and treatment was designated as T1, T2, T3, T4 and T5 respectively. Control (T0) was formulated in which there was no lactulose. On the basis of organoleptic evaluation, it was found that the sensory score of T2 treatment for colour and appearance, flavour and taste, consistency as well as overall acceptability was significantly higher as compared to other treatment. Total solid, fat, protein, carbohydrate and ash content of T2 treatment was found to be 52.14, 11.52, 7.70, 32.16 and 0.76 per cent respectively.

ASHWAGANDHA: A RASAYANA (REJUVENATOR) OF AYURVEDA

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Ashawagandha (*Withania somnifera* L. Dunal) is very revered herb of the Indian Ayurvedic system of medicine as a Rasayana (tonic). It is used for various kinds of disease processes and especially as a nervine tonic. Pretreatment with Ashawagandha showed significance protection against stress induced gastric ulcers. Ashawagandha have anti-tumor effect on Chinese Hamster Ovary (CHO) cell carcinoma. It was also found effective against urethane induced lung-adenoma in mice. In some cases of uterine fibroids, dermatosarcoma, long term treatment with Ashawagandha controlled the condition. It has a Cognition Promoting Effect and was useful in children with memory deficit and in old age people loss of memory. It was also found useful in neurodegenerative diseases such as Parkinson's, Huntington's and Alzheimer's diseases. It has GABA mimetic effect and was shown to promote formation of dendrites. It has anxiolytic effect and improves energy levels and mitochondrial health. It is an anti-inflammatory and anti-arthritic agent and was found useful in clinical cases of Rheumatoid and Osteoarthritis. Large scale studies are needed to prove its clinical efficacy in stress related disorders, neuronal disorders and cancers. Ashwagandha is used for arthritis, anxiety, bipolar disorder, attention deficit hyperactivity disorder (ADHD), balance, trouble sleeping (insomnia), tumors, tuberculosis, asthma, a skin condition marked by white

patchiness (leukoderma), bronchitis, backache, fibromyalgia, menstrual problems, hiccups, Parkinson's disease, and chronic liver disease. It is also used to reduce side effects of medications used to treat cancer and schizophrenia. Ashwagandha is used to reduce levels of fat and sugar in the blood.

Keywords: Rasayana, Medicinal use, Ayurveda and Clinical efficiency.

GREEN TECHNOLOGY: TECHNOLOGY FOR GENERATING CLEAN ECONOMY.

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Green technology (greentech) or clean technology (cleantech) is the application of one or more of environmental science, green chemistry, environmental monitoring and electronic devices to monitor, model and conserve the natural environment and resources, and to curb the negative effect of human involvement. The term is also used to describe sustainable energy generation technologies such as photovoltaics, wind turbines, bioreactors, etc. The term "technology" refers to the application of knowledge for practical purposes. The field of "green technology" encompasses a continuously evolving group of methods and materials, from techniques for generating energy to non-toxic cleaning products. The present expectation is that this field will bring innovation and changes in daily life of similar magnitude to the "information technology" explosion over the last two decades. The emerging clean-energy economy can solve set of problems. It has the potential to drive innovation and stimulate a sustainable economic recovery that changes the environmentally harmful "business as usual" practices of the past. 'Where other people might see problems and crises, innovative green business leaders see opportunity'. A wave of companies both large and small is using success in business to achieve social and environmental change. These emerging business models seek to preserve environmental quality, promote social equity, and stimulate sustainable economic growth. As someone thinking of starting a small business, starting a green business has two advantages over starting any other kind of business. First, environmentalism is still growing so you will be starting a business targeting a growing market. Second, starting a green business can be particularly satisfying as you get to make your own contribution to making the world a better place. New entrepreneurs are not wasting any time crafting a future that looks a lot brighter-one where small businesses provide products, services, training programs, and living wage jobs that preserve the environment and lift people out of poverty.

UNDERSTANDING THE MOLECULAR MECHANISM OF HETEROSIS PHENOMENA

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The heterozygous F1 generation often exhibits better performance than its homozygous parents, a phenomenon known as heterosis or hybrid vigour. In classical genetics, three main hypotheses: dominance, overdominance, and epistasis but these three hypotheses unable to explain the why progressive polyploids display higher levels of heterosis than inbreds or diploid hybrids, unpaired chromosomes (aneuploids) display lower heterosis than diploid, complex traits study etc. So, we have to study the genome wide approaches to reveal the heterosis instead of single locus or single traits based heterosis. There are different types of molecular approaches such as qtlomics, transcriptomics, proteomics, epigenetics, small-RNA, biological clock model, genomic dosage, and cellular efficiency model may help to reveal the heterosis. The epigenetic mechanisms, including DNA methylation or histone modification differences studied in Arabidopsis, maize, and rice genotypes. Genomic DNAs of inbreds are more methylated than those of hybrids and that DNAs of heterotic hybrids are less methylated than those of less heterotic and nonheterotic hybrids. miRNAs and tasiRNAs control the expression of genes that encode transcription factors and proteins by targeting RNA degradation or translational repression that are important for growth and development. Level of siRNA in hybrid or allopolyploids is different than their parents. The hybrid would show a greater gene dosage balance for the two genomic regions and would be more vigorous than the two parental inbred lines. Greater cellular energy efficiency of hybrids due to selective protein synthesis and metabolism and increase the input energy by changing the circadian clock through higher amplitude in hybrid. These mechanisms are gene/allele independent and trait-nonspecific, i.e., would produce heterosis for all the traits to a similar degree

Key word: Heterosis, dominance, genomic, epigenetics, DNA methylation, circadian clock model

ADVANCES IN BIOLOGICAL SCIENCES AND BIODIVERSITY CONSERVATION**¹PRIYANKA, ¹ESHANEE, ¹SHIVANI CHAUHAN, ¹HARNOOR KAUR DHILLON, ¹SHUBHAM KUMAR, ¹SUNIL KUMAR AND ²BHALLAN SINGH SEKHON***Department of Vegetable Science & Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.)*

Noble laureates of 21st century focused their vision towards malnutrition and hidden hunger problems. They have tried to resolve these issues through the awareness programmes. On the same line, young scientists of current era particularly those, who are engaged in agriculture could also help better in elevating the nutrition by focusing towards the genetic improvement of nutraceutical rich foods. Improvement of these nutraceutical rich foods both in the terms of quantity and quality is the need of the hour. If one talks of nutraceutical rich foods, vegetables come first to their mind, and among these, leafy group is of utmost importance. Spinach is considered as the most nutritious vegetable in leaf group. It possesses a varied nutrient profile being particularly rich in vitamin A, lutein, magnesium, potassium, calcium and iron and, thus improvement of this crop could help to combat the above mentioned challenges. Productivity and quality enhancement of spinach could be elevated through the development of hybrids. The highly cross pollinated nature of spinach not only adds to its beauty in the terms of variability but also assist in exploiting the heterosis. But the occurrence of phenomenon of sex reversals causes some problems in hybrid seed production. With the advancement in technology and research, it became possible to alter and exploit the phenomenon controlling sex expression and to get genetically pure and uniform hybrids in spinach. In this review, we briefly discuss about the importance of spinach in terms of malnutrition problems, techniques used for altering the sex expression along with the possible ways to exploit this mechanism for hybrid seed production.

Keywords: hidden hunger, hybrids, malnutrition, sex reversals, spinach

AN EFFICIENT PLANT REGENERATION PROTOCOL FROM LEAF EXPLANTS OF *ACTINIDIA DELICIOSA* (L.)**PRIYANKA¹ AND UPENDRA KUMAR²**¹*Department of Botany, Govt. Girls Degree College, Kharkhauda, Meerut (UP)*²*Department of Molecular Biology, Biotechnology & Bioinformatics, College of Basic Sciences & Humanities; CCS Haryana Agricultural University, Hisar-125004, HARYANA*

Kiwifruit (*Actinidia deliciosa* cv. Hayward) has gained enormous popularity in the recent years in many countries of the world and is in great demand due to its nutritional and medicinal value. The Propagation of kiwifruit by seed can easily be carried out but it results in a highly variable progeny and sex of the seedlings remains unidentifiable till flowering. Therefore, vegetative propagation is considered superior to maintain uniformity and genetic purity of the cultivars. Kiwifruit is generally propagated by grafting, budding, softwood and hardwood cuttings, etc. However, large-scale planting materials are needed to meet the commercial requirements. Hence, a simpler, quicker and economically viable technique has to be needed for mass propagation. To meet the growing demand for planting material, tissue and organ culture techniques are being used as alternative method for propagation. In the present study, an efficient protocol was developed for callus induction and shoot regeneration of kiwifruit using leaf as explants. The young leaf explants were cultured on MS medium supplemented with different concentrations of 2, 4-D for callus induction. Callus was transferred on MS and WPM medium containing different plant growth regulators (2, 4-D, TDZ, NAA, BAP, kinetin) for regeneration. WPM medium supplemented with TDZ stimulated shoot induction. The highest efficiency of shoot regeneration was on medium supplemented with 0.5 mg/l TDZ.

MEDICINAL ORCHIDS IN INDIA AND STRATEGY FOR THEIR CONSERVATION**PARASHURAM. M. ^{1*} PAVAN KUMAR. P. ² AND CHANDRASHEKAR. K.G. ³**^{1, 2}*Department of Floriculture and Landscape Architecture, ³ Department of Fruit Science, College of Horticulture, UHS Campus, Bagalkot,*

Orchidaceae, the largest and most evolved family of the flowering plants comprises 25,000 to 35,000 species under 750 to 850 genera. Numerical strength of orchid species in India has been catalogued as nearly 1220 species, these are variously adapted to terrestrial, epiphytic, achlorophyllous, mixed habit as terrestrial and lithophytes mode. They exhibit incredible range of diversity in shape, size and colour of their flowers. Apart from their ornamental value, orchids have got special importance in traditional medicines. Orchids have been used as a source of herbal remedies in China since 2800 B.C. Some orchids have been used by Indians for their curative and aphrodisiac properties. In specific, some of the orchid species used in traditional medicine includes *Diurys maculata* used as anti- aphrodisiac and skin allergy soothers; *Cyrtorchis arcuata* used to treat the diabetes; *Vanda tessellata* a potential aphrodisiac and fertility booster; *Bulbophyllum maximum* and *Tridactyle tricuspidata* were used to treat against sorcery and madness. Out of 1220 species of orchids reported from India, nearly 300 species are rare, and about 150 species are endangered and ornamental whereas very few are of about 37 are importance for their medicinal value. Among the endangered species, *Paphiopedilum fairieanum*, *P. venustum*, *P. wardii*, *Vanda coerulea*

and *Renanthena imschootiana* belong to the Appendix-I list of CITES and IUCN. So, conservation of these orchids is so important otherwise in coming days they may disappear from earth. Conservation of genetic resources of Orchids through ex situ or in situ is commonly followed and conserved in orchidaria /botanic gardens and in sanctuaries/reserves. However, some of the rare orchid species are depends on other plant, insect and microbial species for their habitat, pollination, seed dispersal as well as germination. So to conserve these kinds of species we need to follow the integrated conservation approaches apart from conventional methods. We should also study their floral biology and pollination behaviours to propagate and introduce novel species to the specific areas in future.

A NEW DIGENETIC TREMATODE OF THE GENUS *HELICOMETRINA* PLAGIOPORINAE MANTER, 1947 FROM MARINE FISHES FROM BAY OF BENGAL, PURI, ODISHA(INDIA)

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Genus *Helicometrina* Plagioporinae Manter, 1947(Trematode: Allocreadiidae Stossich, 1903) is one of the most important digenean trematode parasite. It is prevalent in the intestine of a marine fish *Engraulis mystax* (cuv.and val.) from Puri, Odisha, were examined for infectivity with marine fish as a digenean trematode species. For examination and measurement acetoalum carmine stain was performed, followed by camera lucida drawing of morphological characters and measurement of morphometrical criteria. Total 15 marine fishes were found infected. During the survey of marine digenetic trematode parasites, collected one species of the Genus *Helicometrina*, i.e. *Helicometrina mystaxi* sp.nov., another is redescribed to show certain variations, the new parasite was obtained from intestine of marine fish *Engraulis mystax* (cuv.and val.).

Key Words: Digenean, Marine Fishes, Parasite, Trematode

PGPR FOR SUSTAINABILITY OF AGRICULTURE AND ENVIRONMENT

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Increasing agro productivity for feeding growing world population under present climate scenario requires optimizing the use of resources and adopting the sustainable agriculture productivity. This can be achieved by using plant beneficial bacteria i.e., those enhancing plant growth, nutrient use efficiency, abiotic stress tolerance, and disease resistance into agricultural production. Amongst these, plant growth promoting rhizobacteria (PGPR) have been seen as reliable and most promising candidates for plant growth promotion and phytopathogen control without environmental deterioration. Plant Growth Promoting Rhizobacteria (PGPR) or Yield Increasing Bacteria (YIB) are root colonizing bacteria that exert direct or indirect beneficial effects on plant growth and development. PGPRs are considered as efficient microbial competitors in the soil-root zone that help in plant growth promotion or disease suppression while increasing the resistance in plants. Increase in disease resistance involves Induced Systemic Resistance (ISR) or Acquired Systemic Resistance (ASR). PGPR also help the plant to overcome various biotic and abiotic stresses. The principle biotic stress involves the competing microbes, pathogens and parasites, while abiotic stresses include salinity, extreme (high/low) temperature, heavy metal ions, drought and presence of toxic metabolites or pesticides. PGPR also serve as biocontrol agents for controlling and inhibiting the growth of several plant pathogens, they are also involved in bioremediation (rhizomediation). Global concern over the demerits of chemicals in agriculture has diverted the attention of researchers towards sustainable agriculture by utilizing the multiple potential of PGPR. Therefore, management of pests and diseases, agro-ecosystem well-being, and health issues for humans and animals has become the need of hours. Use of PGPR as biofertilizers, plant growth promoters, biopesticides, soil and plant health managers have gained considerable attention among researchers, agriculturists, farmers and policy makers and consumers.

The multiple potential exhibited by PGPR for increasing agro productivity is the need of hour for feeding growing world population under present climate scenario. Thus sustainable agricultural vision can be achieved through the use of PGPR besides, the use of disease resistance, drought tolerance, salt tolerance, heavy metal stress tolerance varieties with better nutritional value. This can be effectively achieved through the use of PGPRs that include bacteria, fungi, algae, etc. that increase the nutrient uptake capacity. PGPR have been seen as reliable, eco-friendly, self replicating, cost effective and most promising candidates for plant growth promotion and phytopathogen control. However, to be an useful and effective bioinoculant, PGPR strain should possess high rhizosphere competence, safety to the environment, plant growth promotion and biocontrol potential, compatibility with useful soil rhizobacteria, broad spectrum activity, and tolerant to various biotic and abiotic stress. In the light of above properties, the need for a better PGPR to complement increasing agro-productivity as one of the crucial drivers of the economy has been highlighted.

Key words : PGPR, bioinoculants, biocontrol, Biopolymer, PHB

BIOCHEMICAL CHANGES IN RESPONSE TO ANATID HERPES VIRUS-I IN KHAKI CAMPBELL DUCKS

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A sub-acute disease pattern of duck viral enteritis was investigated by inoculation of virus isolated from the field. Four different groups were made each containing 5 birds, Group 1 and 2 were considered as control and after 15 days plasma was obtained and was analysed for different parameters. After obtaining the control samples both the groups were inoculated with virus and thus now Group 1,2,3,4 all are infected with fresh suspension of the collected tissue (Liver and Spleen) was prepared at the dilution of 1 in 10 in sterile normal saline (N.S.S.). After that each duck was inoculated with 2ml of diluents containing virus through intraperitoneal route (I/P). Group 2 and 3 received the infection while ducks of group 1 were inoculated with only diluents @2ml per bird through the same route. Both control and infected samples were differently investigated using 5 biochemical parameters and could found that the plasma GPT value and plasma GOT value increases. There was minor increase in alkaline phosphatase, but tremendous increase in LDH value. The level of haemoglobin percentage and total protein in infected group decreased.

BIOMEDICAL RESEARCH AND ITS IMPACT ON HEALTH CARE

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Because the pattern of scientific advance is uneven, efforts to halt cost-increasing innovation could have the opposite effect. The coevolution of costs and benefits in many medical treatments reveal the importance of research innovation. Traditionally, biomedical research endeavors in low to middle resources countries have focused on communicable diseases. However, data collected over the past 20 years by the world health organization(WHO) show a significant increase in the number of people suffering from non-communicable diseases(e.g. heart disease, diabetes, cancer and pulmonary diseases). Within the coming years WHO predicts significant decrease in communicable disease while non-communicable diseases are expected to double in low and middle income countries like in sub-Saharan Africa. The predicted increase in the non-communicable diseases population could be economically burdensome for the basic healthcare infrastructure of countries that lack resources to address this emerging disease burden. Biomedical research could stimulate development of healthcare and biomedical infrastructure. If this development is sustainable, it provides an opportunity to alleviate the burden of both communicable and non-communicable diseases through diagnosis, prevention and treatment. Using biomedical technology, especially genomics, has produced data that enhances the understanding and treatment of both communicable and non-communicable diseases. The availability of new molecular phenotype data brings many opportunities for developing prevention and treatment strategies that take the characteristics of each individual into account. It is within our reach to turn precision medicine into a reality and improve healthcare effectiveness by assigning more specific preventive or therapeutic interventions to those individuals that are more likely to benefit.

Keywords: Genomics, Biomedical, Coevolution, WHO, Healthcare, Phenotype

MARKER ASSISTED SELECTION OF WATER EFFICIENT AEROBIC RICE LINES(MAS26)WITH INTACT BASMATI GRAIN(PUSA1121)UNDER WATER LIMITED CONDITIONS

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Rice (*Oryza sativa*L.) is *gramene* family member and one of the oldest domesticated crops. As rice is moisture lusty crop, water scarcity has threatened its cultivation. The situation is further worse by adverse climatic changes. Aerobic rice can helps us in tackling this problem as it combines the drought resistant characteristics of upland varieties and highyielding traits of lowland varieties. The roots grow deeper and branched profusely in comparison to shallow roots conventional rice varieties, helpingin better absorption of water. Hence, aerobic rice requires 50% or less of the amount of water used by lowland rice. In India, development of aerobic rice varieties was initiated using the available upland paddy and high-yielding rice germplasm. Several aerobic rice varieties such as MAS946-1, PMK3, MAS25, MAS26 and MAS946 have already been developed for aerobic cultivation. Improvement for water use efficiency should not be at the cost of grain yield and quality to ensure the farmer's acceptability. Basmati rice area has a problem of drought and water availability. In the present study, experiments were conducted to evaluate segregating F₃ and F₄ and back cross populations of crosses derived from Pusa1121 (Basmati)×MAS26 (aerobic), for various physio-morphological and/or root traits, allelic diversity for *BAD2* (aroma) gene

and microsatellite markers linked to the traits promoting aerobic adaptation. The F₃ and F₄ and back cross population(s) of all the crosses, showed enormous variation for plant height, panicle length, and effective number of tillers per plant, root length, root thickness, fresh and dry root weight, 1000 grain weight, grain length/breadth ratio and yield per plant. A number of promising plants have been selected, which had higher grain yield, root length and biomass greater than MAS25, MAS26 and MASARB25 and Basmati specific allele at BAD2 locus (either in homozygous or heterozygous condition) for further progeny analysis. SSR database developed for PUSA1121 x MAS26 F₃, F₄, BC₁F₂ and BC₁F₃ population was used to map QTL for important traits using WinQTL Cartographer 2.5). Analysis revealed a 7,9,11 and 11 total of QTL which individually explained 0.0 – 84% phenotypic variation.

Key words: Rice, aerobic rice, Molecular marker, QTL, basmati, BAD2

MOLECULAR AND GENETICAL STUDIES ON DROUGHT TOLERANCE IN RICE (ORYZA SATIVA L.).

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Rice is an important cereal grown in about one-third of the world's total cereal crop area, providing staple food and 35–60% of the calories consumed by more than 2.7 billion people. In this review we discussed about the Molecular and genetical studies on drought tolerance in rice. Rice requires high temperature above 18-21°C but not less than 40 to 45°C. The lots of work have been done in this area to find out the cultivars, resistance to drought. Production of rice is decreasing day by day due to many biotic and abiotic stresses. Among them drought is one of the most common abiotic stress which affect yield and any other climatic factor of rice. There are three mechanisms are involved in drought resistance namely drought protect, drought avoidance and drought tolerance. Drought affect on the rice grain yield, chlorophyll content, plant height and number of tillers per plant. The first group includes proteins that probably function in stress tolerance (Functional protein), the second group contains protein factor involved in further regulation of signal transduction and gene expression that probably function in stress response (regulatory proteins), and the third group encloses protein. During drought stress, proline and many other proteins provide defense against drought. It has also been discussed that how breeders improved these traits in rice by using a quantitative trait loci (QTL) mapping approach. Different approaches like AB-QTL analysis, gene pyramiding and association mapping can also be used for the improvement of rice. Transgenic approach have also been adopted for rice to over-express transcription factors involved in the regulation of stress-inducible genes such as RD29B, RD22, CBF/DREB1, DREB2, and ICE1. Transgenic rice plants have been produced to over-express several candidate genes, such as Adc, P5CS, HVA1, TPS and TP, RWC3.

IMPACT OF BIO-ORGANIC COMPOUNDS ON EXTRACELLULAR LACCASE ENZYME PRODUCTION FOR BIOLOGICAL DELIGNIFICATION OF BAMBOO USING LENZITES ELEGANS WDP2

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Lignocellulosic bamboo biomass represents an untapped source of fermentable sugars for bioethanol production in Asian countries such as India. Its bio-conversion into bioethanol requires pre-treatment technology for lignin degradation which improves cellulose accessibility for enzymatic saccharification. During present study, the biomass from four different bamboo genotypes was screened and the potential species for bio-alcohol production was selected on the basis of biomass yield, lignin and cellulosic contents. Among the four Bamboo genotypes tested, *Bambusa balcooa* was selected as substrate due to its high biomass yield, high cellulose content (41.6%) and relatively low lignin (29.5%) content. Biological pretreatment of the biomass using a very high laccase enzyme producing mushroom *Lenzites elegans* WDP2 was conducted with few other reported pretreatments for fermentable sugar generation. The fungus showed extracellular laccase production in higher amounts (156.79 Uml⁻¹) in liquid production medium. Optimization of culture conditions using cheap and waste organic substrates further enhanced laccase enzyme production (189.25 Uml⁻¹) at 12d of incubation. Significant decrease in lignin content of biomass from 29.5% to 8.4% and increased in cellulose content from 37.93% to 61.59% was observed with biological pretreatment. Saccharification optimization was done by RSM using crude cellulase (FPU=0.732Uml⁻¹) from *Aspergillus* sp. PCF1. Maximum saccharification yield of 47.19% was achieved under the optimised conditions (18.4 Uml⁻¹ FPU/g substrate at 39.49°C). The degradation patterns in bamboo wood further analysed by various analytical and biophysical UV-Vis spectrophotometry, FTIR spectroscopy and SEM analyses.

ASSESSMENT OF CHANGES IN BIOCHEMICAL FRACTIONS DURING *IN VITRO* DECOMPOSITION OF WHEAT CROP RESIDUES BY *STACHYBOTRYS ATRA* CORDA

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The biochemical changes during decomposition of the different components of wheat residues by *Stachybotrys atra* *in vitro* were assessed. The samples of decomposing wheat internodes, leaves, chaff and straw were collected at the stage of decomposition for one and half month. The samples were subjected to biochemical analysis and the results were compared with non-decomposed initial samples. The fungus caused maximum decomposition of leaves (33.60%), followed by straw (22.87%), chaff (18.33%) and internodes (16.70%). The maximum loss in the dry weight of wheat internodes was due to loss of sugars, amino acids, peptides and soluble minerals, followed by starch, pectin, hexosans, cellulose, hemicellulose and lignin. In case of leaves due to cellulose followed by sugars, amino acids, peptides and chaff loss in the dry weight was mainly due to the degradation of fats, waxes, pectins and lignins. However, the maximum loss of cellulose, sugars, amino acids, peptides, fats and waxes were encountered during decomposition in wheat straw.

Key words: Fungal decomposition, wheat crop internodes, leaves, chaff, straw, *Stachybotrys atra*, biochemical assay.

LIPID PEROXIDATION, AUDPC, YIELD, AND TEST WEIGHT AND THEIR CORRELATION DURING *BIPOLARIS SOROKINIANA* INFECTION IN WHEAT

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The 32 resistant and 2 susceptible (check) (table 1) wheat genotypes were evaluated for the estimation of Lipid peroxidation (MDA), AUDPC, yields and test weight. The resistant genotype have the least MDA (0.106 nmoles/g fresh weight) content than the susceptible genotype having highest MDA (0.415 nmoles/g fresh weight) content and also found positively correlated with the AUDPC ($r = 0.772$) and negatively correlated with the test weight ($r = -0.438$) and the yield ($r = -0.317$). MDA was increase in the both resistant and susceptible genotype over the time period but due to lack of some antioxidant enzymes it shows the more damage to plant and estimated in terms of MDA content and found more at the 48 hours (0.208 nmoles/g fresh weights) time interval after the inoculation. Present study concluded the susceptible genotype shows the more damage after the inoculation of the *Bipolaris sorokiniana* then the resistant genotypes of wheat due to lack of antioxidant enzymes which reduces the harmful effects of ROS.

ASSESSMENT OF INSECT GROWTH REGULATOR ON GROWTH AND DEVELOPMENT OF *ANTIGARTRACATALAUNALIS* DUPONCHEL

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As regards the influence of the insect growth regulators on the biomass accumulation in *Antigarttracatalaunalis* larva, the related results have shown that both fourth generation insecticides considered under this investigation has potential to reduce the growth in this insect even at very low concentration. In context of the efficiency of the insect growth regulator's reducing the accumulation of the biomass in larva, as per results of this investigation, considering concentrations from 0.0001 to 1.00 per cent the insecticides screened under this investigation proved effective and found novaluron is more effective than chlorfluazuron. Pupa obtained from the untreated adults acquired 152.60 mg. biomass which was considerably more than that of the pupa obtained from the adults/larvae treated earlier by all methods. Weight of the pupa varied from 69.56 mg. to 153.82 mg. in response to different concentrations of both insect growth regulators used for treatment by adult feeding method and it was detected to differ with the concentration and decrease with the increasing concentrations. The male obtained from the untreated pupa/adult was heavier (106.47 mg.) than that obtained from pupae treated by adult feeding method with any concentration of both fourth generation insecticides used in this research study. Weight of the male varied from 48.36 to 101.86 mg. in response to the adult feeding treatment with different concentrations of the insecticides and as per analysis of variance, the weight of the male depended on concentration of the insecticide with a clear tendency to decrease with increasing concentration. Like the accumulation of the biomass of the larva, the acquisition of biomass in pupa and adult is also reduced by both insecticides under the both methods of treatment but both methods which applied in this study are not identically effective in causing reduction in the biomass of pupa and adults.

Key words: *Antigarttracatalaunalis*, Novaluron, growth regulators, growth and development

SYNTHESIS AND BIOLOGICAL EVALUATION OF NEW PYREIMIDINES**RAJESH KUMAR MALIK***Chemistry Department M.D University Rohtak*

A simple and efficient method has been developed for the synthesis of various 1, 2, 3, 4-tetrahydropyridopyrimidine derivatives prepared from urea and substituted aldehydes using microwave irradiation technique, the series of ethyl-(2-hydrazino-2-oxoethyl)-6-methyl-2-oxo (4-bromo phenyl)-1, 2, 3, 4-tetrahydropyrimidine -5-carboxylate synthesized, confirmed by analytical and spectral data and evaluated for their calcium channel inhibition.

KEYWORD : Micro irradiation, synthesis antibacterial activity, urea.

BIODIVERSITY OF GRASSY WEEDS AND THEIR ETHNOBOTANICAL IMPORTANCE IN AMROHA AND RAMPUR DISTRICTS (U.P), INDIA**RAJKUMAR* AND BEENA KUMARI***Department of Botany, Hindu College, Moradabad. 244001 (U.P.) India*

The grassy weeds are highly conspicuous and often significant components of the flora of virtually every cropping system in the world. They are found in nearly every crop during the respective seasons, rabi (spring) and kharif (autumn). Grassy weeds on one hand cause serious problems and on the other hand they are used for various purposes by local people. The present study is based on research work carried out during 2017 in Amroha and Rampur Districts of Uttar Pradesh. The research area was extensively surveyed in order to investigate grassy weed species. From the study area 24 weed species of grasses belonging to 19 genera were collected from gardens, agricultural fields, in fire burnt fields, nearly wet irrigated land, ditches, along water courses, along roadsides and railway lines, shady and waste places. These are *Aristida adscensionis*, *Avena fatua*, *Brachiaria ramosa*, *Brachiria reptans*, *Cenchrus ciliaris*, *Cenchrus setigerus*, *Cymbopogon jwarancusa*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Dactyloctenium scindicum*, *Desmostachya bipinnata*, *Dicanthium annulatum*, *Digitaria ciliaris*, *Echinochloa crus-galli*, *Eragrostis minor*, *Imperata cylindrica*, *Panicum antidotale*, *Paspalum paspaloides*, *Polypogon monspeliensis*, *Saccharum benghalensis*, *Saccharum spontaneum*, *Setaria glauca*, *Setaria verticillata* and *Sorghum halepense*. Out of these grasses some are used as fodder for cattle and said to be improves milk production. Some grasses are used as brooms. Some provides a good pasturage, especially on alluvial flats. Some are used for matting and thatching purpose and some are for medicinal purpose. The stems of grasses are also used to woven winnowing trays (Chaj) that is used to separate chaff from grains. Root system of some grasses is extremely extensive and acts as an effective soil binder.

Keywords: Grassy weeds, Diversity, Ethnobotanical importance, Amroha, Rampur.

BIOTIC AND ABIOTIC STRESS MANAGEMENT IN PULSES**RAJU LAL***Rajasthan College of Agriculture, (MPUAT), Udaipur, Rajasthan*

Abiotic stress is the negative impact of non-living factors on the living organisms in a specific environment.^[1] The non-living variable must influence the environment beyond its normal range of variation to adversely affect the population performance or individual physiology of the organism in a significant way. Whereas a [biotic stress](#) would include living disturbances such as [fungi](#) or harmful insects, abiotic stress factors, or stressors, are naturally occurring, often intangible and inanimate factors such as intense sunlight, temperature or wind that may cause harm to the plants and animals in the area affected. Abiotic stress is essentially unavoidable. Pulses, being rich in protein, minerals and vitamins, play a significant role in the nutritional security of Indian people, especially those below poverty line, who can ill-afford animal food products. However, per capita per day availability of pulses in India at present is about 47 g against the minimum recommended dose of 70 g/capita/day. The productivity of pulses in India (~ 755 kg/ha) is very low as compared to other countries. Biotic and abiotic stresses are the major barriers in realizing the yield potential, as about 87% of the area under pulses is rainfed and mainly confined to marginal and sub-marginal lands. Losses due to biotic and abiotic stresses in pulses vary from 30 to 100% depending on the magnitude of their severity. To ensure sustainable pulse production under the impacts of changing climate, integrated package of practices are required for different regions of the country. Among the abiotic stresses, drought and heat stress may reduce seed yields by 50%, especially in arid and semiarid regions and among biotic, fungi and viruses are the largest and most important groups affecting all parts of the plant at all stages of growth of food legumes.

AQUAPORIN AND ITS ROLE IN DROUGHT MANAGEMENT

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Aquaporins are membrane channel proteins that are ubiquitously present in all kingdoms of life. Since the discovery of the lipid bilayer in the 1920s, the flow of water across cells and subcellular compartments was assumed to be carried out by simple diffusion across biological membranes. The molecular identity of the first water channel protein, aquaporin 1 (AQP1) was established by Agre and coworkers in 1992 based upon its ability to dramatically increase the water permeability of *Xenopus* oocytes expressing the CHIP28 gene. Presently, 35 aquaporin encoding genes in *Arabidopsis thaliana* (thereafter *Arabidopsis*), 31 in maize, 33 in rice, 47 in tomato and 66 in soybean were discovered. They are categorized according to their intracellular locations and sequence similarities: the plasma membrane intrinsic proteins (PIPs), tonoplast intrinsic proteins (TIPs), NOD26-like intrinsic proteins (NIPs) and small, basic intrinsic proteins (SIPs). Regulation of plant aquaporin activity occurs at different levels viz. post transcriptional, post translational, pH, heteromerization, ROS, diurnal and circadian regulation. The change in the response and expression of plant aquaporins is due to different environmental stimuli. Both PIPs and TIPs are more responsive to drought, salt and cold stress that disturb cell osmotic balance. They regulate root hydraulic conductivity (L_{pr}) and transpiration rates. TIPs along with NIPs are involved in biotic stress responses and are involved in regulating nutrient homeostasis between host and its pathogen. NIPs and TIPs are also found during pathogen interaction. Plants are able to escape or tolerate drought by regulating their aquaporin activities through different ways such as decreasing water loss via. transpiration (regulation of stomata), maintaining inner water status of cell, CO_2 homeostasis and by cytosolic osmoregulation. During the year 2017, around 59% of India has received substantially less rainfall as compared to previous years. Drought affects economy, agriculture and society. Aquaporin has been found to effectively regulate plant water relation so that it can be used by plant breeder for developing drought tolerant varieties in future.

FORMATION OF INSULATING BRICKS FROM AGRICULTURAL WASTE

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Energy is essential for the economic growth and industrial development of any country. The quality of life is closely related to energy consumption which has continuously increased over the last few decades in developing countries. It is required recovering the waste heat by some means. India is one of the agricultural countries which produce large amount of by-product from agriculture but it is fact that large amount of agricultural waste is still not used in a proper way. The energy output of furnace system using agricultural waste can be used for fabrication of bricks. In recent years different ways are adopted for improving the efficiency of furnace. Various attempts were made to incorporate various waste material in bricks production such as natural fibers, textile laundry, wastewater sludge, foundry sand, granite sawing waste, perlite, processed waste tea, sewage sludge, structural gas waste, PC and TV waste, fly ash, sugarcane baggase ash, organic residue, steel dust, bottom ash, rice husk ash, silica fume, marble and granite waste, municipal solid incineration fly ash slag.

Different tests were conducted on the bricks manufactured from waste. Brick's property like physical, mechanical has been positively influenced by the addition of waste material. Moreover utilization of waste in bricks manufacturing may conclude to be conservation of natural resources, environmental protection and saving in land for construction. Furthermore there will be energy conservation which is in otherwise will be spent in extracting, handling and reclaiming the virgin resources as clay or shale in bricks production. The pollutant gases such as CO , CO_2 , NH_3 are usually emitted through bricks firing and will be considerably reduced in non-fire bricks, hence, sustainability will be achieved. Further works should hold more studies in producing the bricks by an economical and environmental approach neither consume energy nor emit pollutant gases.

Keywords: Reduce energy consumption, Utilization of agricultural waste, Improved quality of Bricks, Pollution control

SYNERGISTIC EFFECTS OF PLANT VIRUSES AND HEAVY METALS ON DIFFERENT RESPONSES OF PLANT SYSTEM

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Keywords: Arsenic, Begamovirus, Defense related enzyme, *Nicotiana tabacum*

Plants develop specific mechanisms, which permit them to detect stress/es and respond against them. These interactions help plants to minimize damage and allow them to survive even in complex stress conditions. Stress may be abiotic or biotic which potentially damage physiological changes within plants. Abiotic stress is a physical such as heavy metals, heat, cold,

drought, salinity, and nutrient stress may impose on a plant. Biotic stresses are living organisms, such as bacteria, viruses, fungi, parasites, insects, weeds etc, through which a plant may be exposed during its lifetime. In this study we focused the investigation on the relationship between host plant, virus and heavy metal interactions. For this study biotic or abiotic stresses was examined in *Nicotiana tabacum* where the *Begamovirus* strain and different concentration of metal (AS III AS V) in soil separately was taken under glasshouse condition. This study showed arsenic metal ion as well as virus activities enhance the defense related enzymes (ascorbate peroxidase, guaiacol peroxidase, superoxide dismutase and catalase). The simultaneous application of virus and metal attenuates the concentration of peroxidase, chlorophyll and carotenoid. The presence of high conc. of heavy metal in soil leads to various physiological changes in plants. The results showed that the virus with heavy metals retards the growth of shoots as well as roots. Interestingly high conc. of metal inhibits the accumulation of virus. This study suggested that using non-toxic concentration of metals may protect plants from viral infection.

EVALUATION OF *IN VITRO* ANTIOXIDANT ACTIVITY OF *PICRORHIZA KURROA* ROYALE EX. BENTH IN CHICKEN LYMPHOCYTES

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Poultry industry is highly susceptible to biotic and abiotic stresses that lead to heavy economic losses. Medicinal plants products can play important role as natural antioxidants and thereby improving chicken immunity if these could be introduced as feed additives to improve overall performance. *Picrorhiza kurroa*, commonly known as kutki and belongs to the family Scrophulariaceae. It is an herbal plant native to the Himalayan regions of India, Pakistan, and Nepal. It is reported to be an effective hepatoprotective and antineoplastic plant that also possesses antihyperlipidemic, immunomodulatory and antioxidant activities. *Picrorhiza kurroa* is rich in several phytochemicals and thus the present study was planned to explore its antioxidant potential through *in vitro* assays. Present study was conducted to explore antioxidative potential of hydromethanolic plant extract of *Picrorhiza kurroa* (PKE) in chicken lymphocytes culture system through DPPH, Nitric oxide scavenging assay. Also, levels of LPO, GSH, Superoxide dismutase and Nitric oxide were determined in chicken cells treated with PKE. The extraction yield of hydromethanolic extract of PKE was found to be 7.78%. In DPPH assay, IC₅₀ of PKE was found to be 153.56µg/ml where as in Nitric oxide scavenging assay IC₅₀ of PKE was found to be 86.82µg/ml. The level of lipid peroxidation was found to be reduced significantly as compared to the control. On the other hand, a significant increase was observed in the levels of GSH, Superoxide dismutase, catalase and nitric oxide as compared to the control. PKE showed marked antioxidant potential in the chosen cell culture system and can be further explored for development of antioxidative herbal preparation for poultry to combat oxidative stresses.

DOMESTICATION, DOMESTICATION SYNDROME AND ITS CONSEQUENCES ON GENETIC DIVERSITY.

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Domestication is the process of bringing wild and their wild relatives under human management. This domestication process starts from the free living crop plants with little investment and intervention of humans (It includes pre domestication archaic cultivation) and further continued increasing co-dependency between crop plants and the human (here takes place the unconscious selection of genes for domestication). And at the later stage the plants cannot reproduce their own without the intervention of human labour, at this stage the humans had turned into an agriculture economy; giving up other modes of subsistence (it includes the selection of wide range of desirable traits). Domestication syndrome is term often used to describe the suite of phenotypic traits arising during domestication that distinguish present cultivated crops from their wild and wild ancestors. Phenotypic variation has been manipulated by humans during crop domestication, which occurred primarily between 10000 to 11000 years ago or before the start of agriculture in the various centers of origin around the world. The morphological modifications selected during domestication have been of such magnitudes that many crop plants usually cannot survive in the wild anymore without human assistance. And the process of domestication has profound consequences on crops, where the domestication has moderately reduced genetic diversity relative to the wild ancestor across the genome, and severely reduced diversity for genes targeted by domestication. It is estimated that cultivated tomato contains only 5% of the genetic diversity present in wild relatives. The question that remains is whether reduction in genetic diversity has affected crop production today. It is clear that selection during domestication and plant breeding has reduced genetic variation in all crop species. Therefore, novel variation can be introduced from wild relatives and/or intermediate landraces, and some proportion of this novel variation will be useful in crop improvement by either traditional breeding methods or biotechnology. For example, several disease-resistance genes have been identified in wild tomato, (*S. pimpinellifolium*), and transferred into modern cultivars. Of course, wild relatives and landraces have potentially useful variation for any trait and,

thus, could contribute to increased production, reduction of inputs such as fertilizers and pesticides, increased tolerance abiotic stress, and improved nutrition.

Key words: Domestication, selection, genotypes, diversity, syndrome and evolution etc.

AMRLIORATIVE EFFECT OF HYDROALCOHOLIC EXTRAXT OF AJUGA BRACTEOSA LEAVES ON LIVER IN ALLOXAN INDUCED DIABETIC CHICKS

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Objective: To investigate the ameliorative effect of hydroalcoholic extract of *Ajuga bracteosa* leaves on the liver function in alloxan induced diabetic chicks. **Hypothesis:** *Ajuga bracteosa* has been reported for its antioxidant and antidiabetic effect clinical or preclinically. However, more scientific research is yet to be done on *Ajuga bracteosa*. **Methods:** Alloxan (12 mg/ 100 gm body weight, i.p.) was used to induce diabetes in chicks and the blood glucose levels were estimated by using commercial kit (Span Biotech, Surat, India). After the confirmation of diabetes in chicks, hydroalcoholic extract of leaves of *Ajuga bracteosa* (10 mg/ 100gm body weight, orally) was administered to the diabetic chicks for 30 days daily. The study was carried out by monitoring the Alkaline phosphatases (ALP), Aspartate amino transferase (AST - SGOT) and Alanine amino transferase (ALT - SGPT) in alloxan induced diabetic chicks; including diabetic and diabetic treated chicks and normal control chicks fed with water ad libitum at the end of the study period. **Results:** The administration of hydroalcoholic extract of *Ajuga bracteosa* in diabetic chicks showed a marked decline in the level of Alkaline phosphatases (ALP), Aspartate amino transferase (AST - SGOT) and Alanine amino transferase (ALT - SGPT) as compared to the diabetic control chicks ($p < 0.05$) and is almost or near to the values in Normal control chicks ($p < 0.05$). **Implication:** These results suggest that the administration of hydroalcoholic extract of *Ajuga bracteosa* leaves in the diabetic chicks significantly ameliorated the enzymological parameters for the assessment of liver function.

Keywords: Diabetes mellitus, *Ajuga bracteosa*, Alloxan, ALP, AST - SGOT, ALT - SGPT.

NANOTECHNOLOGY: POTENTIAL APPLICATIONS FOR CROP IMPROVEMENT

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Nanotechnology, the revolutionary interdisciplinary science is offering promising innovative approaches for accelerating the pace of crop improvement today. Quantum dot aided monitoring of pathogens pave the way for plant disease prevention. Newer dimensions in crop protection include use of Nanoencapsulated pesticides to fight plant diseases. Anti microbial properties of silver, zinc oxide and titanium dioxide nanoparticles are being explored for biotic stress management. Zinc oxide nanoparticles as fertilizers have scope to offer solutions to micronutrient problem. Herbicides encapsulated in nanoparticles provide effective and environmental friendly strategy to combat the threat of weeds. Input of fertilizers, pesticides, herbicides, plant growth regulators is being minimized by entrapment of these agrochemicals inside nanotubes, chitosan polymers, dendrimers which in addition to increasing their bioavailability also reduces their undesirable effects as bioaccumulation, effect on soil fertility and biodiversity loss. Nanobiosensors are emerging as promising crop productivity enhancing tools that by way of detecting levels of soil nutrients and crop pathogens to enable effective farm management strategies. Plants are being bestowed with enhanced capabilities through nanobionics engineering, Incorporating nanomaterials in plants have generated Nanobionics plants with novel functional properties as efficient photosynthesis and biochemical sensing.

Key words: Nanotechnology, nanomaterials, nanobiosensors, nanobionics, pesticides.

THE ANTIBACTERIAL PROPERTY OF BUMBLE BEE HONEY

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Honey is increasingly valued for its antibacterial activity, honey is used on the basis of it being an antibacterial substance but knowledge regarding the mechanism of action is still incomplete. We assessed the bactericidal activity and mechanism of action, the antibacterial effects and minimum inhibitory concentration (MIC) of Bumble bee honey was evaluated. Honey have highly distinct compositions of bactericidal factors, resulting in large differences in bactericidal activity. Honey acts as an antibacterial agent against many bacteria. Four bacterial species viz., *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas*

fluoresces and *Staphylococcus epidermidis* which we isolated from pure cultures were used in this study. There are two sorts of antibacterial agents or so called "inhibines." One of them is heat and light sensitive and has its origin in the hydrogen peroxide produced by honey glucose oxidase. Some workers believe that hydrogen peroxide is the main antibacterial agent. Other authors find that the non-peroxide activity is the more important one. The hydrogen peroxide amount in honey is very small and it can be produced only after aerobic incubation of diluted honey solutions, which might mean that it is not very important for the antibacterial action of honey. However, a certain antibacterial test might be sensitive only to certain types of antibacterial substances. It was found that while in an agar disc diffusion test only the peroxide activity was measured, in a liquid medium test only the non-peroxide substances were active. The healing property of honey is due to the fact that it offers antibacterial activity.

Keywords: Bumble bee honey, antibacterial activity, minimum inhibitory concentration, agar disc diffusion

PARASITIC POTENTIAL OF ECTO-LARVAL PARASITOID, *GONIOZUS NEPHANTIDIS* (MUESEBECK) (BETHYLIDAE: HYMENOPTERA) ON *CORCYRA CEPHALONICA* (STAINTON)

REPALLE NAGANNA AND SHINDE, C. U.

The coconut palm, *Cocos nucifera* L. belongs to family Arecaceae is "Tree of Life" as well as "Kalpa vriksha" provides livelihood to billions of people across the world. The coconut palm is infected by number of insect pests. Among them, *Opisina arenosella* Walker causes the severe damages to the foliage, depriving the palm of its photosynthetic area and thus, directly affecting the yield. The black headed caterpillar, *Opisina arenosella* is attacked by many entomophagous insects during its developmental stages. Among them, *G. nephantidis* is a gregarious larval parasitoid and responsible for the reduction in the population pest under field conditions. However, to know the parasitizing efficiency and to maintain the quality of mass reared parasitoid under field conditions, it is important to determine the parasitizing efficiency of mass reared *Goniozus* under laboratory conditions. Considerable work on the parasitic potential of *Goniozus* is yet scanty. In this view, it was felt necessary to conduct a research work on the parasitic potential of *G. nephantidis*. In the present study, we investigated the detail observation on the ovipositional behavior and clutch size of *G. nephantidis* and the position of *G. nephantidis* eggs on *C. cephalonica* larvae during the present investigation.. Study on the parasitic potential revealed that parasitoid paralyze the larva of *C. cephalonica* within 2 to 3 hours after release. The female examines the host for about 20 to 25 seconds. The average number of larvae parasitized by adult parasitoid of *G. nephantidis* was 6.07 ± 1.55 . The average clutch size of *G. nephantidis* was 8.97 ± 2.09 eggs per larva.

KEY WORDS: Parasitic potential, *G. nephantidis*, *C. cephalonica*, etc

INVESTIGATIONS ON SILVER NANOPARTICLES AS A POTENTIAL NEMATICIDE AGAINST *MELOIDOGYNE GRAMINICOLA*

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Plant-parasitic nematodes cause severe damages to the various agricultural crops leading to socio-economic food security challenge. Therefore, identification and development of novel and environmentally benign nematicides becomes indispensable. In this study, silver nanoparticles (AgNPs) have been investigated as potential nematicide against rice root-knot nematode, *Meloidogynegramnicola* in rice (*Oryzasativa*). A series of *in vitro* assays and greenhouse experiments were conducted to establish the nematicidal effects of AgNPs. No visible phytotoxicity of AgNPs was observed on seed germination and plant growth throughout the experiments. The results from lab assays revealed 0.1 µg/ml as the optimum concentration for 100% nematode mortality after 12 h in water screening test. Further, sand screening test indicated 100% irreversible nematicidal effect of AgNPs at 2 µg/ml after 24 h of incubation. Furthermore, greenhouse assays in soil-less system of rice crop culture resulted in significant suppression of root galling at 1 µg/ml concentration of AgNPs. Also, the effective dosage in experiments using naturally-infested field soil was found to be 3 µg/ml which is appreciably lower than the values (150 µg/ml) reported in literature till date. The results indicated that AgNPs has effective nematicidal activity our potentially toxic existing nematicides.

Keywords: Pusa Basmati 1121, *Meloidogynegramnicola*, nematicide, rice, root-knot nematode, silver nanoparticles, transmission electron microscopy

LONG NON-CODING RNA: MASTER PLAYER OF GENE REGULATION IN PLANTS

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Long non-coding RNAs (lncRNAs) have gained widespread attention in recent years as a potentially new and crucial layer of biological regulation. These molecules refer to over 200 nt functional RNA molecule that are not translated into protein. Previously thought to be dark matters of the genome, lncRNAs have been gradually recognized as crucial gene regulators. Genome-wide identification has uncovered large amount of lncRNAs in Arabidopsis, Rice, Maize and Wheat, and more information from other plant species are expected with the aid of deep sequencing technologies. Until now, at least four divergent lncRNA-mediated regulation mechanisms have been unravelled, including target mimicry, transcription interference, PRC2 associated histone methylation and DNA methylation. lncRNAs are also involved in the regulation of flowering, photomorphogenesis, male sterility, phosphate homeostasis and alternate splicing response in plants. Plant lncRNAs are transcribed by the plant-specific RNA polymerases Pol IV and Pol V, leading to transcriptional gene silencing, as well as by Pol II and III. Deep RNA sequencing has led to the identification of 3679 lncRNAs in tomato fruit that are transcribed from all tomato chromosomes, 85.1 % of which came from intergenic regions. VIGS was used to silence two novel tomato intergenic lncRNAs, lncRNA1459 and lncRNA1840, which resulted in delay of ripening. Although tremendous progress has been made in animals and human, the study of lncRNAs in plant is still in its infancy. There is still plenty to learn and much work to be done.

Key words: Gene silencing, lncRNA, Sequencing and Transcription

CLINICAL MANIFESTATION OF POLYCYSTIC OVARIAN SYNDROME & IT'S RELATIONSHIP WITH PSYCHOLOGICAL DISTRESS LEVELS AMONG THE CONCERNED SUBJECTS IN ALLAHABAD CITY

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Polycystic Ovarian Syndrome is a complex endocrinopathy affecting women of reproductive age affecting 5 to 10 % population worldwide. In India, it has been reported that 9.13 to 22.5 % population are suffering from this syndrome, but prevalence rate varies with different regions of the country. It is increasingly recognised that ethnic differences are likely contributors to the differing manifestations of PCOS. It is now accepted that this problem is arising from persistent anovulation with a spectrum of etiologies and clinical manifestations. It has also been reported in previous studies that PCOS affects quality of life and can worsen existing anxiety and depression either due to the features of PCOS or associated comorbidities. Objective: To find out the pattern of clinical manifestation of PCOS and it's relationship with Psychological Distress levels among PCOS subjects. Materials & Methods: In this cross-sectional, age matched case-control study, 150 PCOS patients were recruited from various Hospitals & Nursing Homes of Allahabad city and 150 controls were recruited from general population on the basis of rotterdam criteria. A self made questionnaire with items related to pieces of information about clinical symptoms was used for data collection. Psychological Distress levels were assessed using the P.G.I Health Questionnaire N1. Statistical analyses were performed using SPSS Ver. 20.0. Chi Square test was used to test the association between variables. A p-value less than 0.05 was considered as statistically significant. Results: The most common phenotypic expression found to be was Androgenic Alopecia followed by Hirsutism, Menstrual Irregularity, Acne, Acanthosis Nigricans, Insomnia, Sleep Apnea in a sequence. Infertility present in most of the married subjects. Psychological Distress levels were reported more in cases rather than controls. Conclusion: The findings of the study revealed that PCOS subjects having more clinical manifestation were moderate to severe neurotic.

Keywords: Endocrinopathy, Anovulation, Hirsutism, Acanthosis Nigricans, Androgenic alopecia

HISTOPATHOLOGICAL AND HISTOCHEMICAL PERTURBATIONS IN THE OVARIES OF *CHRYSOMYA MEGACEPHALA* INDUCED WITH CHLORPYRIFOS

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A dreadful, globally distributed, medically and veterinary important fly *Chrysomya megacephala*, causes myiasis in humans and animals and acts as a vector for the transmission of various pathogens, bacteria, viruses and helminths as it usually seen in the vicinity of the carrion, faeces, foodstuffs and humans. In the present study, an investigation on the histopathology and histochemistry was done to throw some light on the framework of the ovary after insecticide application and changes in the constituents taking place. Organophosphate insecticide Chlorpyrifos was given in the feed of the flies at a sub lethal dose (0.008%) and was observed at 2 post treatment intervals i.e. 24 hours and 48 hours. Ovaries consists of terminal filament,

germarium and vitellarium. Vitellarium consists of follicles having trophocytes and oocytes enclosed within a capsule formed of cuboidal follicular epithelium having oval nuclei and dense cytoplasm. Considering, the histopathology, disruption in the female reproductive organs was prominently perceptible. Treated ovaries exhibited degeneration of primary follicle cells and pycnosis in the cytoplasm. Nuclei of follicular epithelium shows clumping, ooplasm gets contracted and vacuolation of the yolk is evident. Significant reduction is seen in the rate of vitellogenesis and follicle development within 24 hours after ingestion of the insecticide. All these effects became more pronounced after 48 hours. Regarding the histochemistry, the carbohydrate positive content declined after the administration of the insecticide which further declined after increasing the dose time period (48 hours). Thus, Chlorpyrifos can be effectively used in the areas where these flies are creating annoyance, without affecting the humans and the environment.

Keywords: *Chrysomya megacephala*, Chlorpyrifos, Myiasis, Ovariole, histopathology, histochemistry, pycnosis.

INVITROANTIOXIDANTS AND PHARMACOGNOSTICAL INVESTIGATIONS INCLUDING HPTLC ANALYSIS FOR THE STANDARDIZATION OF CICHORIUM INTYBUS L SEEDS.

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Objective: To carry out the physicochemical and phytochemicals standardization with HPTLC fingerprinting of *Cichorium intybus* L seeds to establish the standard pharmacognostical parameters of this valuable medicinal plant. **Methods:** Many standardization parameters of *Cichorium intybus* were analyzed. Standard method was adopted for the preliminary phytochemicals screening. Analysis of total phenolic and flavonoid contents, pesticides residues, aflatoxin & heavy metals were also performed. CAMAG- HPTLC system was used for fingerprinting of methanolic extract of *Cichorium intybus* L seeds. The slides of surface preparation of leaf were prepared for quantitative microscopic parameters. The air dried powdered plant materials were subjected for determination of physicochemical standardization. Phytochemical screening was performed for Presence/absence of phytopconstituents in the plant which was helpful development of analytical profile. The antioxidant potential was evaluated by DPPH method, H₂O₂ scavenging method and reducing power method. **Results:** Phytochemical screening showed scavenging power (59µg/mL) at 100µg/mL concentration and 38µg/mL for Ascorbic acid. And methanolic extract of *Cichorium intybus* showed concentration dependent scavenging activity against hydroxyl radical. The IC₅₀ value of methanolic extract *Cichorium intybus* was found to be 4.54µg/ml against standard ascorbic acid (IC₅₀ 2.50µg/ml) respectively. The total content 57.2 mg GAE/100 g & 5.61 mg QE/100 g phenolic compounds & flavonoids were respectively found in methanolic extract of *Cichorium intybus*. Heavy metal residue, pesticide residue & aflatoxin residue were totally absent in *Cichorium intybus*. The HPTLC method Toluene: Ethyl acetate: Formic acid (70:40:10 v/v) was found to be the best and gave good resolution with R_f 0.53 for quercetin acid and R_f 0.89 for quercetin. The proposed method was found to be precise, simple, specific and sensitive and can be used for quality control purposes of the plant *Cichorium intybus* seeds. Heavy metals concentrations were found to be within standard limits. Aflatoxins and pesticides residues were absent. **Conclusion:** The outcome of this study might prove beneficial in herbal industries for identification, purification and standardization of *Cichorium intybus* L seeds.

Keywords: *Cichorium intybus* L seeds; Chicory; Asteraceae; Antioxidant; HPTLC.

MICRORNAS AND MICROPROTEINS: SMALL BUT MIGHTY

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MicroRNA (miRNAs) are small non coding RNA molecules found in plants and animals whereas Microproteins (miPs) are small and single-domain proteins encoded by small open reading frames (smORFs). MiPs harbour a protein-protein-interactions and also known as interfering proteins which dimerize with larger multi-domain proteins and prevent them from forming functional complexes and acting as dominant, post-translational and negative regulators for their targets in analogy to miRNAs. To date, several miRNAs and miPs have been identified using bioinformatic tools in plants and animals which regulates various physiological processes including growth, development, cellular metabolism and stress response. MiRNAs and miPs both of them play their role to control flowering in plants. They have high potential to be used in biotechnology because they function in a much targeted manner. The ever growing interest of scientists in targeting crop traits such as higher yield, stress tolerance, and reduction of toxic compounds shows the importance of biotechnological tools that can alter

the development of plants to achieve these goals. Knock outs and RNAi have some limitation such as permanent loss of gene-specific functions, off-targets effects or the instability of improved traits through subsequent generations. Artificially derived miPs known as synthetic microProteins as well as artificial miRNAs overcome these limitations. They interact with the target and expressed in a controlled manner to get desired effect. Therefore they are the key tools for controlling the protein activity and gene expression. Further research is needed to understand the network between miRNAs, miPs and their targets which can extend beyond transcription factors to evoke functional responses in biological system.

BIODIVERSITY OF INSECT PEST COMPLEX INFESTING OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH) ECOSYSTEM

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A field experiment was conducted during *Kharif* and *Rabi* seasons, 2017 at Experimental Farm, Deptt. of Horticulture, Assam Agricultural University, Jorhat (Assam) to study the diversity of herbivores and their natural enemies in okra ecosystem. Altogether 20 species herbivores and 20 species of predators were recorded in *rabi* season (February to May) as against 21 species of herbivores with 20 species of predators found during *Kharif* season (July to October) in this ecosystem. Six species of herbivores were identified as "major" based on relative abundance and they were *Aphis gossypii* (Glover), *Amrasca biguttula biguttula* (Ishida), *Bemisia tabaci* (Gennadius), *Sylepta derogata* (Fabricius), *Dysdercus cingulatus* (Fabricius) and *Earias vittella* (Fabricius), in both the seasons. Among the natural enemies, *Coccinella transversalis* (Fabricius) and *Menochilus sexmaculatus* (Fabricius) were recorded as the most predominant species in okra. *A. gossypii*, *A. biguttula biguttula*, *B. tabaci* and *S. derogata* were comparatively more abundant in vegetative stage, while *D. cingulatus* and *E. vittella* in reproductive stage of okra. It was observed that, species richness (R), species diversity (H') and evenness (E) of herbivores was more in *kharif* season (7.37, 2.14 and 0.74) and least in *rabi* season (6.90, 2.16 and 0.72) respectively. As regards to the predators, maximum species richness, species diversity and evenness of predators was found in *kharif* season (4.75, 2.82 and 0.89) as against *rabi* season (4.96, 2.74 and 0.89) respectively.

Key words: Okra, species diversity, species richness, species evenness, pest, predators.

PHARMACOGNOSTIC STUDIES ON *COMMELINA BENGHALENSIS* L. AND *C. DIFFUSA* BURM F. FL – THE LESS KNOWN UNANI MEDICINAL PLANTS.

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Since the dawn of human culture, longevity and eternal health have always remained the esteemed dream of human being and to achieve this man is using natural resources around him. Search for the remedy to relieve pain and discomfort prompted man to search and develop diverse ways of attaining health care that include the development of various therapeutic agents, health boosters and health tonics. Over the millennia, the man followed various systems of treatment and health care. Unani is one such traditional system of medicine followed and adopted in many countries. It involves the use of plants and minerals as a source of medicine. In spite of many merits and sustainable effects, Unani folk medicine is losing its charm in this modern world of synthetic medicine which offers instant relief but has many side effects. However, in the case of traditional / folk medicine, proper characterization of the plants concerned remains the goal of effective therapy. The present study was aimed to characterize *Commelina benghalensis* L. and *C. diffusa* Burm f. Fl. locally known as Badi Mai and Chhoti Mai used by the local hakims of Amravati District, Maharashtra, India. The whole plants of both the species are used as antipyretic. Morphological and anatomical studies of all vegetative plant parts (including vessel studies) was carried out. Camera lucida sketches were made. Whole plant tissue was extracted for bioactive molecule characterization. Plant extracts were tested for 9 types of bioactive compounds and free amino acids. Mineral composition was studied both qualitatively as well as quantitatively. *C. benghalensis* L. contained various useful components such as free amino acids like as L- tyrosine, glucosamine hydrochloride, serine, DL-alanine, threonine, L-cystine, ornithine monohydrochloride, valine and minerals like sodium, potassium, chlorine, sulfur, calcium, magnesium and iron. While *C. diffusa* Burm f. Fl. Amino acids found in these plants are known for their wide range of significance. L- tyrosine is instrumental in causing hyper Lysinemia and hyper ammonia, glucosamine is used to make a "cushion" that surrounds the joints and helps to prevent osteoarthritis. Serine has a fundamental role in metabolism and signaling in living organisms, DL-alanine - plays important function in the glucose-alanine cycle, L- Cystine/Ornithine monohydrochloride is used to produce the antioxidant glutathione, and plays a role in the communication between immune system cells, glycine is used for treating schizophrenia, stroke, benign prostatic hyperplasia other metabolic disorders. It also protects the kidneys from the harmful side effects of certain drugs used after organ transplantation as well as the liver from the harmful effects of alcohol. These amino acids are also useful during illness and

stress conditions. Both plants contained a wide variety of steroids such as iridoids, cardenolides, tannins like leucoanthocyanin and phenolics. Iridoids that exhibit a wide range of pharmacological activities such as cardiovascular, hypoglycaemic, antitumor, antiviral, immunomodulation and purgative, cardenolides plays important role in strengthening the heart while tannins have astringent property. Phenolics have many important functions in plants due to their role in morphological development, physiological processes, and reproduction. It is important for the human diet for its antioxidant properties and beneficial health effects. Both plants showed the presence of an array of biologically active compounds such as amino acids, steroids, and phenolics. These compounds have vital importance in physiology, growth, metabolism, hormone production, protein synthesis and in providing protection and health during metabolic disorders or stress conditions

Keywords : Unani medicine, *Commelina benghalensis* L., *C. diffusa* Burm f. Fl, Pharmacognosy.

SEASONAL INCIDENCE OF CITRUS LEAF MINER (*PHYLLOCNISTIS CITRELLA* STANTON) IN TRANS YAMUNA REGION OF ALLAHABAD, INDIA.

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Seasonal incidence of citrus leaf miner (*phyllocnistis citrella* Stainton) in Trans Yamuna region experiment research work was conducted at Horticultural field, SHIATS, Allahabad during Kharif 2015, where the first peak was observed during first week of October 2015 i.e. in 40 MW when incidence was 26.78 percent infested leaves. Average influencing temperature of the earlier week was 36.42°C and 27.80°C maximum and minimum respectively, humidity 90.71 percent and 47.14 percent maximum and minimum, respectively and rainfall of 0.20mm, Wind velocity 1.71 Km/hr and Sunshine 7.17 hr/day. Second peak of incidence was observed during 41 during second week of October 2015 with 24.94 percent infested leaves. Average influencing temperature of earlier week was 35.77 and 27.82°C maximum and minimum, respectively, humidity 90.00 percent and 51.57 percent maximum and minimum respectively and rainfall of 0.00mm, Wind velocity 1.56 Km/hr and Sunshine 8.68 hr/day.

Keywords: Citrus leaf miner, Incidence, Influence, Temperature, Meteorological week

BIOTIC AND ABIOTIC FACTORS RESPONSIBLE FOR LARGE SCALE DRYING OF KHEJRI TREES, *PROSOPIS CINERARIS* (LINN) IN RAJASTHAN WITH SOME RECOMMENDATIONS FOR ITS EFFECTIVE MANAGEMENT

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Prosopis cineraria (Linn) is commonly known as Khejri in Rajasthan. This tree species is the State tree of Rajasthan because of its big range of products and services rendered to desert inhabitants. Insect pests are amongst the most detrimental factors in the successful establishment and growth of *Prosopis cineraria* (Linn) in arid and semi arid zone of Rajasthan. Khejri has a unique distinction of being referred in a variety of contexts, More than thirty potential insect pests, causing severe damages to *P. cineraria* have been recorded from arid and semi arid areas. Of them, 18 species have been recorded as new pest records on *P. cineraria* which including four species of long horned cerambycid beetles viz., *Derolus iranensis* (= *descicollis*) pic, *Aeolesthes holosericea* fab, *Hypoeshrus indicus* Gahan and *Acanthophorus serraticornis* (Oliver), exhibit severe infestations to *Prosopis cineraria* in four north western districts of Rajasthan, namely Nagaur, Sikar, Churu and Jhunjhunu. Damage by these pests with recommendations to combat and manage *Prosopis* trees with the severe damages caused by Khejri root borer, *Acanthophorus serraticornis*, has been discussed during the scientific session of the conference.

EFFECT OF ORGANIC MINERAL MIXTURES, PROBIOTICS, ENZYMES, EMULSIFIER AND LIVER SUPPLEMENTS ON CARCASS TRAITS OF BROILERS

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A total number of 396 day old commercial broiler chicks (Cobb) were divided into eleven groups with three replicates. The groups were designated as T₀; basal diet, T₁; basal diet along with organic mineral mixture 1 (Organomin forte) @ 0.5 g/ kg feed, T₂; basal diet along with organic mineral mixture 2 (Vannamin) @ 0.5 g/ kg feed, T₃; basal diet along with probiotics (Microguard) @ 0.1g/kg feed, T₄; basal diet along with enzymes + probiotics (Brozyme - XPR) @ 0.5g/ kg feed, T₅; basal diet along with emulsifier (Lipigon) @ 0.5g/ kg feed, T₆; basal diet with 3% less energy, T₇; basal diet with 3% less energy along with liver supplement 1 (Superliv premix) @ 0.5 g/kg feed, T₈; basal diet with 3% less energy along with liver supplement 2 (X- liv Pro) @ 0.5 g/kg feed, T₉; basal diet along with enzymes with probiotics (Brozyme - XPR) and liver supplement 1 (Superliv premix) @ 0.5 g/kg feed, and T₁₀; basal diet along with enzyme with probiotics (Brozyme - XPR),

liver supplement 1 (Superliv premix) and emulsifier (Lipigon) @ 0.5 g/kg feed. The results revealed that maximum dressed yield with and without giblets at six weeks was noted in group T₁₀ i.e. broilers supplemented with enzymes with probiotics, liver supplement 1 and emulsifier followed by T₄, T₉, T₃, T₅, T₂, T₁ and T₈. Similarly, all the supplemented groups showed significant (P<0.05) increase in the cut up parts compared to the control except T₆, T₇ and T₈. Supplemented groups also showed significant (P<0.05) decrease in the processing losses except in T₇ for blood loss & feather loss and in T₆ & T₇ for head loss. Thus, it may be concluded that supplementation has been found beneficial in yielding more edible meat with lesser dressing losses.

CURRENT STATUS AND FUTURE DIRECTIONS IN PHYTOREMEDIATION OF ORGANIC POLLUTANTS

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Phytoremediation is the technique in which plants are used for extraction, sequestration and/or detoxification of pollutants. It is a non-intrusive and nondestructive alternative to the environmentally destructive physical remediation methods in practice. Phytoremediation strategies can broadly be divided into direct and *explanata*. Plants remediate pollutant through various biochemicals, physiological and genetic processes which comprise adsorption, transport and translocation; hyperaccumulation; or transformation and mineralization. Plants completely mineralize organic pollutants into comparatively less toxic substances. Organic pollutants such as polychlorinated biphenyls (PCBs); polycyclic aromatic hydrocarbons (PAHs); nitroaromatic; and linear halogenated hydrocarbons are the potential targets for phytoremediation. In recent years progress has been made to develop native and transgenic plants for the remediation of organic pollutants. Phytoremediation is advantageous in terms of cost, ease of monitoring, contribution in soil stabilization and carbon sequestration. However, some lagging in the process is due to its comparatively slower rate, seasonal dependence, and pre-requisite of adaptation of plants to the environment of the site.

Keywords: Phytoremediation, Organic pollutant, hyperaccumulation, polycyclic aromatic hydrocarbons, polychlorinated biphenyls

MEDICINAL PLANTS SPEAK BIOACTIVE SECONDARY METABOLITES

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The increasing incidence of microorganisms were becoming resistant due to their insufficient control of infectious disease. Traditional medicinal plants as potential sources of phytochemicals are known to have diverse biological activities (antibacterial, antifungal and anticancer). In recent year, plant-derived secondary metabolic compounds become easily accessible and economically available sources for the treatment of many different infection and new drug development. Many developing countries, there are more than 20,000 plant species used plants material that produces novel bio-active substances as "traditional medicine". This study will be discussed the antimicrobial activity of secondary metabolites from different medicinal plants. After analysis of phytochemical it will be shown that medicinal plants have different active natural products. Scientist's able to discover the characterization of active plant extracts (stem, leaves, bark and root) for development of scientific research community. The discovery of different secondary metabolites inhibit highly active pathogenic bacteria (*B.subtilis*, *E.coli*, *P.aeruginosa*, *S.aureus*). An antimicrobial is as agent that kills microorganisms or stops their growth and can be classified according to their function. Some bio-active natural compounds such as terpenoids (Menthol) gives the plant odor, other (quinone and tannins) are responsible for plant pigment. Many compounds are responsible for plant flavor (capsaicin from chilli peppers). *Ocimum gratissimum* and *Toddalia asiatica* were examined for antimicrobial activity against methicillin-resistant *S.aureus* and *P.aeruginosa*. Morphine alkaloids are pain relievers that are used as narcotics. Catechin (flavonoids) from *Cameliasinesis* inactivated cholera toxin in *Vibrio cholerae*. Eugenol is a terpenoid that is considered against both fungi and bacteria.

Keywords: Medicinal plant, Secondary metabolites, Natural compound, Biological activity.

CHECKLIST OF ACRIDIDAE (ACRIDOIDEA) OF UTTAR PRADESH

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Grasshoppers and locusts have long term association with human beings as they have been the major pest of almost every type of vegetation. They belong to suborder Caelifera that comes under the order Orthoptera. They destroy crops over a wide area when they swarm in millions as locusts. Due to the devastating effect they can also be the reason of famine. Even in small no. they can be serious pests. The Acrididae are the major group of grasshoppers, containing about 6,701 valid species

of the 8,132 species of the whole Superfamily Acridoidea (Cigliano et al., 2017). Due to great significance of Acridids as important agricultural pests, it is aimed to prepare a checklist of Acridid fauna of Uttar Pradesh, India. Therefore, a checklist of Acrididae of Uttar Pradesh was prepared in light of distributed data and published literature gathered from various resources and in addition to identified specimens stored in Department of Zoology, Aligarh Muslim University, Aligarh. A sum of 78 species/subspecies were recorded comprising of 49 genera and 12 subfamilies. The most predominant subfamily was observed to be Oedipodinae. Species were arranged by their individual subfamilies and their percentage of occurrence was calculated subfamily wise.

Keywords: Acrididae, Pests, Checklist, Uttar Pradesh

INDUCED MUTAGENESIS FOR SUSTAINABLE PRODUCTION OF AROMATIC PLANT AJWAIN (*TRACHYSPERMUM AMMI*): A REVIEW ARTICLE

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Abstract: In Ancient time seed spices are used as a spice for adding taste and flavour in foods but nowadays people use seed spices as a medicinal purpose because of their immense therapeutic values. *Trachyspermum ammi* is one of the most important medicinal plant commonly known as ajwain, is an annual and aromatic plant belonging to family Apiaceae is a minor group seed crops. It is widely grown in India, Iran, Egypt and Afghanistan. In India, it is grown in Rajasthan, Gujarat, Uttar Pradesh, Madhya Pradesh and Bihar. Ajwain fruits contain various phytochemical constituents mainly carbohydrates, protein, fats, fibre, glycosides, phenolic compound, volatile oil mainly thymol (35-60%) and some carvacrol. Medically it is proved that thymol contains various pharmacological activities like antimicrobial, antifungal, antispasmodic, antihypertensive, diuretic, cytotoxic, nematocidal, anti-filarial, anthelmintic, antitussive, anti-inflammatory, analgesic, antioxidant and antiseptic activity. Traditionally the plant is used as stimulant, carminative, atonic dyspepsia, diarrhoea, abdominal pains, lack of appetite, gastrointestinal problems, asthma and bronchial problems. These studies give a sharp knowledge that ajwain is a source of medicinally active compounds and have various phytochemical and pharmacological effects. This plant has been unnoticed so very little work is known to create genetic variabilities. Genetic variation can be induced by using physical and chemical mutagen. Induced mutagenesis is a cost-effective method of plant breeding to enhance quantitative and qualitative characters in the crop. Studies on mutation breeding suggested that crop varieties generated through the use of mutation breeding are significantly contributing to combat global food and nutritional insecurity and improved livelihoods. Thus it encouraging to find new improved varieties of ajwain through mutation breeding.

Keywords: *Trachyspermum ammi*, Apiaceae, Therapeutic uses, Mutation breeding

ACCESSEMENT OF GENETIC DIVERSITY CRITICALLY ENDANGERED SPICES *COMMIPHORA WIGHTII* USING RAPD MARKERS

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Guggal (*Commiphorawightii*) is a pharmacologically, economically and ecologically important species. It is found in wild form in western India and eastern Himalayas and grow abundantly in Karnataka, Gujarat and Rajasthan. The guggulosterones present in the guggul gum of *C. wightii* plants have antioxidant activity as well as Guggulipids from the resin is effective as anti-inflammatory, anti-bacterial, antimicrobial, anti-oxidant, anti-arthritis, anti-malarial, antimycobacterial, anti-schistomal, hepatoprotective, muscle relaxant, larvicidal, and molluscicidal. The objective of present study to evaluate the genetic variability between the samples collected from different locations of India. Randomly amplified polymorphic DNA (RAPD) analysis was conducted to find genetic relationship among 21 *Commiphorawightii* accessions collected from Rajasthan, Madhya Pradesh, and Gujarat. Seven RAPD markers showed clear banding patterns and resolution in the accessions of *C. wightii*. These 7 RAPD markers produced 30 amplified loci ranging between 250 to 2000 bp. Twenty eight loci (93.33%) were found polymorphic in 21 accessions and the average percentage of polymorphic loci was 4%. Cluster analysis was performed based on Jaccard's similarity coefficient matrices and a dendrogram was generated. Based on phylogenetic analysis, 21 accessions of *C. wightii* were grouped into two major clusters with two sub-groups (A and B) having 10 and 11 accessions respectively. The cluster A contains 10 accessions namely CW-1 to CW-8 collected from Jodhpur, Rajasthan and accessions CW-9 and CW-10 from Anand, Gujarat. The cluster B contains 11 accessions CW-11 to CW-17 from Gujarat and CW-18 to CW-21 collected from Murena, Madhya Pradesh. Present study concluded that there is a significant diversity between collected samples revealed using RAPD primers and the information derived in this study will certainly help in improvement of guggal for commercial utilization.

Key words: RAPD; Molecular marker; Dendrogram; *Commiphorawightii*; Genetic diversity;

MIRNA TARGET PREDICTION OF FLOWERING GENES IN CAJANUSCAJAN, GLYCINE MAX AND MEDICAGOTRUNCATULA**SAKSHI CHAUDHARY AND YASINJESHIMA KHAN**

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The transition from vegetative to reproductive development stage is complicated and essential procedure in the life cycle of flowering plants which needs full response to endogenous signals and multiple environmental aspects. In the past years, all of the known components of the so-called autonomous pathway have been identified that regulates the process of flowering. Phosphatidyl ethanolamine-binding protein (PEBP) related proteins have been discovered in many plant species. Most plant PEBP-like proteins contain conserved eukaryotes-specific regions, which contain the FLOWERING LOCUS T (FT)-like proteins, MOTHER OF FT AND TFL1 (MFT)-like proteins and the TERMINAL FLOWER1 (TFL1)-like proteins. MFT-like genes are involved in seed development and germination, whereas FT/TFL1-like genes are mainly involved in flowering-time regulatory pathways. MicroRNAs (miRNAs) are useful regulators of gene expression in plants. In order to silence many different mRNAs in a precise manner, miRNA stability and efficacy is controlled by highly developed regulatory pathways and fine-tuning mechanisms both affecting miRNA processing and altering mature miRNA target specificity. To predict target for miRNAs of three legumes we have taken all flowering related genes including FT and FLC of *Cajanuscajan*, *Glycine max* and *Medicagotruncatula*. We have completed their annotation and mapping. To calculate the coding potential we have taken transcript sequence of selected flowering genes. In glycine max there was one weak coding sequence that we have taken for further analysis. We have predicted miRNA for *Glycine max* weak coding transcript and using this miRNA sequence we have predicted targets for all three legumes i.e. 277 targets for *Glycine max*, 288 for *Cajanuscajan* and 271 in *Medicagotruncatula*.

GENOME ANNOTATION**SAMITA**

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Genome annotation as a subfield in the general field of genome analysis, which includes more or less anything that can be done with genome sequences by computational means. In simple, operational terms, annotation may be defined as the part of genome analysis that is customarily performed before a genome sequence is deposited in gene bank and described in a published paper rules of inference. It centered on prediction of the functions of proteins encoded in sequenced genomes by extrapolating from the functions of their experimentally characterized homologs. The GeneQuiz project was the first automatic system for genome analysis. Genome annotation consists of three main steps: Identifying portions of the genome that do not code for proteins, identifying elements on the genome and attaching biological information to these elements. Automatic annotation tools try to perform all this by computer analysis, in addition to manual annotation which involves human expertise. These approaches co-exist and complement each other in the same annotation pipeline. The simplest way to perform gene annotation relies on homology based search tools, like BLAST, to search for homologous genes, the resulting information is then used to annotate genes and genomes. Proteogenomics based approaches utilize information from expressed proteins, often derived from mass spectrometry, to improve genomics annotations. Here is a list of on-going projects relevant to genome annotation: ENCODE, Entrez Gene, Ensembl, GENCODE, Gene Ontology Consortium, GeneRIF, RefSeq, Uniprot, Vertebrate and Genome Annotation Project. The success of this approach depends on the sensitivity and selectivity of the methods that are used for detecting sequence similarity.

Keywords: Gene, Annotation, BLAST.

EXAGGERATIVE DEFENSE MECHANISM OF BRASSICA JUNCEA L. BY BRASSINOSTEROIDS (24-EPIBL AND 28-HOMOBL) TREATMENTS UNDER HIGH TEMPERATURE STRESS**SANDEEP KUMAR¹ ALKA RAJPUT², GEETIKA SIRHINDI², RAJKUMARI SANAYAIMA DEVI¹ AND S.N. TRIPATHI¹**¹Department of Botany, Punjabi University, Patiala-147002 ²Department of Botany, Deen Dayal Upadhyaya College University of Delhi, Sector-3 Dwarka-110078

Agriculture represents a core part of the Indian economy and provides food and livelihood activities to much of the Indian population. While the magnitude of impact varies greatly by region, climate change is expected to impact on agricultural productivity and shifting crop patterns. Climatic changes and increasing climatic variability are likely to aggravate the problem of future food security by exerting pressure on agriculture. Increased concentration of greenhouse gases (GHGs) in the atmosphere resulted in warming of the global climate system by 0.74 °C between 1906 and 2005. The trends of rise in temperature, heat waves, droughts and floods, and sea level shown by the Indian scientists are in line with the Inter-Governmental Panel on Climate Change (IPCC) though magnitude of changes could differ. The mean temperature in India is

projected to increase up to 1.7 °C in kharif (July to October) and upto 3.2 °C during rabi (November to March) season, while the mean rainfall is expected to increase by 10% by 2070. This increased temperature affects the agriculture productivity and shifting crop patterns in India. Adaptation of crop plants to environmental stresses is dependent upon the activation of cascades of molecular networks involved in stress perception, signal transduction and the expression of specific stress-related genes and metabolites. To mitigate the impact of high temperature on agriculture crops, biotechnological and breeding approach play a crucial role followed by physiological approaches (by applying phytohormone). Applications of Phytohormones has several advantages over the biotechnological and breeding approach like cost effecting and time saving and without altering the genome of crops. Presents study was pertaining to explore the role of 24-epiBL (brassinosteroids) in the mitigation of harsh effect of high temperature on *Brassica juncea* L. RLM 619 at physiological, biochemical and molecular level. In order to explore the ameliorating potential of BRs in plants particularly in agriculture crops like *Brassica juncea* L. subjected to high temperature stress with various concentrations of 24-epiBL. The morphology of *B. juncea* L. seedlings has revealed remarkable reduction under high temperature stress and 24-epiBL helps in ameliorating this reduction. Photosynthetic pigments such as chlorophyll and carotenoids decreased significantly in seedlings subjected to high temperature (25 °C to 45 °C). 24-epiBL helps in ameliorating photosynthetic ability by protecting chlorophyll and carotenoids content from high temperature stress. All concentrations ameliorate carbohydrate, vitamin C and Proline content in seedlings exposed to different temperatures as compared to control seedlings. Enzymes of antioxidant defense system ameliorate in 24-epiBL treated seedlings as compared to untreated control seedlings when exposed to different temperatures. Observation suggested that photosynthetic machinery reduce their efficiency under high temperature and 24-epiBL treatment helps in maintaining the efficiency of photosynthesis by increasing the activities of antioxidant enzyme followed by enhance level of osmolytes compounds. Improved health of plants with 24-epiBL at morphological level increasing activity of antioxidant enzyme followed by the enhance level of Vit. C and Osmolytes indicate, 24-epiBL can be used to mitigate the toxic effect of environmental stress in agriculture crops.

VIROIDS AND ITS INTERACTION WITH HOST

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Viroids have unique structural, functional, and evolutionary characteristics. They are composed of a small, non-protein-coding, single-stranded, circular RNA, with autonomous replication. The smallest known agent of infectious disease, are single stranded RNA molecules of low molecular weight that multiply in plants and cause disease. The first viroid was discovered by T. O. Diener in 1971 who found it to be the causative agent of potato spindle tuber disease, the disease previously considered to be caused by *Potato spindle tuber viroid*. The viroids are easily transmitted by mechanical inoculation and often seed transmitted. Spread by contact with contaminated pruning tools, farm implements during propagation and cultural practices. Viroids can also spread by graft transmission and seed transmission. Viroid species are clustered into the families *Pospiviroidae* and *Avsunviroidae*, whose members replicate (and accumulate) in the nucleus and chloroplast, respectively. The RNA molecule contains no protein encoding genes therefore; the viroid is totally dependent on host function for its replication. Viroids replicate in three steps through RNA based rolling-circle mechanism: synthesis of longer-than-unit strands catalyzed by host RNA polymerases; processing to unit-length. Symptoms could result from direct interaction between the genomic viroid RNAs and a host factor (HF, protein or RNA). Host factor may be present either in the organelles where the viroid replicates and accumulates or in the cytoplasm during viroid movement. In the family *Pospiviroidae* viroid-specific siRNAs could accumulate either in the nucleus or in the cytoplasm. In the family *Avsunviroidae* is mediated by hammerhead ribozymes; and circularization. Within the initially infected cells, viroid RNA must move to its replication organelle, with the resulting progeny then invading adjacent cells through plasmodesmata and reaching distal parts via the vasculature. To carry out these movements, viroids must interact with host factors. The mature viroid RNA could be the primary pathogenic effect or, alternatively, viroids could exert their pathogenic effects via RNA silencing. *Avsunviroidae* viroid-specific small interfering RNAs (siRNAs) should be generated only in the cytoplasm. Host-pathogen relationship is very important to develop control method. Viroids seem able to encounter the plant defense. This shows the importance to have a comprehensive knowledge of the host-pathogen relationship to act efficacy against viroid.

EFFECT OF HEAT STRESS ON THE IONOMIC PROFILING OF WILD-TYPE (*C. PLATYCARPUS*) AND CULTIVATED VARIETY (*CAJANUS CAJAN*)

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Iononics constitute a high-throughput profiling techniques to decipher the molecular basis underlying mineral and trace element composition, which makes up the "Ionome". Ion accumulation is an intricate process that influences almost every aspect of plant germination, growth, development and survival. In the present study, the ionomic profiling of seeds under

control and heat stress conditions were measured between wild-type (*C. platycarpus*) and cultivated variety (*Cajanus cajan*) also known as Asha of pigeon pea crop. Seeds were kept over germination paper and subjected to heat stress for 12 h and 24 h at 42°C. Possible changes in the ionome of two varieties following heat stress were explored.

It was observed that among macro elements, the order of expression in terms of quantification was K>Mg>Ca> Na, with respective values as (769.2, 490.2, 423.7 and 46.6 at 0hr; 4569.0, 1625.3, 399.5 and 70.1 at 12hr; 7368.4, 2064.6, 478.6 and 37.4 at 24hr in cultivated genotype Asha whereas, 6630.4, 2447.8, 524.3, 66.3 at 0hr; 5698.9, 2076.1, 484.6 and 121.0 at 12hr; 5322.6, 2421.5, 430.9 and 80.6 at 24hr in wild species *C. platycarpus*, respectively). Whereas, among micro elements, the order of expression was Fe>Zn>Cu>B>Mo>Mn Data suggests that the heat stress also affected the elemental balance in plants. The present study will be useful for characterizing plant responses to various abiotic stresses. Further experiments are required on different developmental stages of plants under these stress conditions and also the assessment of ions which act as cofactor for various enzymes.

CRISPR AND ITS IMPLICATIONS IN CROP IMPROVEMENT

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CRISPR/Cas9 (clustered regularly interspaced short palindromic repeat)-Cas9 is a multipurpose technology based on the complementarity of the guideRNA (gRNA) to a specific sequence and the Cas9 endonuclease activity. It has broadened the horizon of crop improvement by opening up doors to develop novel plant varieties with deletion of detrimental traits or addition of beneficial ones. Genome editing using artificial nucleases like Zinc finger (ZNFs) and transcription activator-like effector nucleases (TALENs) have long been used to produce targeted mutation in specific loci in a variety of plants. Recently, clustered regularly interspaced short palindromic repeat (CRISPR)/Cas9 (CRISPR-associated) system has been emerging as a powerful alternative method for introduction of site specific DNA double stranded breaks. CRISPR/Cas9 was demonstrated as a simple and inexpensive method for genome editing in soybean and hence facilitating the use of genome editing to validate candidate genes, develop novel alleles/phenotypes, and engineer plants with important agronomic or quality traits. Resistance to various diseases in major crop plants has been obtained through CRISPR/Cas9 technology. For example, resistance against blast disease is seen in rice plants by targeting *OsERF922* gene. Metabolic engineering is another area where CRISPR/Cas9 strategy has found its niche. Manipulation of the biosynthetic pathway of benzylisoquinoline alkaloids (BIAs) in *Papaver somniferum* was done by knocking out 3'O-methyltransferase (3'OMT2) gene through CRISPR/Cas9 mechanism. Thus the future of versatile genome editing for designing elite and superior crops lies in the hands of CRISPR-Cas9 technology. This strategy has the potential to radically change crop improvement techniques and thus help plant breeders to develop designer crops in the years to come.

Key words: CRISPR/Cas9, Crop improvement, DNA double stranded breaks, Designer crops, guideRNA.

CHARACTER ASSOCIATION AND D^2 ANALYSIS IN INDIAN MUSTARD [*BRASSICA JUNCEA* (L.) CZERN & COSS]

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The present investigation involving thirty eight genotypes was undertaken to examine the various parameters. All the genotypes were tested in RBD with three replications during *rabi* 2015-16. Observations were recorded for twelve characters. PCV and GCV were observed moderate for number of primary branches per plant, number of secondary branches per plant, number of siliqua per plant, number of seed per siliqua, biological weight per plant, harvest index, seed yield per plant and 1000 seed weight. This indicated that, there was least influence of environment in the expression of these traits. High heritability coupled with high genetic advance were observed for number of primary branches per plant, number of secondary branches per plant, number of siliqua per plant, number of seeds per siliqua, biological yield per plant, harvest index, seed yield per plant and 1000-seed weight. This indicated that the preponderance of additive gene effects for these characters and hence the selection, directly based on these traits may be rewarding. Seed yield was found to be highly significant positive correlation with siliqua per plant and harvest index. Thus, it can be inferred that by improving these traits through selection either alone or in combination, will result in improvement of yield in mustard. Path coefficient analysis showed positive direct effect on influence of harvest index, biological yield, number of siliqua per plant. Mahalanobis D^2 statistics revealed considerable genetic diversity among the genotypes. The 38 genotypes grouped into seven clusters. The I and II cluster having the maximum number of genotypes. This envisaged that the genotypes grouped within a particular cluster are more or less genetically similar to each other. Divergence study suggested that among the genotypes like PBR-210 and Sanjucta ASECH with RLM-619, Pusa Tarak, Jawahar mustard, Swarnajoyti and RGN-73 would be rewarding for getting desired segregants, from breeding point of view.

DETERMINATION OF PHYSICAL AND BIOCHEMICAL PROPERTIES OF GROUNDNUT (GG – 20)**SAPARIYA P. S.¹, ZILPILWAR, S. R.² AND SAKARIYA K. K.³**^{1, 2 & 3} College of Agricultural Engineering and Technology, JAU, Junagadh

India occupies the first place, both in regard to the area and the production of groundnut in the world. Gujarat is leading state in production of groundnut and GG-20 is the most famous local variety of groundnut in Saurashtra region. For the design of the processing machinery as well as production of processed food there is necessity of physical and biochemical properties of groundnut kernel. The physical properties of freshly harvested groundnut kernel was found viz., weight of 100 grains, maximum diameter, minimum diameter, bulk density, true density and porosity were found 117.00 ± 13.92 g, 8.71 ± 0.75 mm, 7.39 ± 0.34 mm, 459.86 ± 53.50 kg/m³, 1125.60 ± 132.96 kg/m³ and 48.41 ± 6.62 %, respectively at the time of harvesting and 51.99 ± 5.23 g, 8.11 ± 0.49 mm, 7.3 ± 0.31 mm, 595.9 ± 9.14 kg/m³, 836 ± 116.10 kg/m³ and 49.04 ± 6.44 % respectively at the time of threshing. The biochemical parameters of freshly harvested groundnut kernel, viz., moisture, protein, carbohydrate, fat and ash content were found 53.07 ± 3.17 %, 20.37 ± 0.59 %, 25.07 ± 0.80 %, 25.56 ± 0.88 % and 1.55 ± 0.50 % respectively at the time of harvesting and 8.31 ± 0.26 %, 22.50 ± 0.77 %, 22.50 ± 0.51 %, 43.79 ± 2.29 % and 1.33 ± 0.29 % respectively at the time of threshing. The bulk density, porosity, protein and fat content of fresh groundnut kernel at a time of harvesting were more as compared to a time of threshing and weight of 100 grains, maximum and minimum diameter, true density, moisture, carbohydrate and ash content of fresh groundnut kernel at a time of harvesting were less as compared to a time of threshing.

ANTIBACTERIAL ACTIVITY OF CYAMOPSISTETRA GONOLOBA (GUAR GUM) AGAINST E. COLI (GRAM - VE) AND BACILLUS SUBTILIS (GRAM +VE)**SARITA RANA AND PUSHPENDRA SHARMA**

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Cyamopsistetragonoloba (Guar Gum) also known as guar bean belongs to Family -*Fabaceae*. Endosperm of guar seeds are used in many sectors of industries like mining, petroleum, drilling and textile., food products, pharmaceuticals, cosmetics, water treatment, mining, drilling, explosives, confectioneries and many more. Since a long time Guar Gum can be also named as a hydrocolloid, is treated as the key product for humans and animals as it has a very high nourishing property. Medicinal plants have been used for centuries as remedies for human diseases because they contain components of therapeutic value. Medicinal plants are the best source to obtain a variety of drugs. Dry powder of Guar seed was prepared by grinding method. Plant extract prepared through Soxhlet Extraction method in Methanol and Ethanol organic solvents. The plant extract were prepared for antibacterial activity which is used against *E. Coli* and *Bacillus subtilis* by Disc diffusion method. Gentamycin disc and Streptomycin disc were used as control media. The result shows that Guar Gum seeds are having good antibacterial activity and showing minimum inhibitory concentration zone of 10 mm against *E. coli* and 4mm against *Bacillus subtilis* in Methanol solvent whereas 7mm against *E. coli* and 4mm against *Bacillus subtilis* in Ethanol solvent.

POTENTIAL USE OF FOLIAR BIOINOCULANTS FOR GROWTH PROMOTION OF POTATO (SOLANUM TUBEROSUM L.)**SATISH KUMAR* & RAKESH KUMAR**

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Plant growth promoting bacteria (PGPB) are plant associated microorganism known to induce plant defenses and beneficial effects such as increased plant growth and low susceptible to diseases caused by pathogen. PGPB are capable of significantly altering the growth phenotype of inoculated plant. A total of forty six bacterial isolates were isolated from phyllosphere of five different crops (Cotton, Mung bean, Potato, Wheat, and Pearl millet). All the bacterial isolates were characterized for IAA production, Antifungal activity and Phosphate solubilization. All the isolates were producing IAA and highest IAA produced by isolate WHK2 (31.06 µg/ml). Out of 46 isolates, only 17 isolates showed antifungal activity against *A. niger* and *R. solani*. A total of 15 bacterial isolates solubilized phosphate and highest phosphate solubilisation index was observed in isolate COJ4 (19.18). On the basis of plant growth promoting traits, total 7 isolates (POK3, PMK3, COJ4, MUK1, WHK2, WHN1 and WHN2) were selected for the pot house studies in potato (Kufri bahar var.). Potato yield & its plant height were observed at 90 days after showing. Maximum plant height was observed with foliar application of isolate PMK3 along with RDF i.e. treatment T15 (36.0 cm). Highest potato yield was observed in foliar application of isolate PMK3 along with RDF i.e. treatment T15 which is 0.194 kg respectively. Among the seven bacterial isolates (POK3, PMK3, COJ4, MUK1, WHK2, WHN1 and WHN2) tested for plant growth promotion effect in potato crop, maximum plant growth promotion effect was observed with bacterial isolate PMK3 and COJ4. So, bacterial isolate PMK3 and COJ4 may be explored further for the field experiment.

Key word: PGPR, IAA, Growth promotion

ROLE OF POLYPHENISM IN INSECTS

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Polyphenism is a phenomenon in which multiple discrete phenotypes develop from a single genotype. Phenotypic plasticity can be continuous or discontinuous where in the former is called as reaction norm and later as polyphenism. The polyphenism are discrete alternative phenotypes that develop in response to the environmental variations. It can be one of the major reasons for the success of the insects which offer the opportunity to deploy the same genome to partition life history stages to adopt different phenotypes that best suited to predictable environmental changes. It occurs in almost all insect orders viz, wing length polyphenism and reproductive polyphenism in hemimetabola, seasonal, colour and form polyphenism in Holometabola and caste polyphenism in Isoptera and social Hymenoptera. The temperature, photoperiod, population density and quality and quantity of larval diet are the major environmental cues that trigger the polyphenism. In addition several neuroendocrine hormones especially ecdysone and juvenile hormone are associated with the polyphenic regulation in several insect species. So, polyphenism can evolve if one or more of these components of endocrine switching mechanism become sensitive to environmental variables. The phenotypic plasticity promotes the origin of novel phenotypes, divergence among populations and species and the formation of new species that leads to the development of strong species to adapt and survive in the changing environmental condition.

Keywords: Polyphenism, Phenotype, Photoperiod and Insect pest.

ROLE OF HOST PLANT RESISTANCE IN INSECT PEST MANAGEMENT

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Plants and phytophagous insects have evolved a very long close relationship approximately 350 million years ago. Although insect resistant plants have been recognized for many years as sound approach to crop protection, it is only during the last two decades that insect plant interaction have been extensively investigated from the behavioral, ecological and physiological point of view. During last 20 years, more than 500 commercial insect resistant varieties of many crops have been developed and released. These varieties are helpful to farmers to save billions of dollars in insecticide costs. "The relative amount of heritable qualities possessed by the plant which influence the ultimate degree of damage done by the insect". The first documented record of an insect resistant wheat variety 'Underhill', was reported against Hessian fly. There are four major characteristics i.e., resistance is heritable, relative, measurable and variable by which resistance can be assessed. Painter, 1951 grouped mechanisms of resistance in to three main categories viz. non-preference, antibiosis and tolerance. A number of plant characteristics are known to render the cultivars less susceptible for feeding, oviposition and development can be classified in to two categories i.e., biophysical and biochemical. On the basis of biophysical plant resistance is controlled by several morphological factors e.g. color, shape, size, thickening of cell wall, rapid proliferation of plant tissues, solidness, trichomes, surface waxes, and anatomical adaptation of organs, while other hand on the basis of biochemical resistance some chemical substances including inorganic chemicals, primary and secondary metabolites are known to impart resistance to wide variety of insect pest, however secondary plant metabolites play a major role in defense mechanisms. Host plant resistance to arthropods has been successfully integrated with allied pest management tactics in many of the world's major food and fiber crops.

Keywords : Host plant resistance, bases of resistance, advantages and disadvantages of resistance

SPIRULINA- A COMPOUND WITH MULTIPLE HEALTH BENEFITS

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If we pay attention to the wellness world, it is noticed that spirulina has become a staple for healthy eaters lately. While the bright blue ingredient may look bizarre, spirulina comes with tons of health benefits. Spirulina is a blue-green microalgae that typically grows in freshwater lakes, natural springs, and saltwater in subtropical and tropical climates. A great attention is being paid to understand its therapeutic benefits on a wide array of disease including hypercholesterolemia, hyperglycerolemia, cardiovascular diseases, inflammatory diseases, cancer, and viral infections. It is the most nutritious food as it contains antioxidants, phytonutrients, essential fatty acids, probiotics, and nutraceuticals. It is a rich source of protein, β-carotene, γ- Linolenic Acid, minerals, chlorophyll, sulpho-lipids, glyco-lipids, super oxide dismutase, phycocyanin, enzymes etc. Spirulina is known worldwide for its rich nutritional profile. It is being widely used in the health foods,

pharmaceutical and speciality feeding sectors. Spirulina has a blend of nutrients that no single plant source can provide. In contrast to many other nutritive food products, Spirulina is extremely easy to digest as it does not have a cell wall made of cellulose. Also, Spirulina has got no side effects and is non-toxic in nature. It contains its own anti-oxidants like beta-carotene, superoxide dismutase, selenium and vitamin E. These antioxidants help to protect our body against free radicals (can lead to degenerative disease like cancer, aging, age related macular degeneration etc) formed due to stress, exposure to toxic chemicals, drugs and poor diets. Studies have revealed that antioxidants in fruits and vegetables and Spirulina have a synergistic effect. Nowadays, Spirulina is being used as a therapeutic agent because of its antioxidant, anticancer properties and its ability to strengthen the immune system. Spirulina is known to improve malnourishment, and Vitamin A status in children and in pregnant women respectively. Spirulina has properties known to lower blood sugar levels in diabetics, have beneficial effects on patients suffering from pancreatitis, hepatitis and cirrhosis, also it may be helpful in glaucoma and cataracts, gastric ulcers, night blindness, liver and circulation disorders and in controlling anaemia. As a whole Spirulina is a boon to people suffering from different diseases.

Keywords: Spirulina, antioxidants, nutrition, diseases.

HISTOCHEMICAL STUDY ON THE EFFECTS OF DELTAMETHRIN IN THE MIDGUT OF ADULT BLOW FLY, *CHRYSOMYA MEGACEPHALA* (FABRICIUS) (DIPTERA: CALLIPHORIDAE)

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Keywords: *Chrysomya megacephala*, blowfly, histochemistry, myiasis, midgut

Chrysomya megacephala, commonly known as the oriental latrine fly, is a member of the family Calliphoridae in order Diptera. This family includes 1100 known species of flies. *C. megacephala* is considered important to forensic science because it is one of the first flies to show up on a corpse, can cause accidental myiasis and also infects fish and livestock. The purpose of this study was to determine the amount and distribution of polysaccharide content in the midgut of *C. megacephala* as polysaccharides are essential to energy production. Sublethal doses (0.0005, 0.001 and 0.005%) of insecticide were provided in food at 24 and 48 hours to investigate the variation in the amount and distribution of polysaccharide content from the untreated fly. A large amount of polysaccharide was observed in the midgut cells of control, as indicated by the strong PAS-positive reaction given by these cells. At 0.0005% and 0.001% concentrations, a moderate reduction in polysaccharide content was observed as compared to the control after 24 hours of treatment and this difference slightly increased after 48 hrs. A remarkable reduction in polysaccharide was observed at highest concentration i.e. 0.005% of insecticide after 24 hrs and slight enhancement was found after 48 hrs of treatment. This study has shown that a synthetic pyrethroid insecticide, deltamethrin reduced the polysaccharide content in midgut tissues after treatment and the decrease was in accordance with time and concentration used.

EFFECT OF PHYTOCHEMICALS FROM *CALOTROPIS GIGANTEA* AGAINST *E.COLI*

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Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani, Egyptians and Chinese writings illustrated the use of herbs. Evidence exist that Unani Hakims, Indian Vaid and European and Mediterranean cultures were using herbs for over 4000 years as medicine. Among ancient civilizations, India has been known to be rich repository of medicinal plants. Around 1500 medicinal plants have been tagged out by Indian system, among which 500 species are commonly used in the preparation of herbal medicines. Among all herbal drugs, Indian drugs alone contribute as much as 80%. Most of the drugs given even today are directly and indirectly from natural sources. It has been shown that herbal drugs are safer, free from any side effects, eco-friendly and more effective as compare to synthetic drugs. In consonance with this information, *Calotropis gigantea* (family- Asclepiadaceae) which is commonly known as Arka plant has been chosen for the study. The leaves and bark of the plant is extracted by using different solvents methanol, benzene, aqueous, butyl alcohol and tested for antibacterial activity against *E.coli*.

Key words: *Calotropis gigantea*, Antibacterial activity, Solvent extract.

USE OF MICROBES IN MERCURY DETOXIFICATION FOR IMPROVEMENT OF ENVIRONMENT**SHALINI PORWAL***Amity Institute of Microbial Biotechnology, Amity University, Sector-125, Noida (U.P.)*

Exponential use of mercury used for various anthropogenic sources has led to contamination of environment on large scale causing number of diseases. Mercury exists in two forms in the environment i.e. inorganic {Hg(II)} and organic (CH₃Hg⁺) form of mercury respectively. To overcome the toxicity of mercury, microorganisms have evolved with the operon called *mer* operon which readily detoxifies mercury from its inorganic or organic form or both to elemental form of mercury (Hg⁰) which is very volatile and released in environment. Mainly two genes *merA* and *merB*, of *mer* operon encodes for enzymes mercury reductase and mercury lyase which detoxify inorganic and organic form of mercury respectively. In detoxification process two types of mechanisms are found i.e. broad spectrum and narrow spectrum detoxification depending upon the genes present in the operon. Also, it had been found that the occurrence of antibiotic and metal resistances can be found in same conjugative plasmids, chromosomes as well as on transposons element. Thus, microorganisms can be deployed to detoxify the mercury from contaminated sites.

NUTRITIONAL QUALITY AND HEALTH BENEFITS OF OKRA**SHALINI*, TINU ANAND KAIN, SHAHID UMAR***Department of Botany, School of Chemical and Life Sciences, Jamia Hamdard, New Delhi-110062*

Okra (*Abelmoschus esculentus*) belonging to family Malvaceae is a conventional and versatile vegetable crop which is widely cultivated because of its several health benefits due to the abundance of phytochemicals. It possesses pronounced nutritional essentials such as minerals, vitamins and carbohydrates. The mucilaginous pods of Okra are a healthy source of fibres and have various medicinal properties like blood plasma replacement. It also has unsaturated lipids, especially oleic acid, folic acid and linoleic acid. The roots of okra have muco-protective agents which can relieve inflammation. Okra is also helpful in the treatment of diabetes as it has a low glycemic index and its diuretic property helps in detoxification. Smooth muscle spasms are usually relieved by seeds of Okra. It also contains numerous vitamins such as - Vitamin K which is responsible for checking excessive bleeding; Vitamin C which is beneficial in treating asthma and act as an antioxidant which helps in scavenging free radicals; Vitamin A present in minute amount leads to the proliferation of white blood cells and enhanced eyesight and Vitamin B acts as anti-fatigue and boosts metabolism. Magnesium is abundantly present in Okra which has various roles in body functioning such as an increase in energy generation. Calcium in Okra is known for promoting bone and teeth health, blood clotting, cell signalling and nerve functioning. Therefore, okra can be substituted as a balanced nutritional crop for combating malnutrition.

Keywords: Okra, Nutrition, Diabetes, Minerals

UTILIZATION OF SSR MARKERS FOR STUDYING GENETIC DIVERSITY OF POPULAR MAIZE AND THEIR HYBRIDS**SHALU CHAUDHARY^{1*}, PUSHPA KHARB¹, SHIKHA YASHVEER¹, DEEPAK RAJ PRAJAPATI² AND MEHAR CHAND KAMBOJ²***1Department of Molecular Biology, Biotechnology and Bioinformatics, COBSH, CCSHAU, Hisar-125004, Haryana, India**2Department of Genetics and Plant Breeding, COA, CCSHAU, Hisar-125004, Haryana, India*

Analysis of the pattern of genetic diversity in crops is invaluable as it opens up the possibilities for systematic management, conservation and introgression of desirable genes from diverse genetic sources into the elite material. Maize hybridization programs also depend on the knowledge of genetic distances. SSR markers can be used for fingerprinting of hybrids and their parental lines. In present study, a total of 75 Simple Sequence Repeat (SSR) were used to screen 14 genotypes of maize. The 14 genotypes were divided into two major cluster (I and II) consisted of six genotypes and eight genotypes at a similarity coefficient of 59.5%. These two major clusters I and II were further divided into two sub-clusters at similarity coefficient of 60.5% and 59.5% respectively. The minimum similarity was 59.5% between (HM-2 and HKI193-1) and maximum was 76% between (HQPM-4 and HQPM-5) and (HM-2 and HKI1344). The fourteen genotypes were grouped by using PCA analysis into 2-D and 3-D scaling followed the same pattern as depicted in dendrogram. SSR markers shows that primers amplified a total of eighty nine alleles which varied from 1 (pumc1009) to 3 (pumc1183) with a mean of 1.5 allele per locus. Polymorphic information content (PIC) value obtained in the present study was 0.402 for 2 alleles and 0.523 for 3 alleles. By this study we concluded that these markers are highly accurate, efficient and reproducible for genetic diversity study and identification at any developmental stage.

Keywords: Genetic diversity, markers, PIC, Dendrogram

SCREENING OF RICE (*ORYZA SATIVA* L.) GENOTYPES FOR SUBMERGENCE TOLERANCE TRAITS AT SEEDLING STAGE.**SHAMBHOO PRASAD*, ASHISH KUMAR, VISHWAS MISHRA, BANDANA JAISWAL, REEN AND D. K. DWIVEDI***Department of Plant Molecular Biology and Genetic Engineering, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad-224229, U.P., India*

A pot experiment was conducted with five rice genotypes Nagina 22, Swarna sub1, NDR 97, Susk Samrat and NDR 9830102 to evaluate submergence tolerance traits at vegetative stage. Thirty five days old seedling was exposed to 11 days complete submergence. At the end submergence, shoot elongation, catalase activity, chlorophyll content and total soluble sugar were measured against control. Less shoot elongation, high catalase activity and less percent reduction in chlorophyll content and total soluble sugar were recorded in Swarna sub 1 and NDR 9830102. Nagina 22 failed to survive after desubmergence. Survival percentage of Swarna sub1, NDR 9830102, NDR 97 and Susk Samrat was nearly 95, 75, 10 and 8 percent respectively. The days to 50% flowering and maturity were less effected in Swarna sub1 and NDR 9830102 and comparison to other genotypes. The high survival percentage in Swarna sub1 and NDR 9830102 was due to reserved carbohydrates, less shoot elongation and high activity of anti oxidant enzymes and consequently these two genotypes also showed less reduction in yield and yield components.

TRADITIONAL AND PHARMACOLOGICAL STUDY OF *TRICODESMA INDICUM*; A CASE STUDY OF TEMPERATE KASHMIR ANANTNAG.**SHAMEEMA YOUSUF*, JAVAID WANI AND SANTOSH KUMAR SINGH***Department of Life-Sciences, Glocal University, Saharanpur UP*

Objective: To document ethnobotanical information of plant *Tricondesma indicum* species in the region of Kashmir Anantnag. **Methods:** An ethnobotanical survey was conducted in Kashmir Anantnag. Data were collected by interview and semi structured questionnaire from selected local informants and traditional practitioners as well as by field assessment. **Results:** The present study documented the ethnobotanical uses of plant *Tricondesma* species. Study revealed all species have medicinal value due to presence of tannins, flavonoids, phytosterols, sugars, saponins, protein and free amino acids. The potential of *T. indicum* as herbal medicine, the phytochemistry and pharmacological properties of its parts used as herbal edicines are reviewed. The extensive literature survey revealed that *Tricondesma* species. is traditionally used to treat or anage at least human and animal diseases and ailments. The species is used as herbal medicine for diseases and ailments uch as abdominal pains, boils, fever, inflammation, malaria, rheumatism, swellings and tuberculosis and as ethnoveterinary medicine. *Trihcodesma indicum* has several ethnomedicinal uses as laxative, purgative, rubefacient, carminative. **Conclusions:** *Tricondesma* as medicinal plants are still widely used for health care by locals of Kashmir. *Trichodesma indicum* was used in the folklore medicine as an anti inflammatory. Hence this study provide useful information for the identification of this plant for the future plan and also give standardization parameters for the development of herbal formulation. Some species of *Tricondesma* seem to be vulnerable to over collection and deforestation. It is suggested to close the forest of district Anantnag for next two to three decades for the conservation of plant biodiversity. The obtained results provide a support for the use of this plant in traditional medicine but further pharmacokinetics studies are required. **Keywords:** Traditional uses of *Trichodesma indicum*, Phytochemical Analysis.

STUDY OF FREE LIVING PLANT NEMATODE AROUND THE ROOT ZONES MANGO PLANT (*MANGIFERA INDICA*) AT HAPUR REGION.**SHASHIBALA***Dept. of Zoology, R.G. PG College, Meerut.*

Free Living plant nematodes are small sized, microscopic, world widely distributed round worm. They are occupy every Niche Of environment. Their abundance depend upon many factors like type of soil, vegetation etc. Most of the free-living nematode are ectoparasite. They freely move in soil and feed upon root surface bacteria, fungi etc. Most of the plant nematodes caused various disease to plant, stunting growth, mechanical damage, gall formation, wilting of plant etc. But free living plant nematodes are beneficial to plant because they de compose the organic matter, recycling of Nutrient. In present study soil samples were collected from 0-30 cm vertical depth and 30-60 cm horizontal depth fromaround the root of mango plant at Hapur region from July to November. The Nematodes were extractedby Decanting and sieving techniques (Cobb 1918) was applied. Under the microscopic examination free-living nematodes were recorded as minimum percentage 14.2% and 8.88% at both vertical and horizontal depths in comparatively to other nemic fauna (parasitic and sluggish). So occurrence of free-living plant nematodes at both depth affected by various edaphic factors, PH, Temperature, soil, moisture, Seasonal change and availability of various food Resources etc.

Key word – Free Living Nematodes, Stunting Bacteria, Fungi

ROLE OF FLAVONOIDS IN PHOTOSYNTHESIS

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The flavonoids are a large group of naturally occurring compounds that comprise flavonols, flavones, flavanones, anthocyanidines, catechins, and biflavans. They are widely distributed in the plant kingdom located in vacuoles of fruits, vegetables and berries. These are diverse low molecular weight polyphenolic secondary metabolites synthesized by plants for various biological activities such as regulation of plant development, pigmentation, lure insects for pollination, UV protection, and array of roles in defense and signaling between plants and microorganisms as well as relation to environmental response. Since they have very strong antioxidative properties they are used in medicine or in the food industry. Flavonoids act as protectant to screen against severe sunlight illumination. The Sun light contain radiation of various wavelengths, struck to the canopy of plants, among wavelengths very narrow range of wavelength used by plants for the fixation of inorganic carbon by the help of chlorophylls. But chlorophylls cannot absorb all the solar radiations themselves. Chlorophylls assisted with other pigments to help and protect them from photo-oxidation of harmful high energy radiations such as UV-A, B, and C particularly UV-B is more dangerous. UV-B radiation may affect photosynthesis and transpiration, pollination and DNA and cellular damage, competitive balance in a community, susceptibility to diseases, environmental stress and it also brings changes in plant foliar chemistry, including decreases in carbohydrates concentrations. Flavonoids generally absorb UV-B band and thus act as UV filters and protect the tissue from damage and selectively protecting interference in photosynthesis

Keywords: Flavonoids, secondary metabolites, defense, pigmentation and antioxidative.

ADVANCES IN BIOLOGICAL SCIENCES AND BIODIVERSITY CONSERVATION HISTOLOGICAL ALTERATIONS INDUCED BY HEAVY METALS EXPOSURE ON EARTHWORMS

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The experiment was conducted to determine the effect of heavy metals viz. arsenic and chromium on the intestine of earthworm *Eudrilus eugeniae*. The earthworms were exposed to 24h with varying concentrations of arsenic and chromium. Chromium was found to cause more deleterious effect, damaging the cellular portion of the intestinal region in comparison to arsenic. Thus, observed trends could be taken as an early warning to the imminent threats of heavy metal pollution to epigeic earthworm species.

Keywords: Earthworms, Heavy metal, Toxicity

BIOCHAR: CARBON NEGATIVE TECHNOLOGY

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Million tones of surplus residue generated every year in IGP is burned to ensure the clean cultivation which tends to cause environmental pollution however, incorporation of agriwaste of rice-wheat system leads increment in green house gas emission; addition of CO₂ and CH₄ to the atmosphere. Thermal decomposition (pyrolysis) of agriwaste to the biochar as a recalcitrant carbon rich material being used as soil amendment supposed to improve the soil phisico-chemical properties. Pyrolysis is a direct thermal decomposition of biomass in the absence/limited oxygen conditions, which produces a mixture of solids; Biochar. The yield and properties of pyrolysed material is dependent on pyrolysis conditions, such as temperature, and biomass used for biochar production. Biochar is a way of storing carbon in the soil for a long period of time, potentially reducing atmospheric greenhouse gas emission at the same time it will enhance the soil water holding capacity, increase soil fertility; nutrient retention/adsorption due to high surface area, and raise agricultural productivity. Biochar production and its soil incorporation remove carbon dioxide directly from the atmosphere through uptake by plants, leading to reduction of atmospheric carbon dioxide levels. Such a carbon-negative technology would lead to a net withdrawal of CO₂ from the atmosphere, while producing consumable energy. Thus, biochar has potential to mitigate the climate change and green house emission via carbon sequestration.

Keywords: Biochar, carbon sequestration, pyrolysis and green house gas

HUMAN CLONING :LEGAL IMPLICATIONS AND ETHICAL ISSUES**SHIVI BHATNAGAR***AMITY LAW SCHOOL, NOIDA (UP) INDIA*

The possibility of cloning of Homo Sapiens and the ethical and legal implication of such overwhelming development remained remote and uncharted until recently. The ethical aspects of cloning depend on our perspectives about its process. All religions have different bias towards cloning and there is multifariousness in opinion. Ethics vary more by culture than by religion. Society does not disagree on what is ethically wrong. There is no consensus on the morality of human cloning. The development of law in this regard might be a mere speculation, but those who promote cloning, have to show and establish with evidence how they are going to deal with different situations, which pose a problem as a consequence of human cloning.

ADVANCES IN BIOLOGICAL SCIENCES AND BIODIVERSITY CONSERVATION.**SHIVOM DIXIT***Department of Genetics and Plant Breeding Chandra Shekhar Azad University of Agriculture and Technology Kanpur, UP, India*

In the few previous years the Indian government has taken a strong pro-active stance towards introduction of new technologies for improving agricultural productivity and sustainability. Genetically Modified (GM) crops is one such technology with high economic and social stakes, as evident from debates about the utility of technology after the introduction of Bt cotton in 2002. Strong positivistic approach underscores the potentiality that GM technology can help address for food security, agricultural productivity, agriculture sustainability etc. On the another hand, opposition has ranged from extreme stance (a strong precautionary approach) of disallowing GM technology in India to calling for a long-gestation period before scientific evidence emerges to strengthen the regulatory process. Issues of high royalty of Bt cotton, seed unavailability for non-GM cotton growers, and field trials being too restricted to properly assess the impact of this technology on environment, health, and food supply have further complicated this debate. Due to extensive public criticism, The Bt brinjal in spite of getting regulatory approval was finally not introduced. An episode of regulatory failure, which is visible again in the indigenously developed GM mustard recently. This study has revisited the GM debate in India by examining some of these issues through the lens of systems approach, social constructionism, and strategic management. India epitomizes to a large extent the emerging/developing country's challenges and thus the study has a larger relevance for innovation and policy. The study underscores that policy articulations should be made simultaneously with strong institutional changes in the regulatory process. This, the study argues can provide a useful platform for resolving the conflicting stance among the different stakeholders, including bench-level scientists for improved decision making, and helping address the information asymmetry in the regulatory process.

ROLE OF PREDATORS AND PARASITOIDS IN MANAGEMENT OF INSECT PESTS**SHREENIDHI. S, UNDER SUPERVISION OF PROF.DR. C.P.SRIVATSAV***Entomology and Agricultural Zoology, Institute of Agricultural Sciences, BHU, VARANASI*

With increasing hazards due to chemical pesticides, the only answer to mitigate these ill-effects is use of safe alternatives. Amongst them, use of natural enemies comprising of parasitoids, predators, entomopathogens, etc. as biological control agents is the most effective, environmentally sound and cost effective pest management approach to control insect pests. It is anticipated that biological control will play an increasingly important role in integrated pest management programs as broad-spectrum pesticides use continues to decline. Moreover, biological control is a cornerstone of organic farming and the production of organic commodities in developed countries like the USA continues to increase at roughly 20% per year. For a given arthropod pest or weed, a pool of natural enemies often exists which consists of vertebrates, invertebrates and microorganisms. The fundamental problem in applied biological control is to select an appropriate species or combination of species from this pool that will bring about the desired level of pest suppression with minimal impact on non-target species.

KEYWORDS: Natural enemies, Biological control, Predators, Parasitoids, Pesticides, Organic farming

EFFECTS OF SIMULTANEOUS APPLICATION OF SALICYLIC ACID AND CALCIUM ON SALT TOLERANCE IN TWO VARIETIES OF CARROT**SHREYA CHHABRA*, TINU ANAND KAIN, SHAHID UMAR***Department of Botany, School of Chemical and Life Sciences, Jamia Hamdard, New Delhi*

Soil salinity is a major limitation to crop production. To combat salinity stress, plants show various salt tolerance mechanisms, which may vary from species to species, cultivar to cultivar and rely on complex interacting physiological and

biochemical mechanisms. Salicylic acid (SA), a phytohormone, when applied exogenously either through seed soaking or foliar application through fertigation, is reported to induce salinity tolerance and increases the plant yield under abiotic stress. According to the literature available, it was observed that the addition of Ca^{2+} to the root environment prevented the deleterious effects of Na^+ on plants grown under NaCl stress. Various reports have suggested phytohormones and Ca^{2+} may act cooperatively or independently integrated into the stress signalling pathways. Carrot (*Daucus carota* L.) is a glycophyte root vegetable, usually orange in colour, though purple, black, red, white, and yellow cultivars exist. It is native to Europe and south-western Asia and widely consumed in India as a vegetable. Seeds of two varieties of carrot namely, *Pusa Asita* and *Pusa Rudhira*, were procured from Division of Vegetable Sciences, Indian Agriculture Research Institute, New Delhi. The experiment was setup in pots at the Herbal garden, Jamia Hamdard, Delhi. Seeds were sown in pots with 8 kg of soil. Recommended dose of fertilizers like NPK was applied. Salt treatment was applied 5 days after germination. In order to protect the plants from salt shock, treatment was given in increments of 20 mM NaCl solution till it reached 100 mM NaCl in required pots. Plants were harvested after 60 days and treated with liquid nitrogen and kept at -80°C for further analysis. The carrot roots were tested for morpho-physiological characters like plant height, root length, number of leaf per plant, yield, moisture content and biochemical parameters like chlorophyll content, protein content, phenol content, sugar content. The salt treatments induced noticeable variations in morpho-physiological traits and biochemical parameters. Application of SA and calcium-induced the tolerance for salt stress in the selected crop.

KEYWORDS: Carrot, calcium, salt stress, salicylic acid.

RECENT TRENDS IN AGRICULTURAL SCIENCES AND TECHNOLOGY

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Erucic acid is one of the most important fatty acids in mostly found within *Brassica* genus. This 22-carbon fatty acid is undesirable for human consumption when present in higher amounts in edible oil. Higher erucic acid in cooking oil hampers the myocardial conductance in humans and leads to increased blood cholesterol levels. Earlier studies has been reported to cause lipidosis in children and myocardial fibrosis in monkeys. The improvement of seed quality is one of the most important objectives in *Brassica* breeding for satisfying future quality edible oil requirements. In this present study 15 *Brassica juncea* genotypes was use for the erucic acid profiling. The erucic acid content in *Brassica juncea* genotypes varied from 0.90 to 59.83 %. Minimum erucic acid content (as per international oil quality norms $\geq 2.0\%$) was observed in PM 24 (1.56%), PM 21 (0.96%) and Pusa Karishma (0.90 %). However, highest erucic acid content was noted in SKJM-5 (51.83%). Maximum genotypes in the present study which showed higher levels of erucic acid. Therefore there is an urgent need to develop new varieties, containing low levels of erucic acid. Hence there is great need to screen out breeding lines for lower levels of erucic acid ($<2\%$) and higher yield potential.

BIODIVERSITY CONSERVATION

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Biodiversity refers to the variety of all forms of life on earth. The different plants, animals, micro-organisms, the genes they contain and the ecosystem they form. Despite the benefits from biodiversity, today's threats to species and ecosystems are the greatest recorded in recent history and virtually all of them are caused by human mismanagement of biological resources often stimulated by misguided economic policies, pollution and faulty institutions in addition to climate change. The biological resources of a country are of primary importance for the economic development; hence conservation of biological resources are very important for the economic life of a nation. Some of the existing measures of ex-situ biodiversity conservation include; zoological gardens, botanical gardens, seed banks, cryopreservation, Tissue culture etc. It is used for threatened and endangered species to avoid their extinction. In-situ conservation measure includes Biosphere reserve, National parks, Wildlife sanctuaries, Biodiversity Hotspots, Gene sanctuary, Sacred groves etc. It helps in maintenance and recovery of viable populations of species in their natural habitats. The management of biodiversity is a complex matter that needs the involvement of many different partners ranging from governmental organizations to private companies, NGO's and volunteers. This aside, national and international commitment, legislation and enforcement offer an essential framework for promoting and maintaining biodiversity.

KEYWORDS:- Biodiversity, Cryopreservation, Ecosystem

ROLE OF COMPATIBLE SOLUTES IN ABIOTIC STRESS TOLERANCE**SNEHA GUPTA* AND AMIT SINGH***Department of Genetics and Plant Breeding Institute of Agricultural Sciences, BHU, Varanasi-*

Abiotic stresses not only determine the geographical and regional distributions of crops, but they also dictate whether a potentially arable land piece can actually be used for cultivation. They are the primary source of yield losses as they may reduce the crop yield to bare 20 percent or even less of the potential crop yields. Among these, drought and salinity are the most destructive. Osmotic adjustment, at the physiological level, is an adaptive mechanism involved in drought or salinity tolerance, which permits the maintenance of turgor under conditions of water deficit, as it can counteract the effects of a rapid decline in leaf water potential. It is positively associated with yield under stress conditions. Compatible solutes or osmoprotectants are the small molecules which are produced under stress inside the cell through upregulation of gene. They do their function in mechanism of tolerance without disturbing the normal internal metabolic functions. The metabolites which act as compatible solutes are different among various species of plants and include glycine-betaine, proline, sorbitol, mannitol, ammonium compounds the sugar trehalose. In terms of cell compatibility, proline may be considered as an ideal osmoticum. There is general agreement that the major role of these metabolites is to serve as organic osmolytes with compatible properties at high concentrations; such osmolytes increase the ability of cells to retain water without disturbing normal cellular functions. Metabolic acclimation via the accumulation of compatible solutes is often regarded as a basic strategy for the protection and survival of plants under abiotic stress.

Keywords: Abiotic stress, Compatible solutes, Osmoprotectants, Salinity, Drought

IN VITRO IMMUNOMODULATORY POTENTIAL OF *BERGENIA LIGULATA* (WALL.) ENGL. IN CHICKEN LYMPHOCYTES**SNEHA RAWAT, ANAMITRA RUJ AND SONU AMBWANI***Department of Molecular Biology and Genetic Engineering, C.B.S.H., G. B. Pant University of Agriculture and Technology, Pantnagar 263145, India*

Himalayan region is known for many native plants that possess therapeutic and antioxidative properties. *Bergenia* species is endemic to Northern and Eastern temperate Himalayan region in Himachal Pradesh, Jammu & Kashmir, Uttarakhand and North Eastern hilly states. *Bergenia* species is used in traditional ayurvedic medicine because of its diuretic, antilithic, antiviral, anti-inflammatory, antipyretic, hepatoprotective activities. *Bergenia ligulata* belongs to the family Saxifragaceae, is a kind of perennial herb, containing rich medicinal ingredients. For the present study, rhizomes and roots were collected from wild growing *Bergenia ligulata* from Berinag, Uttarakhand and authenticated. Aqueous extract of the dried plant material (BLE) was prepared and then BLE was evaluated for its immunomodulatory potential in chicken lymphocytes culture system through lymphocytes proliferation assay (LPA). First of all, maximum non-cytotoxic dose (MNCD) of BLE in chicken lymphocytes was determined by exposing the cells to various concentrations of the plant extract. Maximum concentration of BLE exhibiting 100% cell viability was found to be 150 µg/ml and was selected for further *in vitro* analysis. In LPA, the *in vitro* exposure of chicken lymphocytes to 150 µg/ml dose of BLE resulted in significant increase in mitogen (LPS) stimulated B cell proliferation as well as mitogen (Con A and PHA) stimulated T cells proliferation in comparison to the BLE untreated control cells. The significant upregulation in the proliferation of both the lymphocytes is indicative of immunopotentiating ability of the plant extract. Thus it could be concluded that it would be worthwhile to further evaluate *Bergenia ligulata* for its immunostimulatory potential in poultry system through suitable *in vitro/ in vivo* analyses.

Keywords: *Bergenia ligulata*; Immunomodulation; Chicken, Lymphocytes proliferation assay.

DIVERSITY OF RHABDITID NEMATODES FROM SAPHROBIC HABITAT**SOBIA KHATOON AND IRFAN AHMAD***Department of Zoology, Aligarh Muslim University, Aligarh*

Nematodes abound in every possible niche in almost every environment over the world. They have successfully adapted to nearly every ecosystem from marine to fresh water, to soils, and from the polar regions to the tropics, as well as the highest to the lowest of elevations. They are key microfaunal grazers that regulate ecological processes of decomposition and nutrient cycling thereby, indirectly affecting primary production. Nematodes offer practical advantages for monitoring ecological changes in soil conditions due to man-made or natural disturbances. They possess most important attributes of any prospective bio- indicator. Samples were collected from different habitats rich in organic matter such as farmyard manure, cavities in tree trunk, soil, ditch, litter, wild mushroom, banana rhizome, rotten fruits and barks. Nematodes were isolated by modified Cobb's sieving and decantation and modified Baermann's funnel techniques. For light microscopy, the extracted nematodes were heat-killed and fixed in FG fixative, dehydrated by the slow method, mounted in anhydrous glycerine and viewed under Olympus BX-51 DIC microscope. Different types of nematodes were found belonging to order Dorylaimida,

Tylenchida, Rhabditida. The present work deals with the study of diversity of nematodes of the family Rhabditidae. Sixteen genera, viz., *Cruznema*, *Distolabrellus*, *Mesorhabditis*, *Metarhabditis*, *Cephaloboides*, *Rhabditella*, *Oscheius*, *Protorhabditis*, *Crustorhabditis*, *Diploscaaptor*, *Diploscapteroides*, *Poikilolaimus*, *Pelodera*, *Teratorhabditis*, *Caenorhabditis* and *Prodontorhabditis* were identified. Three of these genera, viz., were found in four different habitats. Three genera, viz., *Poikilolaimus*, *Oscheius* and *Caenorhabditis* were found in three habitats while *Cephaloboides*, *Protorhabditis* and *Distolabrellus* were found in two habitats. Seven genera were found in specific habitat each, viz., *Rhabditella*, *Crustorhabditis* in tree hole, *Teratorhabditis*, *Pelodera* in farmyard manure, *Prodontorhabditis*, *Diploscapteroides* in banana rhizome and *Cruznema* in soil. 50% of these genera were found in farmyard manure, 43.75% in tree hole, 37.5% in litter, 31.25% in banana, 18.75% in bark, 16% in ditch and 1% each in soil, mushroom, rotten fruits.

Keywords: Diversity, Habitat, Nematodes, Rhabditidae

PHORATE INDUCED DOWN REGULATION OF CHICKEN LYMPHOCYTES PROLIFERATION THROUGH OXIDATIVE STRESS DUE TO *IN VITRO* EXPOSURE

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Today chemical pesticides are playing vital role in controlling agricultural, industrial, home garden and public health pests globally though not without deleterious effects on human, animals and birds. Phorate is a broad spectrum, non-biocumulative organophosphorus insecticide and acaricide. It is extremely toxic to mammals and other non-target organisms. Present paper reports immunotoxic effects due to *in vitro* exposure of low level dose of phorate in chicken lymphocytes employing lymphocyte proliferation assay. Phorate induced oxidative stress was evaluated by nitric oxide estimation in the treated cells. There was significant decrease in B and T cell blastogenesis in chicken lymphocytes exposed to thousand times dilution of No Observable Effect Level (NOEL/10³) dose of phorate. There was increase in oxidative stress on measuring nitric oxide level in phorate treated cells as compared to control cells. Thus *in vitro* exposure of phorate revealed its immunotoxic properties in chicken lymphocytes. It caused elevated oxidative stress even at low dose level. It is also proposed that such *in vitro* tests can be useful in preliminary evaluation of pesticide induced immunotoxicity and oxidative stress furthermore help in reducing the use of laboratory animals.

Key Words: Phorate; immunotoxicity; oxidative stress; chicken lymphocytes.

EVALUATION OF PROTECTIVE EFFECT OF VITAMIN C ON CADMIUM INDUCED HEMATOLOGICAL AND BIOCHEMICAL CHANGES IN LABORATORY CHICKS

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Objective: Present study was designed to evaluate the protective effect of vitamin C on hematological and biochemical parameters in Laboratory chicks exposed to cadmium chloride. Hypothesis: Cadmium is a toxic heavy metal causes a variety of toxic effects on various body tissues of both humans and animals. It is already established that Vitamin C is an effective antioxidant and play a very important role against toxicity. So, we have decided to work on vitamin C against toxicity induced by cadmium. Method: Chicks (100±20 gm BW, 1-2 weeks old) were randomly divided into three groups A, B and C. Group A and B administered with cadmium chloride orally (5.0 mg/100 gm BW) on each alternate day for 30 days. In addition to cadmium supplementation, group B also administered with vitamin C (20 mg/100 gmBW) orally on each alternate day for 30 days. Chicks of Group C were considered as control. Investigation was carried out by monitoring levels of biochemical parameters: aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) in liver, creatinine in kidney and haematological values: red blood cells (RBCs) count, white blood cells (WBCs) count, haemoglobin (Hb) and packed cell volume (PCV) in blood. Result: Result showed a significant decrease (P<0.05) in RBCs count, WBCs count, haemoglobin percentage and PCV in cadmium treated chicks as compared to control chicks. There was significant increase (p<0.05) in level of serum AST, ALT, ALP and creatinine in cadmium treated chicks as compared to control chicks. However co-administration of vitamin C with Cd improved the alteration caused by Cd in above haematological and biochemical parameters. Conclusion: Present study reveals that vitamin C act as effective antioxidant and may be helpful in decreasing toxicity induced by cadmium.

Key words: Cadmium chloride, Vitamin C, Chicks, Hematology, Biochemistry.

BIOTIC AND ABIOTIC STRESS MANAGEMENT**SUMAN CHOPRA* AND GOATM CHOPRA** M.SC. STUDENT**

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Living factor are called biotic components and non-living factor are called abiotic components. These biotic and abiotic components of an ecosystem form the basic structure of the ecosystem. Mostly factor of biotic and abiotic stress these are flooding, temperature, frost, drought, rainfall, air, microorganism, moisture, biotic and abiotic stress are survive in non-coding RNAs are a distinct class of regulatory RNAs in plants and animals that control a variety of biological processes. In plants, several classes of small RNAs with specific sizes and dedicated functions have evolved through a series of pathways. One way in which plants respond to environmental stress is by modifying their gene expression through the activity of small RNAs. Thus, understanding how small RNAs regulate gene expression will enable researchers to explore the role of small RNAs in biotic and abiotic stress responses. Stress is defined as a phenomenon that limits crop productivity or destroys biomass. Biotic and abiotic stress are management in use of spray (1). Foliar spray of 0.5% zinc sulphate + 0.3 % boric acid + 0.5 % Ferrous sulphate + 1% urea during critical stages of moisture stress Application of PGRs namely Cytokinin (10 ppm); Brassinolide (0.5 ppm); Salicylic acid (100 ppm); Ascorbic acid (100 ppm) and CCC (10 ppm). (2). providing adequate drainage for draining excessive stagnating water around the root system. (3). Spray of growth retardant of 500 ppm cycocel (CCC) for arresting apical dominance and thereby promoting growth of laterals. (4). Foliar spray of 2% DAP + 1% KCl (MOP). (5). Spray of 0.5 ppm brassinolide for increasing photosynthetic activity Seed hardening with NaCl (10 mM concentration) · Application of gypsum @ 50% Gypsum Requirement (GR) · Incorporation of daincha (6.25 t/ha) in soil before planting (6). Foliar spray of 0.5 ppm Brassinolide for increasing photosynthetic activity (7). Foliar spray of 2% DAP + 1% KCl (MOP) during critical stages · Spray of 100 ppm salicylic acid (8). Spray of 40 ppm of NAA for arresting pre-mature fall of flowers /

Keywords: factor of biotic and abiotic stress, activity of RNAs, components, management,

ANTIOXIDANT AND PHYTOCHEMICAL ANALYSIS OF TINOSPORA CORDIFOLIA AND OCIMUM SANCTUM**SUMIT KUMAR¹, DR. R.C. ARYA²**

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Over the centuries, plants have been one of the important sources of many traditional medicines throughout the world. A number of medicinal plants, traditionally used for thousands of years are present in a group of herbal preparations of the Indian traditional health care system which possess interesting antioxidant activities. In India, approximately 3000 plant species have been reported to have medicinal properties. Antioxidants derived from medicinal plants used in the prevention and treatment of oxidative stress related diseases. They may protect cells from damage caused by unstable molecules known as free radicals. They terminate chain reactions by removing free radical intermediates and inhibit the oxidation reactions by being oxidized themselves. In the present study methanol extract of *Tinospora cordifolia* and *Ocimum sanctum* leaves extract were screened for the presence of phytochemical compounds and tested for antioxidant activity by DPPH (2,2-diphenyl-1-picrylhydrazyl) assays. Result revealed the presence of alkaloids, steroids, tannins, and flavonoids. Antioxidant activity of extract of leaves of *Tinospora cordifolia* and *Ocimum sanctum* would lead to the establishment of some compound that show relation to diet, drugs, food preservatives and industrial uses.

Keywords: Phytochemical screening, *Tinospora cordifolia*, *Ocimum sanctum*, leaves extract, antioxidant activity DPPH assays.**STUDIES ON THE EFFICACY AND THERAPEUTIC POTENTIAL OF SWEET BASIL AGAINST E.COLI****¹SUMIT KUMAR SINGH & SURENDRA SARSAIYA**¹Department of Microbiology, S.S.S.U.T.M.S., Sehore, Bhopal.

Sweet Basil belonging to the plant *Ocimum basilicum* (Family: *Lamiaceae*). The present study, leaves of *Ocimum basilicum* was collected and the collected leaves were shade dried and powdered by grinder. The preparation of sweet basil leaves extract was done through soxlet distillation method. Two different solvents Chloroform and Aqueous were used to study the antimicrobial activity of medicinal plant. Disc diffusion method was adopted for evaluation of antimicrobial activity of medicinal leaves. The result shows that sweet basil leaves are having good antibacterial activity and thus showing maximum inhibitory concentration zone of 22 mm against *E.coli* of Chloroform solvent and 13 mm against *E.coli* of Aqueous solvent.

PSEUDOMONAS FLUORESCENS: A POTENTIAL BIOCONTROL AGENT**SUNAINA VARMA¹ PRIYANKA² TARA YADAV³**¹Department of Plant Pathology, SKRAU, Bikaner, ²Department of Plant Pathology, RARI, SKNAU, Jobner³Department of Entomology, RARI, SKNAU, Jobner

Non-judicious use of broad spectrum fungicides against target fungal pathogens imposes undesirable impacts on non-target organisms. However, biological methods of disease control are efficient, eco-friendly, cost effective and safe for human health. Fluorescent Pseudomonads has attained scientific attraction due to its biocontrol activity against various aerial, root and soil pathogens of economic importance. Fluorescent Pseudomonads are suitable for application as biological control agents due to their abundant population in natural soils and plant root system and their capability to utilize many plant exudates as nutrient. *Pseudomonas fluorescens* is a common gram negative, rod-shaped bacterium. As its name implies, it secretes a soluble greenish fluorescent pigment called fluorescein, particularly under conditions of low iron availability. Certain members of the *P. fluorescens* have been shown to be potential agents for the biocontrol which suppress plant diseases by protecting the seeds and roots from fungal infection. They are known to enhance plant growth promotion and reduce severity of many fungal diseases. This is due to production of a number of secondary metabolites including antibiotics, siderophores and hydrogen cyanide. The anti-fungal metabolite 2, 4-diacetyl phloroglucinol play a major role in the biocontrol capabilities of *P. fluorescens*. 2, 4-DAPG is a phenolic compound with broad spectrum antifungal, antibacterial, antihelminthic, and phytotoxic activity. Different Pseudomonas strains able to significantly control a number of fungal, bacterial and nematode diseases in cereals, horticultural crops, oil seeds and others.

Keywords: *Pseudomonas fluorescens*, Siderophores, Biological control, Phytotoxic activity

SEASONAL DIVERSITY OF BUTTERFLIES IN ARAVALLI HILLS RANGES RAJASTHAN**SUNITA RANI AND SYED IRFAN AHMED**

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The Aravalli forest ranges covers 9% area of Rajasthan and it's a home of many wildlife sanctuaries like Kumbhalgarh Wildlife Sanctuary, Jaisamand Wildlife Sanctuary and Sariska Tiger Reserve etc. Dominating plant species of aravalli forest ranges are *Anogeissus pendula*, *Anogeissus latifolia*, *Anogeissus dhofarica*, *Anogeissus bentii* etc. Butterfly fauna of the Aravalli forest ranges are rich but still not properly explored. However, recent survey on the butterflies in Sariska tiger reserve, Kumbhalgarh Wildlife Sanctuary and Jaisamand Wildlife Sanctuary were carried out in year 2015 to 2017. Total 3231 individual of butterflies were witnessed using pollard walk method and the recorded individual includes 40 species, 28 genera, 5 families. Out of which, Nymphalidae is dominating family with 13 species, lycaenidae is second most dominating species with 11 species, pieridae with 10 species, papilionidae with 2 species and hesperidae is with 3 species. Environmental affluences cause dynamic alteration in species diversity of butterfly such as *junonia alma*, *junonia atlitis* which were season-specific. Dominant species such as *Eurema hecabe* and *Junonia lemonias* and *Hypolimys missipus* were present throughout the year. Exciting changes in behavioural activities like mud puddling and sun basking also observed in varied season. Our novel study focuses on the effect of environmental changes on various butterfly species which are season specific as well as remarkably found throughout the year. As butterflies are very scarce in number so it should be our priority and matter of concern to preserve this valuable butterfly species in near future which is a part of our ecological system.

IN SILICO ANALYSIS OF POLYMORPHISM, LINKAGE DISEQUILIBRIUM AND RECOMBINATION IN PATHOGENIC GENES OF FUSARIUM OXYSPORUM F. SP. LYCOPERSICI**SUPRIYA DIXIT*, MUKESH SRIVASTAVA, PRAMOD KATARA¹**

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Linkage disequilibrium and recombination rate analysis is the major aspect to study association between nucleotide variations. Species of *Fusarium oxysporum* (Fo) includes extensive group of soil and plant pathogens which causes vascular wilt and root diseases to wide range of agricultural crops. Further *F. oxysporum* is divided into more than 120 formae species (f.sp.) depending upon their hosts. Among all formae species, *Fusarium oxysporum* f. sp. *lycopersici* (Fol) is well known pathogen which infects tomato plants and lead towards a destructive disease known as "*Fusarium* wilt" and later on it was found to be causes disease in humans. The present study focused to analyse association based linkage disequilibrium pattern and recombination rate in around five genes of interest for causing pathogenicity in both plant as well as humans: fpr1, fmk1, pacC, chsV and tom1. Number of variable site identified in fpr1 (765), fmk1 (182), pacC (544), and tom1 (307) respectively. The gene fmk1 has the highest average nucleotide diversity (π) value (0.66) and lowest was found in fpr1 (0.54) whereas calculation of average number of nucleotide variation per site showed that gene fpr1 (765) to be highly varying gene and

fmk1 (121) to be lowest varying gene. The above results showed variation due to varying number of haplotypes in both genes, in fpr1 only 2 number haplotypes and in fmk1, 11 number of haplotypes were present. Further, in LD analysis all polymorphic sites were considered but site which were segregating for three or four nucleotides were not considered. LD was calculated in terms of ZnS for fpr1 (1.00), fmk1 (0.0788), pacC (0.1651) and tom1 (0.1317), the variations indicate the success of linkage study and minimum number of recombination event identified in terms of Rm for fpr1 (0), fmk1 (5), pacC (44) and tom1 (17). An alternative conclusion of the above study is the low nucleotide diversity due to the presence of high number of repeated variable nucleotides in sequence because the current estimated LD suggest that it does not extend beyond a few hundreds of base pair.

MOLECULAR MARKERS: AN ADVANCED BIOTECHNOLOGICAL TOOL IN RICE GENOMICS AND BREEDING

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Rice is the most important crop for people particularly living in the monsoonal areas of Asia, where it has a long history of cultivation and is deeply ingrained in the daily lives of Asian people. 50% of the human population depends on rice (*Oryza sativa* L.) as its main source of nutrition. The world population is expanding rapidly due to a significant decline in mortality rates resulting from advancements in modern medicine and human health care, while the availability of land for cultivation had dramatically declined as the result of desertification caused by reckless deforestation and construction. Since rice breeding by conventional crossing and selections may not catch up with increasing global food demand, other more efficient strategies are required. One such strategy is the molecular breeding approach through molecular markers which promise to expedite the time taken to produce crop varieties with desirable characteristics. Conventional breeding strategy remains unchanged today, but the use of molecular markers has made rice breeding more efficient with development of rice plants with a range of improved characteristics such as increased yield, resistance to disease, and tolerance to stresses such as drought and salinization. To achieve these plant breeding goals, the identification and isolation of the genetic information held in rice genomic DNA is essential which can be revealed through efficient Marker Assisted Breeding strategies, including Quantitative Traits Loci (QTL) approaches. The use of molecular markers in plant breeding has several advantages over the traditional phenotypic markers previously available to plant breeders. The application of molecular markers in rice genomics will also provide us with very useful and powerful strategies to improve the efficiency of rice breeding. In addition, the rice genome is very similar to major cereal crops such as maize, barley, and wheat. Therefore, rice genomics has very significant implications not only for rice but also for other cereal breeding programs. Marker Assisted Selection (MAS) is a very convenient and efficient breeding strategy in which conventional breeding selection is carried out on molecular markers linked to target traits rather than on the traits themselves. Selection is followed by the marker genotype tightly linked to target traits. RFLP markers can be used for MAS, but they cannot efficiently screen genotypes of many plants in a short time because they require intricate and time-consuming experiments. Many kinds of PCR-based markers have replaced RFLP markers. These include RAPDs (Random Amplified Polymorphic DNAs), STS (Sequence Tag Site), SSR (Simple Sequence Repeats, including Minisatellite repeats and Microsatellite repeats), CAPS (Cleaved Amplified Polymorphic Sequences), AFLP (Amplified Fragment Length Polymorphism), and SNP (Single Nucleotide Polymorphisms). Handling of these PCR-based markers is very simple and efficient, making it possible to hasten the transfer of desirable genes among varieties and to introgress novel genes from related wild species. SSR markers in particular are very convenient for genotyping, mapping, cloning genes, QTL analysis and MAS. Increased recognition of MAS and diffusion of molecular markers to breeders are required for more efficient breeding.

PHYTOCHEMICAL AND BIOCHEMICAL STUDIES OF MEDICINAL PLANT- ANDROGRAPHIS PENICULATA (LINN.)

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Medicinal plants have many phytochemical compounds which are very useful to control of various disease and disorders. The present study has been made to analyse phytochemicals and biochemicals of plant *Andrographis peniculata* (Linn.). Phytochemical analysis of aqueous and alcoholic (Ethanollic) extract of whole plant has been shown the biological compounds cholesterol, carbohydrates, proteins (amino acids), fatty acids, phenols, alkaloids, flavonoids, saponins, tannins, terpanoids and steroids. The plant is tested and the results suggests that the phytochemical present in aqueous and alcoholic extracts of the plant *Andrographis peniculata* (Linn.) May Show various medicinal properties as antipyretic, antihelminthic, stomachic medicine and reproductive medicine.

BIODIVERSITY: WEALTH OF THE EARTH

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The term biodiversity refers to the wealth of the earth, viz., the millions of plants, animals and microorganisms that live on our mother earth, the genes they contain and the intricate and often delicate ecosystems they formulate. Biodiversity is a part of the biosphere supported by biological processes and organic evolution. Extinctions in the past have been the result of many cataclysmic changes on the Earth. However, the causes for the present perturbations arise from human activities. India is one of the World's richest countries in terms of its vast array of biodiversity. Biodiversity forms the foundation for sustainable development. It is the basis for the environmental health of our planet and the source of economic and ecological security for future generations. All our food, many of our industrial materials and medicines are provided by plants, animals and microorganisms. Animals supply meat, leather and insulin. Plants give us rubber, timber, cotton and are used to manufacture diverse items such as glue, soaps, photographic film and plastics. Antibiotics like penicillin are derived from microorganisms. The wider the variety of species, the wider is the range of natural resources potentially available. We also rely heavily on these, many of which, being a variety of ecosystems, fulfill important environmental functions. Forests help to prevent the soil being washed away by rain and rivers, safeguard against flooding, absorb carbon dioxide, and produce oxygen. Wetlands and the life they contain, help to clean water by trapping sediments, nutrients and harmful bacteria.

Key Word: biodiversity, sustainable development, environmental

PUTATIVE FUNCTION OF *SALMONELLA TYPHI* YEJF GENE THROUGH IN SILICO STUDIES

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Bacterial infections are very common, especially in developing countries. *Salmonella typhi* is one of the important human pathogen. It has a single circular chromosome (~ 4.8 Mb) and contains an extra chromosomal plasmid that imparts drug-resistance to the microorganisms. These microorganisms are becoming increasingly resistant to available antibiotics and so it becomes necessary to develop new strategies to combat the infection. In the present study, the transcriptomics data was analysed and the *yejF* gene was selected whose function was not known and in its expression level increased after 24 hrs of infection. *yejF* sequence was retrieved from the UniProt and it consists of 529 amino-acids. Sub-cellular location was predicted by Phobius as non-cytoplasmic protein, likely to be present in either inner membrane or periplasm. EcoCyc predicted that YejF protein is putatively a part of ATP Binding Cassette (ABC) transporter family and most probably the component of *yejABEF* operon. Three-dimensional structure model of YejF was build using a threading meta-server LOMETS. This model was used for further prediction of YejF function. The model was structurally superimposed on the identified hits obtained in BLAST search having function as a ABC-transporter. The superimposition showed that YejF had all the conserved features like, Walker A, Walker B/D, Q-loop, His Switch and signature motif. Therefore, the present study strongly suggested that YejF is an ABC-transporter and a drug can be synthesized which upon interaction with *yejF* or its operon may lead to the reduction in the infection rate caused by *Salmonella typhi* in human macrophage.

Keywords: ABC transporter, BLAST, LOMETS, Phobius, UniProt, *Salmonella typhi* and *yejF*

BIOCHEMICAL STUDIES OF VARIOUS COMPOUND IN TEA

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The tea plant is commonly grown for beverage production and it is of great economic importance. Tea extracts are used in sweets, bakery product and in bottled tea beverages as flavoring agent. The extracts from the green tea, *Camellia sinensis* contain a numbers of amino acid which enrich the human nutrition. The extracts also contain catechins and flavonoids which play a potential role in the prevention and the treatment of cancer and heart disease. The most affecting factors that affect the character and quality of tea is the aroma content in tea. The quality which is defined by colour, freshness, strength and aroma is important for the tea marketing. Phenolic compounds are responsible for the colour and taste, volatile compounds are fundamental for tea odor and aroma. This review will basically discuss the various compounds their chemical characteristics and their composition of raw and manufactured tea, also the role of the enzymes in the oxidative process.

Key words: *Camellia sinensis*, odor, volatile compounds, enzymes, quality

MODERN BIOTECHNOLOGICAL APPROACHES IN INSECT RESEARCH**SUSHIL KUMAR*, RITESH KUMAR AND RAVINDRA KUMAR***Department of Entomology, GBPUA&T, Pantnagar, Uttarakhand-263145, India*

To meet the growing demand for food it is essential to increase the production of food. Insect pests are major constraints to global production for food and fibre that can be reduced utilizing modern biotechnological tools. In insect research field, the biotechnological tools have been applied to study various issues such as insect identification, insect control and insect genetic relationships. It has a significant role in improving efficacy, cost-effectiveness and in expanding the markets for the bio insecticides. Molecular techniques employed for identifying and monitoring establishment and dispersal of specific biotypes of natural enemies. Production, formulation and storage of entomopathogenic fungi can be dramatically improved through biotechnology and genetic engineering. Proteinaceous insect toxins (scorpion toxin, mite toxin, trypsin inhibitor), hormones (eclosion hormone, diuretic hormone) and metabolic enzymes (juvenile hormone esterase) introduced into NPV and GV genome virus to increase its efficacy to kill insect. Genetic manipulation of *Bacillus thuringiensis* (Bt) genes encoding for proteins toxic to insects offers an opportunity to produce genetically modified strains with more potent and transgenic plant expressing Bt toxin. In 2011, planting of Bt cotton in India surpassed the historical milestone of 10 million hectare for the first time and occupied 88% of the recorded 12.1 million hectare cotton crops. However, field resistance of Bt crops to various insects have been noticed and to combat this problem two approaches namely refuge and pyramiding were recently introduced. The development of cryobiological method for preserving embryos of insects can significantly save the rearing costs, and the valuable collection of insect natural enemies could be maintained indefinitely.

Keywords: Entomopathogenic, Biotechnology, Cryobiological, *Bacillus thuringiensis*

STRESS-RESPONSIVE WRKY TRANSCRIPTION FACTORS PLAY A PIVOTAL ROLE AGAINST BLB DISEASE IN RICE**SUSHIL KUMAR SINGH^{1*}, BUBUL CHANDRA DAS², SANJAY KUMAR CHETIA², TOMIZUDDIN AHMED², MAHENDRA KUMAR MODI¹**¹*Department of Agricultural Biotechnology, Assam Agricultural University Jorhat-785013, Assam.*²*Regional Agricultural Research Station, Titabar-785630, Assam*

The Host-pathogen interaction eventually leads to transcriptional reprogramming of stress-responsive transcription factor in plants. In case of bacterial leaf blight (BLB) diseases of rice caused by *Xanthomonas oryzae* pv. *oryzae* (Xoo), WRKY transcription factor plays a vital role in regulating diverse plant processes including responses to defence response either positive or negative. WRKY transcription factors were reported to function by binding to W-boxes in the promoter regions of target genes to regulate their expression. Rice plants contain about 100 WRKY-TF among them some are specifically involved in regulation of basal defence responses against Rice-Xoo compatible interaction and trigger the expression of defence responsive pathogenesis-related protein (PR protein). In order to understand the regulatory mechanism of rice OsWRKY gene expression pattern under *Xanthomonas oryzae* pv. *oryzae* (Xoo) challenged condition. The qRT-PCR expression analysis of OsWRKY10, OsWRKY12, OsWRKY76, OsWRKY45, OsWRKY13 and OsWRKY42 in *Xa4* harbouring rice variety Disang revealed that expressions of WRKY transcription were altered upon Xoo infection in rice. Statistically significant ($p < 0.01$) up-regulation of OsWRKY12, OsWRKY76, OsWRKY45, OsWRKY13 and OsWRKY42 and down-regulation of OsWRKY10 express in only incompatible interaction as compared to the compatible interaction of Xoo with respect to Disang rice variety of Assam. This conforms the involvement of WRKY transcription factor in regulating BLB resistance response in rice in the presence of dominant resistance gene *Xa4* which activate effector-triggered immunity (ETI).

Keywords: WRKY, *Xanthomonas oryzae* pv. *oryzae* (Xoo), qRT-PCR, expression study, bacterial leaf blight, PR protein

WITHSTANDING HOTNESS THROUGH HEAT SHOCK PROTEINS**SUSHMA SHARMA, ¹SHIKHA YASHVEER, HEMENDER, ¹SONALI SANGWAN AND V. S. MOR***Department of Seed Science and Technology, CCS HAU, Hisar*¹*Department of Molecular Biology, Biotechnology and Bioinformatics, CCS HAU, Hisar*

Global warming, the most talked topic today gives reason to discuss about the responses of organisms to strive their existence in the ever increasing warmth of earth. Increased temperatures (beyond their optimum) pose stress on living beings, plants being sessile are the most feared creatures to withstand this heat. Several heat stress responses are immediately initiated by organisms when met with a sudden hike in temperature. A set of stress proteins commonly called heat shock proteins (HSPs) show an elevated quantity when met with a stress, providing stabilization to normal proteins by binding to them during a state of denaturation threat. HSPs are believed to be the conserved members throughout the evolution process and came forward in 1962 when the puffing pattern in response to heat shock was being studied in *Drosophila melanogaster*. Presently, HSPs

have been studied in a huge variety of life and their role in providing thermotolerance is being studied extensively. Broadly classifying, HSPs have been grouped in five families namely, Hsp 100, Hsp 90, Hsp 70, Hsp 60 and small heat shock proteins (sHSPs). Hsp 90, Hsp 70 and Hsp 60 acts as molecular chaperones (Peptide chain binding proteins) and have roles in protein folding, protein transportation across membranes and modulation receptor activities. The cellular proteins get denatured and aggregated during stress resulting in cell death. Here, the phenomenon of acquired thermotolerance needs to be addressed in which the cells acquire tolerance to future lethal dose of hotness by facing an exposure to non-lethal heat initially. The thermotolerant cells have higher levels of expressed HSPs. RT-PCR technique is used to quantify the expression levels of HSPs.

Keywords: Climate change, heat stress, thermotolerance, HSPs

EFFECT OF MICROBES IN BIOGEOCHEMICAL TRANSFORMATIONS OF SULPHUR IN RELATION TO SOIL-PLANT SYSTEM

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The biogeochemical transformations of the sulphur in soil results mainly due to microbial activity, although some chemical transformations are also involved such as oxidation of iron sulphide, the major types of sulphur transformations in soil are mineralization, immobilization, oxidation and reduction. The majority of rhizospheric interactions focus on pathogens and mycorrhizal symbiosis. Transformation of sulphur between organic and elemental states brought by various micro-organisms like bacteria (*Bacillus*, *Pseudomonas*, and *Arthrobacter*), fungi (*Aspergillus*, *Penicillium*) and actinomycetes, these microbial activities significantly changes their availability to plants. Microbial oxidation with oxygen supplied by radial oxygen loss from roots in wetlands causes acidification, while reduction using alternative electron acceptors leads to generation of alkalinity, affecting pH in the rhizosphere. Water level fluctuations are very common in wetlands, rapid changes in the availability of oxygen and alternative terminal electron acceptors will result in strong changes in the prevalent microbial redox reactions, with significant effects on plant growth. All sulphate-reducing bacteria excrete an enzyme called **desulfurases or bisulphate reductase**. The predominant sulphate-reducing bacterial genera in soil are *Desulfovibrio*, *Desulfatovacuum* and *Desulfomonas*. amongst these species *Desulfovibrio Desulfuricans* are obligate anaerobes that reduce sulphates at rapid rate in waterlogged / flooded soils, while species of *Desulfatovacuum* are thermophilic obligate anaerobes that reduce sulphates in dry land soils. The sulphur / sulphate released are either absorbed by the plants or escapes to the atmosphere in the form of oxides. Rate of sulphate reduction in nature is enhanced by increasing water levels (flooding), high organic matter content and increased temperature with microbial activities.

GREEN TECHNOLOGY: FOUNDATION FOR 21ST CENTURY CROP IMPROVEMENT

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The fundamental discoveries of Darwin and Mendel established the scientific basis for plant breeding and genetics at the turn of the 20th century. With the development of molecular marker technology in the 1980s and with the advances in biotechnology & genomic research, the fate of plant breeding has changed and has paved a path for the foundation of molecular plant breeding, which helped in revolutionizing the 21st century crop improvement. The development of different types of molecular markers and the advances in sequencing technologies has geared crop improvement. The progress made in molecular plant breeding, genetics, genomic selection and genome editing has contributed to a more comprehensive understanding of molecular markers and provided deeper insights into the diversity available for crops and greatly complemented breeding stratagems.

MOLECULAR IDENTIFICATION OF ENTOMOPHILIC NEMATODE OF DISTRICT HAPUR, U.P., INDIA

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A new species of entomophilic nematode was isolated through the soil-baiting technique. The samples were collected from different cultivar fields of district Hapur, U.P., India. On the basis of morphology, morphometry as well as molecular analysis it was placed under genus *Oscheius*. Molecular analysis of nearly full length small subunit of rDNA gene, D2D3 expansion of segment of the large subunit rDNA gene, ITS gene revealed it as a new species of genus *Oscheius*. The result of BLAST search using the newly obtained partial sequences also revealed it as a new species. The morphometric characteristic of new

species are: male body "J" shaped on fixation, a short part of tail protruding beyond the bursa, spicule paired, symmetrical, nine pairs of genital papillae is present; females are almost straight upon fixation, vulva is covered with double flapped epipygma tail is long with pointed tips, juvenile body cylindrical, mouth smooth, tail long pointed as a part of hyaline.

Key words: entomophilic nematode, oscheius, morphology and DNA sequencing.

ROLE OF ETHYLENE SUPPRESSANTS FOR ENHANCING NODAL PROPAGATION OF C. PAPAYA

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Papaya is a member of Caricaceae family. It is a polygamous fruit crop with an excellent source of vitamins and proteolytic enzymes. It is a fast growing fruit tree with a short juvenile phase. Conventional propagation of papaya using seeds leads to variation in fruit characteristics such as shape, colour and taste. Therefore *in vitro* culture can be used to produce true to type papaya plants. During tissue culture protocol development of *Carica papaya*, bacterial contamination, ethylene accumulation, leaf senescence etc are major hindrances. A Micropropagated nodal culture of papaya shows leaves senescence due to ethylene concentrations and its accumulation in the culture vessel. Ethylene accumulation causes growth suppression. Aminoethoxyvinylglycine (AVG), silver nitrate and silver thiosulphate (STS) are some ethylene suppressants. The ethylene-suppressant, AVG, STS, were reported to improve nodal culture growth, leaf area and reduce leaf senescence. Furthermore, better control of ethylene accumulation produces healthier nodal cultures for micro-propagation of papaya and improves productivity of papaya shoot culture systems. Further lesser leaf fall raises number of shoots obtained and increases efficiency of the protocol. MS media modified with different concentration of BAP, NAA, KIN and GA₃ were used for initiation and multiplication of nodal explants under controlled conditions. On the other hand, additives (AgNO₃, Ads, PEG) showed an increase in number of shoots (18.90) due to decrease in leaf fall. Silver nitrate was found best effective in decreasing leaf senescence due to reduced ethylene formation. Ads and PEG showed lower response in decreasing leaf fall due to ethylene. Thus improves the tissue culture protocol for producing suitable planting material.

Keywords: micropropagation, silver nitrate, tissue culture

IN VITRO MUTAGENESIS TO DEVELOP ABIOTIC STRESS TOLERANT GENOTYPES IN WHEAT (TRITICUM AESTIVUM L)

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Wheat is a major cereal crop second to rice worldwide including India. It is used as staple food crop in India. Due to incorporation of Norin 10 gene, country witnessed Green Revolution and attained self sufficiency in food grains production. Presently, wheat is grown in an area of about 30 million ha. With climate change drought, heat and terminal heat are the major issues that affects production adversely. These have become important challenges to agricultural researchers and plant biotechnologists as it is one of the most common widespread environmental stresses constraining the global food production. Extreme water shortage causes considerable physiological, metabolic and morphological changes in plant, and ultimately reduces crop yield and quality. The global demand and increased need of wheat worldwide have been lead to extensive research and development to this crop, where mutagenesis and hybridization are the most leading methods to be followed. Mutagenesis has the ability to modify the few characters in an otherwise promising cultivar without alerting significantly the remaining and often unique genetic background. Mutagens belonging to the class of alkylating agents are mostly used such as ethyl methane sulfonate (EMS), diethyl sulphate (DES), ethylamine (EA), ethyl nitroso urethane (ENU) and methyl nitroso urea (MNU). EMS is generally used in a concentration range of 0.2 to 1% whereas the range for nitroso-ethyl urea is used in the concentration 0.1 to 0.3mM to get mutations in treated smaterial. *In vitro* culture in combination with induced mutations brings about a devastating change among conventional method of breeding used in crop improvement practices. Among the different *in vitro* methods, somatic embryogenesis is the most useful tool for mutagenesis as somatic embryos usually originate from single cells. The above mentioned approach would be helpful in speeding up the breeding programmes, improving many agronomical important traits such as shorter growth period, suitable for rotation and increasing tolerance or resistance towards biotic stresses.

Keywords: Mutagenesis, EMS, EI, ENU, MNH, somatic embryo, abiotic stress.

ENZYMES OF HMP PATHWAY AFFECTED BY DIFFERENT TREATMENTS OF IRON AND ZINC CONCENTRATION ON RICE PLANT

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Rice (*Oryza sativa* L.) is the most important cereal crop which serves as primary or secondary staple food for 50% of the world's population but it is a poor source of essential micronutrients such as iron (Fe) and zinc (Zn). Zinc is an essential micronutrient for almost all organisms, and its deficiency cause a serious nutritional problem in humans and plants. Iron (Fe) is a redox active essential micronutrient that plays critical role in metabolic processes such as DNA synthesis, respiration and photosynthesis in all living organisms. Biochemical changes in glucose -6- phosphate dehydrogenase , 6- phosphogluconate dehydrogenase in root and shoot tissues of four rice varieties (HKR47, PUSA1121, HBC19 and PAU201) were studied in response to varied iron and zinc concentrations ($T_1 = 0.1 \text{ mM Fe(II)-EDTA} + 0.06 \text{ mM ZnSO}_4 \cdot 7\text{H}_2\text{O}$, $T_2 = 0.1 \text{ mM Fe(II)-EDTA} + 0.12 \text{ mM ZnSO}_4 \cdot 7\text{H}_2\text{O}$, $T_3 = 0.1 \text{ mM Fe(II)-EDTA} + 0.48 \text{ mM ZnSO}_4 \cdot 7\text{H}_2\text{O}$). The application of iron and zinc treatment with yoshida nutrient solution increased the uptake of zinc at T_3 due to which specific enzyme activity of these enzymes are increased at T_3 treatment with respect to control (T_2). The present investigation was show that zinc and iron are divalent ions and both show antagonistic behaviour. Therefore a specific concentration ratio of iron and zinc elements are required for the proper growth of the plant.

Keywords - Iron, Zinc, glucose -6- phosphate dehydrogenase , 6- phosphogluconate dehydrogenase

EPN BIOFORMULATIONS: A PROMISING ALTERNATIVE

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India is mainly an agricultural country. Presently agriculture contributes about 16% of total GDP and 10% of total exports. But the agro industry incurs huge losses due to insect pests. According to Indian agrochemical industry report (2016) approximately 15 -25% potential crop production is lost due to pests, weeds and diseases posing a threat to food security as country's population is increasing with the pace of time .Currently the Indian crop protection market is dominated by insecticides accounting for almost 60% of domestic crop protection market and their continuous use not only showed detrimental effects on agro-ecosystems but also has negatively impacted human health. Consequently novel biorational and more specific approaches were developed but still there are appeals for effective,environment friendly and economically acceptable alternatives and bioformulations specifically entomopathogenic nematodes (EPNs) formulations represent a promising alternative to chemical pesticides due to their high efficacy against target organism and no harm to humans and other non target organisms.EPNs from 2 genera steinernema and heterorhabditis are widely used as biocontrol agents . These insect-parasitic nematodes encroach upon soil-dwelling stages of insects and kill them within 48 h through the expulsion of pathogenic bacteria. After the host dies, the infectious stages of the nematodes become adults and a modern generation of infective juveniles (IJs) develop.In an epn formulation active ingredients are epns and solids liquids gels and cadavers are carriers. Bioformulations are successfully used commercially in USA and Europe but in India are still not potentially exploited.there is a need to develop bioformulations which can be used as a tool in integrated pest management strategy.

Keywords-insect pests control, entomatogenic nematodes, bioformulations.

IN VITRO EFFECT OF FeCl_3 ON AMPHIZOIC AMOEBAE ISOLATED FROM DIFFERENT WATER SAMPLES

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Iron is essential for the growth of nearly all living system. The need for affinity of *Naegleria* sp. for iron containing compound in axenic culture and this has been *in vitro* demonstrated. Numerous axenic culture media have been developed for the cultivation of amphizoic amoebae. In this part of study an attempt has been made to see the *in vitro* effect of iron on amphizoic amoebae, isolated from different water samples. Observations were recorded after 8, 24 and 48 hours of incubation at 25°C - 35°C temperature. The concentrations of iron chosen for this study were 0.25mg/l, 0.50 mg/l, 1.0 mg/l, 1.5 mg/l, 2.5 mg/l, 3.5 mg/l and 4.5 mg/l respectively. From the results obtained after experiment, it was observed that iron greatly enhances the viability of all the amphizoic amoebae including pathogenic species of *Naegleria* and *Acanthamoeba* sp. At very low concentration of about 0.25 mg/l, 0.50 mg/l and 1.0 mg/l of iron, no noticeable change was visible on the trophic forms of amphizoic amoebae even after the time interval of 8, 24 and 48 hours and were similar to that of control.

Key Words: FeCl₃, *Naegleria*, *Acanthamoeba*, Axenic, Amphizoic

GENETICALLY MODIFIED CROPS AND THEIR ROLE IN INSECT PEST MANAGEMENT

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GMCs are plants used in agriculture, the DNA of which has been modified using genetic engineering methods. The aim is to introduce a new trait to the plant which does not occur naturally in the species. With the advent of genetic transformation techniques, it has become possible to clone and insert genes into the crop plants to confer resistance to insect pests. Resistance to insects has been demonstrated in transgenic plants expressing genes for delta-endotoxin from *Bacillus thuringiensis* (Bt), protease inhibitors, α -amylase inhibitors, enzymes and plant lectins. It should also be harmless to the natural enemies, target the sites in insects that have developed resistance to the conventional pesticides, flexible enough to allow ready deployment of alternatives (if and when the resistance is developed by the pest), and preferably produce acute rather than chronic effects on the target insects. Genes conferring resistance to insects have been inserted into crop plants such as maize, cotton, potato, tobacco, potatoes, rice broccoli, lettuce, walnuts, apples, alfalfa and soybean. The need for genetic transformation of crops to improve crop production in the developing world has been discussed. There is an urgent need to develop a scientifically sound strategy to deploy exotic genes for minimizing the extent of losses caused by insect pests. Equally important is the need for following the biosafety regulations, more responsible public debate, social attitude and better presentation of the benefits for a rational deployment of the genetically transformed plants.

Key word: - Genetically modified crops, Bt, enzyme inhibitors, biosafety regulations

ASSESSMENT OF POTENTIAL OF CERTAIN OIL CAKES AGAINST ROOT-KNOT NEMATODE, MELOIDOGYNE INCOGNITA INFESTING LENTIL

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A greenhouse experiment was conducted to study the nematostatic efficacy of some oil cakes viz., cotton cake, mustard cake, jasmine cake, sesame cake and pongamia cake (applied at 35g and 70g/pot) against root knot nematode, *M. incognita* in lentil. All treatments significantly ($P \leq 0.05$) improved the shoot and root height, fresh and dry weight of plants and number of pods per plant compared to untreated inoculated control plants. However, application of mustard cake (@ 70g/pot) showed most significant exaggeration in plant growth characters and thereby suppression in nematode multiplication. On the other hand, cotton cake (@ 35g) was found to be least effective. Thus the above results indicate that oil cakes can help lentil plants to combat attack of root knot nematode in a sustainable and environment-friendly manner.

Key words: Oil cakes, Lentil, *Meloidogyne incognita*, Management.

METHYL JASMONATE PROMOTES PHOTOSYNTHETIC PERFORMANCE THROUGH REGULATION OF STOMATAL BEHAVIOR UNDER CADMIUM STRESS IN MUSTARD

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The effect of exogenous methyl jasmonate (MeJA) on stomatal responses and photosynthetic performance was studied in mustard (*Brassica juncea* L. cv. Ro Agro 4001) in presence or absence of cadmium (Cd) stress at 30 days after sowing. The application of 50 μ M MeJA prominently influenced stomatal behaviour, photosynthetic (net photosynthesis, stomatal conductance, intercellular CO₂ concentration, chlorophyll content) and growth (leaf area and plant dry mass) performance both in the absence and presence of 50 μ M Cd stress. Plants exhibited increased oxidative stress (superoxide and H₂O₂ accumulation) and impaired photosynthetic function when grown with Cd, but MeJA ameliorated effects of Cd on stomatal apertures and promoted photosynthetic functions. These findings indicated that MeJA influenced photosynthesis in mustard plants by regulation of stomatal behaviour under Cd stress.

Keywords: Cadmium, Methyl jasmonate, Photosynthesis, Stomatal behaviour

PROXIMATE AND NUTRITIONAL PROFILE OF VARIOUS ACCESSIONS OF OKRA (*ABELMOSCHUS ESCULENTUS*)

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The promotion and consumption of native vegetables could help to diminish food insecurity and improve the condition of malnutrition in developing countries. In the latest Global Hunger Index (GHI) 2017 report, released by International Food Policy Research Institute (IFPRI), India ranked 100th among 119 countries. About one-fourth Indian population is living below poverty line resulting in malnutrition. Utilization of indigenous vegetables can help in mitigating food security issues and addressing malnutrition. Okra, one of the most widely grown and consumed vegetable of family malvaceae, is a highly nutritive multipurpose crop. Proximate and nutritional compositions of twenty accessions of Okra Pods were investigated. Seeds were procured from National Bureau of Plant Genetic Resources, Indian Agriculture Research Institute, New Delhi. The experiment was set up in pots at the Herbal garden, Jamia Hamdard, Delhi in Kharif season of year 2017. Seeds were sown in pots with 8 kg of soil. Recommended dose of fertilizers like NPK was applied. Pods were harvested between 50-60 days after germination and oven dried at 45 degree Celsius. Proximate and mineral composition of Okra pod accessions were determined using standard methods of Association of Official Analytical Chemists. The results of our study suggest that the proximate composition (g/100 g) in dry weight basis have significant variations among accessions. The results of analysis revealed that Okra pods contain a considerable quantity of vital nutrients like protein, fibre, calcium, iron, and zinc with high mineral bioavailability. Therefore, promoting the production and consumption of nutrient-rich accessions of Okra pods can provide cheap sources of nutrients and help in combating hidden hunger by improving the nutritional status and reducing the prevalence of malnutrition especially among people living below poverty line.

Keywords: Okra, Hidden hunger, Bioavailability, Nutrition, Minerals.

PETROBIANLATENS (MULLER) (ARACHNIDA: TETRANYCHIDAE) REPORTED FOR THE FIRST TIME FROM JAMMU AND KASHMIR, INDIA

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Among the biotic constraints, insect pests cause considerable loss in yield and change their status over time. The crops are heavily attacked by armyworm, cereal leaf beetle, wheat aphid, grasshopper, white grubs, ghujia weevil, and termites. *Petrobiatens* (Muller) (Arachnida: Tetranychidae) was first time recorded in Kashmir, which is one of the states of Indian union during survey conducted in rabi 2017-18 to know the pest complex on wheat crop. The mites feed only on leaves, which results in leaf yellowing and mottling, in unhealthy grain formation and in wilting and dying of plants. An entire field can appear yellow-brown during heavy infestations. Most damage is seen during periods of dry and hot weather. Extensive mite injury is sporadic, usually occurring when winter rains are followed by a dry period and the plants are stressed thus reducing yields.

B-CAROTENE: A BOON IN HUMAN HEALTH CARE, TESTED AGAINST EXPERIMENTAL HEPATIC FIBROSIS RODENT DISEASE MODEL

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Carotenoids are found ubiquitously in plants and their regular consumption has been associated with a reduction in the risk of a number of metabolic diseases, including cardiovascular diseases and various types of cancers. β -Carotene is one of the most important nutrient in human diet. Despite of its reported benefits in various diseases, the comprehensive anti-fibrotic mechanism is yet to be investigated. In this study, albino rats were injected with N-nitrosodiethylamine (NDEA) to induce hepatic fibrosis and β -carotene to observe its possible effect. The animals were divided into four groups: Group-1 Control (normal saline), Group-2 Control (β -carotene), Group-3 NDEA-treated, Group-4 NDEA + β -carotene treated. Following sacrifice after two weeks, liver function markers, hepatic hydroxyproline, carbonyls, glycogen and antioxidant enzyme levels were estimated. The changes in the liver anatomy were constantly monitored by routine histopathological studies. Oxidative stress and hepatic inflammation were assessed by western blot analysis of Nrf2, iNOS and NF- κ B. NDEA provoked significant increase in liver function markers, carbonyl contents and decline in glycogen and antioxidant enzyme levels.

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Histopathological studies revealed deposition of collagen and alteration in hepatic architecture. Expressions of Nrf2, iNOS and NF- κ B indicate oxidative stress and liver inflammation. However, β -carotene restores the deviated antioxidant status, possesses anti-inflammatory action through regulation of Nrf2 and NF- κ B pathways. It is thus suggested that β -carotene may be a potential therapeutic agent to counter experimental hepatic fibrosis in experimental animals. Further, the use of β -carotene may be suggested as a prospective pharmaceutical in human health care against liver fibrosis subsequent to proper clinical trials.

Key words: Dietary supplement, β -Carotene, NDEA, Hepatic fibrosis, Oxidative stress

EFFECT OF DIFFERENT BOTANICAL EXTRACTS AGAINST DRY ROOT ROT OF CHICKPEA CAUSED BY RHIZOCTONIA BATATICA (TAUB.) BUTLER

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Chickpea or chana is a very important pulse crop that grows as a plant named *Cicer arietinum* L. in the Leguminosae family. The main cause of this disease is a fungus, *Rhizoctonia bataticola* (Taub.) Butler in most of the gram growing regions. The tap root is dark, shows signs of rotting, and is devoid of most of its lateral and finer roots. Drooping of petioles and leaflets is confined to top of the plant and sometimes when the rest of the plant is dry, the top most leaves are chlorotic. The growth inhibition of mycelium of *Rhizoctonia bataticola* was tested by treatment of culture by four botanical organic extract viz. Neem leaf extract, Marigold leaf extract, Aloe Vera and Bitter gourd leaf extract and compared with control culture. These botanical extracts were added to the culture media at two concentration viz. 20 % and 30 % and tested by poisoned food technique. The result reveals that Neem leaf Extract was best botanical extract and found highly inhibiting the mycelia growth of *Rhizoctonia bataticola* at both the concentration viz. 20% and 30% (60.77% and 69.66% inhibition respectively) followed by Marigold Leaf Extract, Aloe Vera Extract and Bitter Guard Leaf Extract accordingly at both concentrations. In this way, this study will helpful to the farmers for selection of effective botanical extract for control of Dry Root Rot of Chickpea and also obtaining better Chickpea yield.

MOLECULAR BASIS OF HOST-PATHOGEN INTERACTIONS

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Plants are attacked by a wide variety of microbial pathogens like biotrophs and necrotrophs. Plants protect themselves from pathogenic microbes with both preformed and inducible defences. Upon breach of preformed barriers, such as outer coats of wax that resist pathogen penetration, inducible defences are triggered by the recognition of specific pathogen-derived elicitor molecules. Host-Pathogen interactions can be either compatible or incompatible. Host-pathogen interactions involve three steps: recognition, signal transduction and activation of defense responses. Gene for gene concept explains that resistance gene in the host and corresponding avirulence genes in the pathogen decide the outcome of host pathogen interaction. Hypersensitive response characterized by rapid and localized cell death leading to restriction of pathogen growth in cells is one of the prominent resistant reaction by plants. The reactive oxygen species are the main component of hypersensitive response that damage all cellular parts, from nucleic acids, carbohydrates, lipids to proteins. The subsequent activation of the components of signaling pathway eventually lead to the expression of defense related genes such as pathogenesis related proteins, peroxidases, proteinase inhibitors and the production of antimicrobial secondary metabolites. Systemic acquired resistance in plants is a secondary resistance response induced after a hypersensitive response to avirulent pathogens. Transcriptional responses of plants have been found critical for resistance towards necrotrophic pathogens. Defense responses have deleterious effects on plant growth and hence, appropriate regulation of defense responses in reaction to pathogen attack is important for plant fitness. Understanding of host pathogen interactions is still in infancy and further studies are needed to exploit the molecular level mechanisms underlying such interactions which will reveal the hidden basic information regarding host pathogen interactions at molecular level.

Key words: Gene for gene concept, hypersensitive response, systemic acquired resistance, Pathogenesis related proteins

HEPATO AND RENAL PROTECTIVE EFFECT OF VITAMIN E IN TOXICITY INDUCED BY CHROMIUM IN LABORATORY CHICKS

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Objective : Present study has been carried out to investigate the protective effects of vitamin E as an antioxidant therapy against toxicity induced by chromium in laboratory chicks on hepatic and renal enzymes (AST, ALT, ALP and creatinine respectively). Hypothesis : It is well established that vitamin E act as an antioxidant against toxicity induced by different

heavy metals. To prove this fact we have decided to research on protective effects of vitamin E against hexavalent chromium toxicity on enzyme functions produced by liver and kidney. However, to strengthen this work, further studies are required to clarify the action mechanism of vitamin E as a therapeutic agent. Method: Experiment was conducted in randomly divided three equal groups (n=6) of chicks. Chicks of group A were administered with sublethal dose of potassium dichromate ($K_2Cr_2O_7$) (5 mg/100 gm body weight) by gavage on each alternate day for 30 days. Chicks of group B were treated with potassium dichromate ($K_2Cr_2O_7$) as chicks of group A but also administered with vitamin E (intramuscularly) (0.5 IU/100 gm body weight) on each alternate day for 30 days. Chicks of Group C were administered with saline only to serve as purely control. The serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) and creatinine enzymatic activity were determined using commercial kits. Result: Significant decrease of serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) and creatinine were observed in purely chromium treated groups. However, these values were significantly increased in vitamin E treated groups as compared to chromium treated group up to normal control level.

Implication: It may be concluded that the progressive hepatotoxic and nephrotoxic effects of hexavalent chromium in the form of potassium dichromate ($K_2Cr_2O_7$) can be moderately reduced by supplying vitamin E intramuscularly in laboratory chicks.

Key words: Hexavalent chromium, vitamin E, liver, kidney

MICRO RNA AND ITS ROLE IN GENE REGULATION

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MicroRNAs (miRNAs) are endogenous ~22 nucleotide RNAs that can play important regulatory roles in animals and plants by targeting mRNAs for cleavage or translational repression. Victor Ambros and colleagues Rosalind Lee and Rhonda Feinbaum in 1993, discovered that RNAs *lin-4*, a gene known to control the timing of *C. elegans* does not code for a protein but encoded for a 22 nt small RNAs (David P. Bartel, 2004). Two processing events lead to mature miRNA formation. In the first, the nascent miRNA transcripts (pri-miRNA) are processed into ~70-nucleotide precursors (pre-miRNA) by Drosha inside the nucleus. Pre-miRNA are transported to the cytoplasm by Exportin 5 and are processed into miRNA: miRNA duplexes by Dicer. Only one strand of the miRNA:miRNA duplex is preferentially assembled into the RNA-induced silencing complex (RISC), which subsequently acts on its target by translational repression or mRNA cleavage, depending on the level of complementarity between the small RNA and its target. (Lin He and Gregory J. Hannon, 2004). Post embryonic development in rice is regulated by different sets of miRNAs. (Yu Chun Luo et al., 2006). miRNA governs aging at the level of organism life span, tissue aging and cellular senescence. Role of miRNA has been studied in cancer and apoptosis (N.L. Lennon et al., 2009). Ideal Plant Architecture in rice is generated by regulation of OsSPL14 by miRNA (Yongqing Jiao et al., 2010). miRNA regulates nutrient homeostasis in plants by regulating expression transporter (Soumitra Paul et al., 2015). miRNA mediated gene regulation can be used in development of transgenic plants which give better yield under stress conditions (Man Zhou and Hong Luo, 2013). Artificial miRNAs are being used for highly specific gene regulation (Norman Warthmann et al., 2008). A large number of miRNAs and their functions have been discovered, and more are expected to be explored in the near future. Structure of complexes and biochemical role of various factors associated with miRNA biogenesis are yet to be revealed.

ISOLATION AND EVALUATION OF LACTOBACILLUS AND STREPTOCOCCUS AS PROBIOTICS FROM CURD SAMPLE.

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Lactobacillus bulgaricus and *Streptococcus thermophilus* are strains of Lactic Acid Bacteria (LAB) found in curd. The human gut microbiota play a significant role in nutritional processes. The concept of probiotics has led to widespread consumption of food preparations containing probiotic microbes such as curd and yogurt. Curd prepared at home is consumed every day in most homes in India. In this study different curd samples were evaluated for lactic acid bacteria (LAB) with probiotic potential. *Lactobacillus* is known to produce lactase, the enzyme that breaks down the sugar in milk. (People who are lactose intolerant don't produce this enzyme), Prevents and treats diarrhea, Reduces overgrowth of pathogens in digestive tract, Relieves Irritable Bowel Syndrome, Crohn's disease, and gut Dysbiosis, Decreases frequency of yeast infections and urinary tract infections, Increases immune response, May treat respiratory infections like sinusitis and bronchitis. The strains of *Lactobacillus* and *Streptococcus* were isolated from different curd samples on the Briggs agar media and Reddy medium respectively. From curd sample CS-1 01 *Lactobacillus* and *Streptococcus* isolate was purified and they were designated as

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LC-1 and SC-1, respectively. From curd sample CS-2 01 *Streptococcus* isolate was purified and it was designated as SC-2. From curd sample CS-3 01 *Lactobacillus* and *Yeast* isolate was purified and they were designated as LC-3 and YC-3, respectively. Isolated microorganisms were identified on the basis of colony morphology and microscopy. All the native isolates were gram positive. These native isolates were tested for their ability to form curd individually and in combinations. This was followed by sensory analysis of curd on the basis of certain parameters (smell, texture, taste etc). On the basis of this analysis for individual isolates best curd formation was obtained with isolate LC-3 with overall acceptability (+4 score), then LC-1 with overall acceptability (+3 score), then LCM-1 with overall acceptability (+2 score), then SC-2 was favored with acceptability (+1) and SC-1 was least favored.

QUANTITATIVE ANALYSIS OF PHENOLIC AND FLAVANOID CONTENTS IN DIFFERENT PARTS OF CASSIA JAVANICA

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Objective: Phytochemical screening for quantitative analysis of total phenolic and flavanoid content in methanolic extract of different parts viz; leaves, flower and seed was carried out of medicinally useful plant. **Hypothesis:** Plants have richest source of various secondary metabolites which play a vital role in prevention and cure of disease. The Genus *Cassia* belong to family leguminosae comprises of about 500 species. *Cassia javanica* L. is ethnomedicinal and ornamental plant with traditional claim of their parts to be used as home remedy in prevention and cure of diseases, but still limited research reported available yet about different part specific studies in this species. **Method:** Plant parts were extracted in organic solvents for estimation of total phenolic and flavanoid using Folin-Ciocalteu reagent in reference to gallic acid at 760nm and Sodium bi carbonate in reference to quercetin at 420nm respectively through UV-spectrophotometer. **Results:** Phytochemical screening showed the presence of both phenolic and flavanoid in a significant amount. It was noted that phenolic content was the highest in flowers i.e. 0.04mg/100g and lowest in seeds i.e. 0.01mg/100g respectively whereas the flavanoid content was similar in all plant parts. **Implication:** Study confirm *C. javanica* flowers are the best source materials among other parts for defense, prevention and protection due to over production of reactive oxygen species and all parts play to similar effect in detoxify against harmful stress. Hence, thus it is scope to utilize this potential source of natural extracts/compounds for better health care.

Keywords: *Cassia javanica*, Phenolics, Flavanoids, health.

LEAF SPOT DISEASE (A. ALTERNATA FR. KEISSLER) OF CHICKPEA AND ITS GROWTH IN DIFFERENT CONDITIONS.

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The foliar blight disease of chickpea caused by *A.alternata* has been observed in severe form in many places of Uttar Pradesh during Rabi season. Therefore studies on growth of pathogen were carried out on natural & synthetic agar media. The Potato dextrose agar medium supported best vegetative growth followed by Kirchoff's and Czapek Dox agar media, while studied various cultural characteristics of pathogen on different media. Very good growth was recorded on Potato dextrose agar, Kirchoff's and leaf decoction media. Statistical analysis of the data however revealed that the variation in the length of the conidia observed in media Sabouraud's – Potato dextrose and corn meal and Browns starch were found insignificant. Maximum conidial breadth was observed in Czapek Dox (17.91 µm), followed by Kirchoff's (17.81 µm), Richard's (17.57 µm), chickpea leaf decoction (17.52 µm) and PDA media (17.48 µm). The pathogen was grown on different liquid media and it was evident that PDA and Kirchoff's medium supported best growth and was significantly Superior to rest of the media. The pathogen was grown at six temperatures ranging from 5°C to 35°C and found that 30°C was significantly superior to others. Temperature also effects the conidial size of the pathogen, biggest length & maximum breadth observed at 30°C (35.27 µm) & (15.70 µm) respectively. pH plays considerable role on the growth of fungi. However optimum pH supporting maximum growth was found 6.5. It was also noticed that with the increase of acidity & alkalinity, the dry mycelium weight of the pathogen was also affected & found minimum at pH 4.0 & 9.0

Key words : Chickpea, Kirchoff's Medium, Czapek Dox Medium, PDA Medium, vegetative growth

ISOLATION AND CHARACTERIZATION OF COCCUS SHAPED BACTERIA CAUSING TAIL ROT DISEASE IN FRESHWATER PRAWN, *MACROBRACHIUM ROSENBERGII* (DE MAN) IN HARYANA, INDIA

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The rapid expansion of the prawn farming industry is plagued by diseases affecting shrimp survival and growth. The bacterial pathogens have been found to play an important role in shrimp production. The gram-positive, ovoid bacterial pathogens (*Streptococcus* grp Q1, *Staphylococcus aureus*, *Micrococcus luteus* 1, *M. varians* and *Cellobiosococcus scluri*) were isolated and identified from diseased freshwater prawn/shrimp, *Macrobrachium rosenbergii* in Ladwa farm, Hisar (Haryana). The diseased prawns displayed rotting of tail and antennular flagellum. The genus and species of the bacterium were characterized and identified by biochemical tests and confirmed with the help of Computer Programme PIBWin.

Key words: Physico-chemical parameters, coccus shaped bacteria, tail rot, freshwater prawn/shrimp, *Macrobrachium rosenbergii* (de Man).

BACTERIOPHAGE AND ITS SIGNIFICANCE

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Bacteriophage or phages are obligate intracellular parasites. Bacteriophage are those viruses that eat bacteria. They multiply inside bacteria by making use of some or all of the host biosynthetic machinery. Bacteriophages known to occur everywhere in nature. As more as 2700 types of tailed phage have been reported, few percent of these are distributed among as among cubic, filamentous and pleomorphic types. F.W. Twort (1915) discovered the bacteriophage and Felix d'Herelle (1917) coined the term bacteriophage. These are possess only one type of nucleic acid either DNA or RNA. In respect to their mode of replication, phage may be grouped into two types; namely, the lytic or virulent phage and other is temperate or avirulent phages. Lytic or virulent phages are phages which can only multiply in bacteria and kill the cell by lyses or burst releasing new phages at the end of the life cycle while in the lysogenic cycle cell do not lyse. Significantly they are used for treatment of bacterial infection like- plant pathogenic bacteria and identification of its. And also used in molecular biology & phage therapy. The main advantage of the invention is development of a preparation to treat and prevent bacterial plant diseases by the method which is an alternative to chemical bactericides that can have negative effects on the environment.

GENETIC VARIABILITY IN *LEPIDIUM SATIVUM* L. GERMPLASM FOR DIFFERENT PHENOTYPIC QUANTITATIVE TRAITS

VINAY KUMAR AND HEMANT YADAV

Genetics & Plant Molecular Biology, Academy of Scientific and Innovative Research, CSIR-National Botanical Research Institute, Lucknow 226001, India

Lepidium sativum is a fast-growing, edible, underutilized and medicinal plant of the Brassicaceae family. Indian system of medicinal and health (ISHM) recognizes this plant as a source of several, medicinal and nutraceutical factors. Using D² analysis, ninety-nine germplasm of garden cress (*Lepidium sativum* L.) was categorized based on genetic diversity into six clusters. All clusters were poly genotypic-based with genetic divergence. The highest inter cluster D² distance was observed between in the cluster II and VII (361.02) and lowest inter-cluster distance was observed between cluster III and IV (51.63). The highest intra cluster D² distance was observed among the genotypes of cluster I (138.89) and IV lowest inter cluster showed (26.92) values suggesting that genotype of these clusters may be used a hybridization program. The Phenotypic coefficient of variability (PCV) was slightly higher than that of the genotypic coefficient of variability (GCV) and the Environmental coefficient (ECV) for all characters. Estimates of heritability (a broad sense in percentage) ranged from 4.36 (date of emergence) to 88.88% (Plant height). High estimates of genetic advance coupled with the genetic advance in percent over mean were found for all the traits except Plant height, date of maturity and number of silique plant⁻¹. The results of this research might be important in genebank management and agricultural and breeding programs to develop underutilized crop to utilized crop in the future.

Keywords: Diversity, Phenotypic, Cluster analysis, Genetic variability, Genetic advance, Heritability

ECO FRIENDLY ENHANCEMENT OF STRESS RESISTANCE IN CROP PLANTS**VINAY MAHADEV HEGDE, UNDER THE SUPERVISION OF PROF DR.***Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi*

Food security remains one of the most challenging tasks for growing population rapid changes in climate imposes increasing biotic and abiotic stress of crop plants. In recent years melatonin has emerged as research highlight in stress resistance of plants. The main functions of melatonin are related to abiotic stresses such as drought, radiation, extreme temperature and chemical stresses. Melatonin found in flowers and developing fruits of *Datura metel*. It is found to be highest level in developed flower buds. Regulatory effect of melatonin will generate when plant face harsh environmental condition. Evidence suggests that concentration increase the level of endogenous melatonin in plants. Exogenously applied melatonin can also improve the ability of plant to tolerate abiotic stresses. Over expression of melatonin biosynthetic genes increases melatonin levels in plants.

Keywords: melatonin, biotic, abiotic, drought, datura.

INDICATION AND BIOREMEDIATION OF HEAVY METALS TOXICITY IN SOIL**VINAYAK V SAVANOOR***Department of Soil Science, College of Agriculture, CCS HAU, Hisar-125004, Haryana*

An abiotic environment of organisms and plant is dependent on biotic environment which includes soil, water and air. Man is also constantly interacting with both environments. In present scenario, the increasing population, factories, dumping of hospital wastes, over mining, irrigation of sewage water to field and connecting of polluted water come from textile industries to rivers leads to accumulation of heavy metals. Toxic heavy metals such as lead (Pb), cadmium (Cd), mercury (Hg), chromium (Cr), zinc (Zn), uranium (Ur), selenium (Se), silver (Ag), gold (Au), nickel (Ni) and arsenic (As) which are not useful to plants, are capable of reducing plant growth due to reduced photosynthetic activities, plant mineral nutrition, and reduced activity of essential enzymes. Therefore we need to raise the prevention of pollution by monitoring environmental quality. There were several monitoring methods on the environmental quality. Among them, Biological methods assess the presence of several species, such as plants, insects, fish, bacteria and viruses as environmental indicator and 50–65% of cost saves when bioremediation was used for the treatment of one acre of heavy metal (Pb) polluted soil compared with the use of conventional methods such as excavation and landfill. So the species of bacteria have been used as bio-indicators in monitoring environmental quality. *E. coli*, *Streptococcus* sp., *Pseudomonas* sp., *Vibrio* sp., *Clostridia* sp., *Bifidobacterium* sp., *psedolongum*., *Acrobacter* sp and *Thiobacillus* sp. are some important bacterial species indicates toxic elements which is present in soil. The bacteria are the best indicator to heavy metals from soil, house wastes and other polluted materials. So in this context the microorganisms are good indicator of heavy metals in ecosystem.

Key words: Toxic metals, biotic, bacteria, degradation, microorganisms.

COMPARISON OF TIKHUR GENOTYPE BY USING AMMI MODEL FOR GENOTYPE AND ENVIRONMENT INTERACTION**VISHAKHA TIWARI, DEOSHANKAR, D. P. SINGH AND R. R. SAXENA***Indira Gandhi Krish Vishwavidyalaya, Raipur (C.G.)*

Tikhur (*Curmuma angustifolia*) is one of the herbs mentioned in ancient scriptures of ayurveda. It is economically and medicinally important product of India as well as Chhattisgarh. The edible rhizome rich in starch content is processed to obtain tikhur flour. Tikhur production in Chhattisgarh is fairly high. The experiment carried out in Randomized Block Design on Tikhur genotype in Chhattisgarh state of Bastar district during 2015-16 crop years. By using multiplicative model such as AMMI models for analyzing genotype and environment interaction. It also find out which genotype most probably suitable for different location and which environment condition most favourable for tikhur crop. Statistical analysis is done by using R software and PB tools as the programming tool.

Keywords: AMMI model and tuber crop.

MOLECULAR DIAGNOSTIC APPROACH PREVAILS SUPERIOR METHOD IN DETECTING GENETIC DIVERSITY IN *DOLICHOS LABLAB***VISHWAJEET SINGH AND RAJDEEP KUDESIA***Department of Botany, Bundelkhand University, Kanpur Road, Jhansi*

Abstract: In this work, genetic assorted variety in *Lablab purpureus* was surveyed utilizing SSR markers on Ten Indian *lablab* accession got from Indian gene bank. Also evaluate the polymorphism information for checking the efficiency of markers. DNA was isolated by CTAB method and its integrity was identified by Gel Electrophoresis (0.8%). For SSR,

analysis 5 primers were used for checking the diversity in *Lablab* and the performance of markers were measured by using 4 parameters (1) PIC, (2) Mean resolving Power, (3) Resolving Power and (4) MI. SSR (05) markers produced a total of 51 bands, out of which 45 bands (88.23%) were polymorphic which varies from 6 (Primer-111) to 15 (Primer-AGB-9) with mean of 10.5 bands per locus. In the UPGMA dendrogram of all the Genotype with 5 primers, the 10 genotypes were divided into two main clusters. The Polymorphic information content value ranges from 0.265-0.488 with a mean of 0.390. The value of Matrix index is 3.2. Higher the Mi, better the method is. The value of resolving power ranges from 2.2 to 12.60 with a mean of 7.40. Our present examination uncovered that genetic markers might be effectively used for deciding hereditary assorted variety and connections in *lablab* genotypes and could be utilized as a part of reproducing programs

LAMBDA-CYHALOTHRIN USED FOR STRUCTURAL PEST MANAGEMENT OR IN PUBLIC HEALTH APPLICATIONS

VIVEK KUMAR

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Lambda-cyhalothrin is a synthetic pyrethroid insecticide. Pyrethroids are manmade chemicals that are form a group of chemically different compound, Pyrethroids are low toxicity and easily metabolized in mammals and ecosystem. The main system metabolism includes breakage of the esters bond by esterase action and oxidation at various parts of the molecules. Synthetic pyrethroids are neuropoisons acting on the axon in the peripheral and central nervous system by interacting with sodium channels, In mammalian sodium channels is much less sensitive to pyrethroids. Lambda-cyhalothrin used to control a wide range of pests in variety of application. Pest controlled include aphids, beetles and butterfly larvae, and in public health applications to control insects such as cockroaches, mosquitoes, ticks and flies which may acts as disease vectors.

Key words: Lambda-cyhalothrin, Pest controlled, Public health.

IN SILICO STRUCTURE PREDICTION OF GALACTOMANNAN GALACTOSYLTRANSFERASE IN GUAR VRANTIKA CHAUDHARY, ANIL PANWAR AND NEELAM R YADAV

Department of Molecular Biology, Biotechnology & Bioinformatics CCS HAU, Hisar

The study of 3D protein structures is critical for understanding the sub-atomic components of life. Due to expanding rate and number of genome sequencing ventures the hole between the quantity of known structures and the quantity of known protein successions continues to be expanding and interest for solid computational techniques today is higher than any time. Galactosyltransferase is known to be a key enzyme in control of galactose substitution in galactomannan biosynthesis in *Cyamopsis tetragonoloba*. Structurally galactomannan comprise of a linear (1-4) - β -linked D-mannan backbone which carries single unit, (1-6) linked, α -D-galactopyranosyl substituents attached to backbone mannose. Galactomannan galactosyltransferase 1 belongs to glycosyltransferase family 34. Guar gum is a galactomannan extracted from guar seed endosperm and is most commonly used as food additives to provide stiffness and texture. First of all the query sequence of galactosyltransferase was matched against NCBI then most noteworthy likeness has a place with *Glycine max* having e-value 0.0 and identity 78%. Thereafter Conserved Domain search resulted into conserved domain PLN03181. Different structures were obtained using different tools like I-TASSER, SWISS-MODEL, PHYRE2, Raptorx using different methods such as homology modelling and fragment assembly. These models were validated in silico by SAVES (Structural analysis and verification server), out of these models quality factor estimated by ERRAT was highest for model obtained by I-TASSER i.e. 77.283. Predicted model have C-score=-1.87, estimated TM-score = 0.49 ± 0.15 , estimated RMSD = $11.4 \pm 4.5 \text{ \AA}$ whereas QMEAN4 score was -2.55 for structure predicted by SWISS MODEL using 4uioB as template (lowest). After this clustering of protein models is done using different templates in CABS server having 8 cluster groups with cluster density 40.5, average cluster RMSD 1.4 and cluster size equal to 40.5.

ADVANCES IN BIOLOGICAL SCIENCES AND BIODIVERSITY CONSERVATION ISOLATION AND CHARACTERIZATION OF TERMITE HILL BACTERIAL BIOCONTROL AGAINST *ALTERNARIA ALTERNATA*

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Termites are common biological agents as "ecosystem engineers" that produce significant physical and chemical modifications to tropical and subtropical soils. A 100 gm of termite hill (TH) soil samples were collected from the five different location of Paum Pare district, Arunachal Pradesh and used for isolation of thermophilic and spore forming bacterial strains. Heat treatment of soil sample followed by serial dilution was performed for the isolation of bacterial strain. Morphological and microscopic studies showed that these strains belong to *Bacillus* spp. A total of 42 *Bacillus* strains were isolated from termitarium soil and screened for their antifungal activity by the production of diffusible and 8 isolates showed

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promising activity against *A. alternata*. TH5/J showed maximum per cent inhibition of pathogen i.e. 35.06 % after 48 hrs. CFCF also inhibited the growth of *A. alternata*. TH5/J and TH2/2 produced highest amount of IAA which support the plant growth promotion 17.4 cm for both the strain as compare to control which is 6.9cm in mung bean seeds under *in vitro* experiments.

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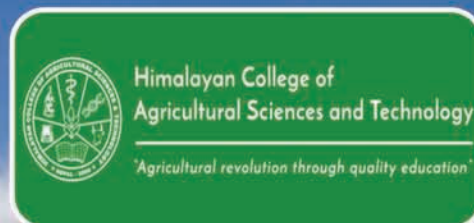


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ABSTRACTS

THEME-4

**INNOVATIVE APPROACHES IN APPLIED
SCIENCES AND SOCIO-ECONOMIC
DEVELOPMENT**

PACKAGING ADDS VALUE TO AGRI PRODUCE: A SUSTAINABLE APPROACH**TANWEER ALAM***Joint Director- IIP Delhi***ABSTRACT**

In recent time there are several incidents of farm distress are reported in several parts of country and there have been reports of price crashes in case of farm produce, such as tomatoes, mangoes, sugarcane and onion etc. In some cases, farmers have dumped their produce on roads. Produce such as fruits and vegetables are perishable and therefore have a short shelf life. Further, due to inadequate storage facilities and poor food processing infrastructure farmers have limited options but to sell the produce at prevailing market prices. This can lead to distress sales or roadside discards (in some cases to avoid additional cost of transportation). It is also observed there is increase in- put cost for farm production. Food packaging including Agri produce is regarded as such a strategic product service system since it adds value to consumers both in the first and the second moments of truth. Through out the supply chain, the package is the interface between the product and the consumer and adds values in terms of information, usability, marketing, functionality and recyclability, among others. The role of food packaging as a value adding element and interface to the product, the package also has a function of adding values to other actors of the food supply chain. Such values could be information, handle ability, stackability, etc., in the different parts of the chain. Packaging has become increasingly important as a value addition of product, since package design influences the consumer's experience of product use as well as accelerating and affecting the first purchase decision. In recent time there are several incidents of farm distress are reported in several parts of country and there have been reports of price crashes in case of farm produce, such as tomatoes, mangoes, sugarcane and onion etc. In some cases, farmers have dumped their produce on roads. Produce such as fruits and vegetables are perishable and therefore have a short shelf life. Further, due to inadequate storage facilities and poor food processing infrastructure farmers have limited options but to sell the produce at prevailing market prices. This can lead to distress sales or roadside discards (in some cases to avoid additional cost of transportation). It is also observed there is increase in- put cost for farm production. Recent research in food packaging has resulted in technological innovations that provide information on the real shelf life and expiration of food products as a service to users. These product-service innovations present an added value to consumers and also a clear benefit from a sustainability perspective, but they are beneficial for all stages of the supply chain. This manuscript presents a study with the purpose to elaborate the value of food packaging innovations. The paper discusses the technological innovation and its potential value addition.

Keywords: Packaging, value addition, product-package-service system, supplies chain.

PROLOGUE**Role of Packaging in the Food Supply Chain**

When it comes to food products, packaging is a valuable aid in providing safe food to consumers. Food supply chains are both time critical due to temperate storage requirements and dynamic due to variance in raw material supply and quality. Even though food safety has a high priority on the food producers' agenda, the food industry has become global and more complex. This means that there are longer distances from the production of food to the consumer. This certainly places higher demands on food safety matters and on the process of guaranteeing safe food to consumers. Although complex, food supply chains can be generalized into certain steps from crop, to production and consumption. Typical steps in these complex food supply chains are agriculture, food manufacturing, food wholesaling, food retailing and, food services. The trend among consumers for fresh products has resulted in chilled food, particularly prepared chilled food, now competing more and more with their frozen counterparts. These new trends and lifestyles place strict requirements on new food products for a safe and quality controlled distribution. In order to highlight safety and quality, temperature control is an important issue in chilled food distribution

VALUE ADDITION

Packaging offers additional functional values, such as better branding, elements that fight counterfeiting and protection of the formulation within. As consumers demand more of their products and brands, companies have to be prepared to work more with their suppliers and product developers to create this value for their consumers. In , there are two constants in packaging: it must be functional and attractive. It must effectively contain and dispense the product while also engaging consumers from the shelf, enticing them to pick up this product instead of the one next to it. However, increasingly, packaging is becoming integral to the use experience of a product, and these added value elements are making collaboration between packaging suppliers and brands that much more important, as well. Packaging needs to evolve to help display innovative products. According to Damien Dossien (2016), If a product is innovative, the packaging may have to be as well," Inc. "In the consumer's eyes, packaging and product are inextricably intertwined."Value is what is perceived by the consumer. When a consumer looks at the value of a product they consider a few things, the quality of the product vs the price.

Role of Packaging in Brand Identification

Majority of today's consumers are very busy people, they zip into the store to get what they need and get out. Most purchase decisions are made within 30 seconds. So, ultimately you have less than 30 seconds to 1) get the consumers attention, 2) get them to pick up product and 3) get them to make the purchase decision of buying product as apposed to competing brands. Most purchase decisions are made within 30 seconds. product packaging is the focus here of getting attention and the first step of the process to getting the purchase. Firstly, having a product in packaging that resembles brand and what brand stands for is a great way to start. For example, if you have an eco-friendly product, use that as a selling point and make sure those products characteristics are carried through to packaging. If brand / product has multiple variations it is important to ensure that the same brand image and message is carried throughout entire product line. This makes it easier for the consumer to establish brand and also aids in repeat sales. When the consumer recognizes brand and has a sense of trust, they are more likely to purchase other products, knowing that other products will (should) carry the same quality.

Packaging as a Tool for Advertising at the Point of Purchase

After the consumer has identified brand/ product its now time to get them to make that purchasing decision and influence them in doing so. A packaging carton is most efficient in this as it allows you to add additional information that cant fit on the actual product; information that could influence them to purchase product. In today's modern world where we are so busy and thrown with various advertising media from every angle, we have become oblivious to them out. Think about D Stv or the American Cable TV where you just fast forward through the adverts or let them play while you go get something to drink. Consumers are increasingly becoming immune to advertising.

Modern world of Packaging for Product Transport

Now that the consumer has purchased product, can they transport it easily? The easier product is to transport the better value it creates to the consumer. The ease of transport is unfortunately often overlooked and the consumer has to take the hit for it.

Role of Packaging to maintain Food Quality and Shelf life

The shelf life of food products is an indicator of the level of quality. All food products in Sweden have to be marked with either "best-before date" or "last date for consumption". The latter is used for more sensitive food like fresh meat, fish and chicken. The best-before date is set so that the food, if stored under the right conditions and in an unbroken package, will be possible to consume some additional time after the set date. Since food producers have to add a safety margin to the best-before date, this results in an unnecessary waste of food, both by the consumers in their home and at retail locations. The majority of consumers tend to throw away food when the best-before date has expired, irrespective of if the food has gone bad or not Consumer behaviour in retail stores also creates waste. Since consumers buy products with the longest remaining shelf life irrespective of whether the product is going to be consumed the same day or not. This generates waste of products with shorter shelf life since they remain on the shelves. The two most important factors concerning the shelf life of a product are time and temperature. Most of the deteriorating changes that take place in food are temperature dependent and occur at a slower rate at lower temperatures. When temperature is infringed upon, the shelf life is affected leading to an uncertainty of the quality and food safety. There have been some initiatives on the market to make indicators for detecting products that have been exposed to higher temperatures than stipulated. These indicators, however, have only been able to indicate if a product has been exposed to higher temperatures, but not how long. They usually shift in colour if the product has been exposed, but they really do not say much since the exposure is also dependent on time.

CONCLUSION

Agricultural packaging is essential to the food industry. Packaging prevents food from being spoiled or ruined by pests or toxins from packages. In a health conscious world demand is to know where our food comes from. Agricultural packaging has taken on a new level of importance considering that 54% of wasted food is lost during the production process, after-harvest treatment, and storage transportation. Discover more about five important agricultural packaging products from wholesale to retail. Some packages may not hold up very well, and may become susceptible to pests or the external elements such as wet weather. For these reasons, bulk bags are one of the most affordable and effective ways to store and transport dry goods and produce. Consider the packaging best used for agricultural bulk shipping. It's really important to understand the importance of agricultural packaging for better business for the short and long term. Packaging within the agricultural industry will help to preserve and protect farm produce. It will save money on shipping costs and will aid in product branding. Plus, utilizing the right agricultural packaging is essential in delivering the freshest, best-looking products and add value to the product.

CARBON NANOTUBES: SYNTHESIS, CHARACTERIZATIONS AND ITS POTENTIAL APPLICATIONS**PROF. MUSHAHID HUSAIN***Ex- Vice Chancellor, M.J.P. Rohilkhand University, Bareilly & Former Director, Centre for Nanoscience and Nanotechnology, Jamia Millia Islamia, New Delhi-110025*

Miniaturization is the general aim of current technology and it is taking place in nearly all types of technology. In nature, there are some pure materials that have striking different properties even though they are made of the same atoms. For example, diamond and graphite are two pure forms of carbon called allotropes and frequently used in jewellery and in pencils respectively. These two materials have enormously different properties such as graphite is light, flexible, soft, and conducts electricity whereas diamond is an exceptionally hard, strong and does not conduct electricity. Both of these materials are made up of carbon atoms and attached through strong covalent bonding. But in graphite each carbon atom uses three out of four electrons to form three single bonds with its neighbours and forming a linear sheet, whereas in diamonds each carbon atom uses all its four electrons to form four single bonds and resulting in a 3-D structure. In the early 1990s, an exceptionally new form of carbon namely Carbon Nanotubes (CNTs) was first discovered by S. Iijima. CNTs are seamless hollow cylinders of covalently bonded carbon atoms. The carbon atoms in the walls of a tube are arranged in a honeycomb lattice just as in a single sheet of graphene. These are found as single wall carbon nanotubes (SWCNTs), double wall carbon nanotubes (DWNTs) and multi wall carbon nanotubes (MWCNTs). SWCNTs is a single cylinder of carbon atoms which is typically 0.5–4nm in diameter and several micrometer (μm) in length whereas MWCNTs consist of concentric SWCNTs (or shells) stacked together and having diameters in the range of 20–80nm and several tens of micrometer in length. MWCNTs were first synthesized by using arc discharge technique where fine threads in a bit of shoot were observed under electron microscope. The tresses were very thin and long tubes of pure carbon. SWCNTs were synthesized, using metal catalyst in arc-discharge method, for the first time, by Iijima and Ichihashi and Bethune et al. in 1993. SWCNTs can only be grown in presence of a catalyst whereas MWCNTs do not need a catalyst for growth. Generally, three techniques are being used for producing CNTs: (i) Arc-discharge technique (ii) Laser ablation technique and (iii) Chemical vapor deposition (CVD) technique.

The properties of CNTs are derived from the properties of graphene. Depending on the “rolling” angle or chiral angle with respect to the lattice, the corresponding arrangement of the atoms in the walls of the CNT with respect to the CNT axis is totally different. The angle between the orientation of the lattice and the CNTs axis is known as the “chirality” of the CNT. CNTs specifically SWCNTs have a wide range of unexplored potential applications in various technological/industrial areas such as aerospace, energy, automobile, medicine and chemical industry. In these applications, CNTs can be used as gas adsorbents, templates, composite reinforcements, actuators, probes, sensors, nano-reactors, catalyst supports, nano-pipes etc. However, the industrial application of the carbon nanotubes requires the development of techniques for large-scale production of defect-free nanotubes. The sensing applications of SWCNTs cover environmental monitoring, food quality observation, defence area, fire detection and other safety measures. Different pollutants releasing in the environment require continuous monitoring by different kind of sensitive sensors. Gas sensors are the indispensable part of our modern technology and are being much focused by scientific community. There is large number of sensors available in the market and among all sensors, metal oxide based gas sensors work efficiently but they lack the high quality of selectivity and operate at high temperature consuming much energy. To overcome these limitations of metal oxide based sensors, CNT and specifically SWCNTs based sensors are showing excellent performance in sensitivity and selectivity at room temperature. At present, we are working on SWCNTs based sensors. In our laboratory, SWCNTs have been grown on Fe catalyst deposited on Si substrate by PECVD technique at an operating temperature of 600⁰C. Then, SWCNT sensor was fabricated for NH₃ sensing at different operating temperature and concentration. The performances of the fabricated SWCNTs based sensor have been measured at 30⁰C, 100⁰C and 200⁰C and we have achieved the sensor response 35%, 25%, and 20% respectively. The response have also been investigated by varying NH₃ gas concentrations as 10ppm, 20ppm and 30ppm and the sensor response was observed at 4%, 8% and 15% respectively showing almost a linear behaviour with increasing gas (NH₃) concentrations. In our study, different sensor characteristics such as sensor response, repeatability, selectivity, and long-term stability have been investigated and it has been observed that SWCNTs based gas sensor has shown excellent performances towards these characteristics.

AGRICULTURE WASTEWATER: POTENTIAL SUSTAINABLE SOLUTIONS**SUZYLAWATI ISMAIL***School of Chemical Engineering Universiti Sains Malaysia Engineering Campus, 14300, Nibong Tebal, Penang, Malaysia*

Oil palm production plays a significant role in Malaysia economic growth. Malaysia currently accounts for 29% of world palm oil production and 37% of world exports. Besides the overwhelming growth of this industry, a substantial generation of waste is also generated. The discharge of partially treated or untreated agriculture wastewater into water bodies creates severe environmental pollution. High organic compounds in the wastewater easily decompose and deplete the dissolved oxygen in water, results in threatening the aquatic life and also affecting human activities. The current study focussing on few potential solutions applying sustainable membrane technology. The integrated approach for Palm Oil Mill Effluent (POME) treatment combining the pretreatment and membrane processes was tested on a pilot plant scale. The overall performance of integrated treatment system gave 100% reduction in suspended solids and oil & grease content, 99.5% reduction in COD and 99.6% reduction in BOD. The 81.2% of water present in POME was successfully recovered as high-quality water through this system. The sludge generated from the coagulation-flocculation process could be further treated into fertilizer. This integrated treatment system could be an attractive alternative for conventional POME treatment as it promotes an environmental friendly treatment with zero discharge concepts. Membrane distillation system was also being thoroughly studied and producing promising results for the mass production application.

Keywords: Palm oil mill effluent, integrated membrane treatment system, membrane distillation

PAINTOSORP™ AS AN ADSORBENT AND ITS REGENERATION**MOMINA^{A*}, SUZYLAWATI ISMAIL^{A*}***^aSchool of Chemical Engineering, Universiti Sains Malaysia, Engineering Campus, 14300, Nibong Tebal, Pulau Pinang, Malaysia*

Adsorption considered to be one of the effective methods for the removal of pollutant such as dyes from wastewater. However, the adsorbent cost is one of the disadvantages of this process. For this purpose, low cost adsorbents have been used such as clay-based adsorbents. But, the disposal of these spent adsorbents can lead to the leaching of adsorbate into the environment. Therefore, regeneration of adsorbents is also a matter of concern which can reduce the problem of generated waste and decrease the overall cost of treatment. Clay-based adsorbent coating named as *Paintosorp™* is newly formulated adsorbent and effectively remove Methylene blue with an adsorption efficiency of 99%. In this study regeneration of *Paintosorp™* has been performed using different solvents and to know their role for desorption of methylene blue dye from adsorbent.

Keywords: Adsorption, clay adsorbent, regeneration, solvent, *Paintosorp™*, Methylene blue

IMPACT ASSESSMENT OF FARMERS FAIR AT UNIVERSITY LEVEL**A.K. PASWAN***Department of Extension Education, TCA, Dholi, Muzaffarpur, Bihar, Dr. Rajendra Prasad CAU, Pusa, Samastipur, Bihar*

Kisan Mela is an important mass contact method in extension teaching. It is an organized educational activity for involving and educating farmers by bringing together the farmers, scientists, extension workers, input agencies, developmental departments and non-governmental agencies on agriculture or allied aspects at a Research Station or an agriculturally important educational centre, where the farmers can see, interact and gain first hand knowledge about the latest technologies and developments in agriculture and allied aspects. It integrates several educational activities specifically directed to the farmers of a region, state or country. At present there has been increasing demand for organising such Kisan Mela at different levels. Hence, it is appropriate to study the impact assessment of Farmers fair at university level. Keeping in view of the above fact, a study was conducted at Rajendra Agricultural University, Bihar where Kisan Mela was organized from 5-7th March, 2016 (three days) with involvement of 120 randomly selected participating farmers. The findings indicated that maximum numbers of participants were middle age group, had matriculation level of education, belong to OBC category, untrained with small land holding and agriculture and subsidiary was major occupation. Good majority of participating farmers perceived that information received at Kisan Mela on Agricultural implements & machine, IFS, Dairy & AH, Mushroom Cultivation and Medicinal & Herbal planting were more useful. It was also observed that more than fifty percent of the respondents expressed their opinion suggestions by experts, Kisan Gosthi and horticultural exhibition were very good. Most of them opinion on sale of inputs, transport arrangement and food facilities in farmers fair were average.

REMOVAL OF METAL IONS AND DETOXIFICATION OF RECALCITRANT ORGANIC DYES BY HYDROGELS**AABID H.SHALLA^{1*}, MUSHTAQ A.BHAT¹**¹ *Islamic University of Science and Technology, Awantipora, India, J&K, 192122*

The adulteration of water by dyes and heavy metal ions is a very critical environmental issue and as such vast amount of efforts are invested to prioritise the synthesis of the unique and efficient adsorbent systems with high sorption capacity and at the similar time achieving a major goal to lessen their non-biodegradable and toxic nature. Removal process and detoxification of recalcitrant organic dyes and Heavy metal ions has been done in many ways; however adsorption methods are usually appropriate due to their ease of operation and economical value. Various adsorption techniques as such have been taken into consideration like sawdust and additional wood variety materials, husk obtained from rice, waste products from petroleum, waste products obtained from fertilizers, fly residue, sugar manufacturing industrial wastes, Chitin hydrolysis products and seafood processing wastes, various types of clays and zeolite compounds etc. however; hydrogels with high sorption capacity, high functionality, hydrophilicity, regeneration and nontoxicity have made them a good contender for the removal of various aquatic pollutants including heavy metal ions. Moreover, certain modifications in synthesis of hydrogels, to customize them in response to different stimuli like temperature, pH and ionic strength; has added an advantage in waste water treatment. The present review provides recent progress in the synthesis of the hydrogels for waste water treatment and insight into increase in selectivity, efficiency and reusability of hydrogels.

Key words: hydrogels, synthesis, application, dye, heavy metal ions

CHEMICAL MODELS OF CYTOCHROME P450 IN DRUG METABOLISM**ABHA AWASTHI***Department of Chemistry, Meerut College Meerut India – 250001*

Most of the drugs are metabolised by cytochrome P450 in the liver of human and other animals. Primary metabolites of drugs contribute to the efficacy, side effects and toxicity of parent drugs. Drug metabolisms have been studied by using purified enzymes. Since isolation and purification of membrane bound cytochrome P450 in large amounts for metabolic studies are laborious and costly processes, therefore the chemical models of cytochrome P450 have been developed and applied in the oxidative metabolism of selected compounds in different reaction conditions.

INTRODUCTION OF BROCCOLI CROP IN RAINFED CONDITION UNDER NICRA VILLAGES OF BUNDELKHAND REGION**ABHIJEET SRIVASTAVA, ADESH KUMAR AND NISHI ROY***Krishi Vigyan Kendra, Bharari, Jhansi-284003*

Broccoli (*Brassica oleracea* L.var. *italica*) is more resembling with cauliflower and it is vitamin rich winter vegetable. This is the most widely famous grown vegetable in the temperate and sub-tropical zones. Broccoli comes in the Brassica group and the head comprising unopened green flower bud clusters along with part of fleshy stem. Broccoli is environmentally better adapted and can tolerate comparatively high temperature than cauliflower. It is fairly rich in carotene and ascorbic acid and contains appreciate quantities of thiamin, riboflavin, and iron. In this study in NICRA villages (Gandhinagar and Birgua comes under in Block- Badagaon, Jhansi) broccoli nursery was grown in nursery in the last week of October at Krishi Vigyan Kendra, Jhansi and seedlings was distributed to 16 farmers in the first week of December in Rabi 2017 which has less land holding, to generate high income from the produced. The plants are planted at a spacing of (50X30) cm at farmers field and K.V.K, Jhansi also. It was observed that Broccoli performed well in Rainfed condition of bundelkhand region and having no problems of any type of disease, insect-pest or physiological disorders also there is a strong consumer demand in the market but the production was low as compare to other climatic regions. The average yield of farmers field was about 20.5 qt/ha.

Keywords: Broccoli, Regions, NICRA and Crop.

FLORISTIC COMPOSITION CHANGE REPORTED AS A RESULT OF GRAZING AT SELECTED SITE (GRAZED SITE-YOUSHMARAG) IN KASHMIR VALLEY, INDIA**AFSHAN ANJUM BABA*, NASEEM ZAFAR GEELANI*, MOIEZA JANWARI*, BASIRA MEHRAJ* AND ISHRAT SALEEM*****Faculty of Forestry, Skuast-Kashmir-190025*

In the Indian Himalaya, the grasslands occupy about 35% of the geographical area. The different types of the Himalayan grasslands include the warm temperate grasslands, cold temperate and subalpine grasslands, alpine meadows, the steppes of cold-arid regions, and the alpine scrub. Although, they differ from one another in terms of origin, structure and composition; nevertheless they all support a large number of wild herbivores, domestic livestock, and agro-pastoral activities. Kashmir Valley has vast land area (16%) under grasslands which play an important role in providing economic goods and ecosystem services to the society. Livestock, particularly the migratory flocks, are entirely dependent on these grasslands. Apart from sustaining this pivotal economic activity, grasslands harbor a rich and endemic biodiversity, and regulate the regional carbon, nutrient and hydrological cycles. The data pertaining to Grazed site (Yousmarag) revealed the presence of twenty four herb species in spring season, the highest density was shown by *Cynodon dactylon* (415800 ha⁻¹), maximum frequency (100%) was observed by *Achillea mill folium* and highest abundance was reported in *Cynodon dactylon* (554200 ha⁻¹). It is evident from the data that out of the twenty four herbaceous species a total of nineteen were recorded in summer season, the highest density was shown by *Cynodon dactylon* (554200 ha⁻¹), the maximum frequency (100%) was observed in *Cynodon dactylon* while maximum abundance was reported in *Cynodon dactylon* (554200 ha⁻¹). A total of nineteen herbs species were found in autumn season amongst the twenty four species reported at this site. Maximum density was recorded in *Cynodon dactylon* (284100 ha⁻¹), maximum frequency (100%) were recorded in *Cynodon dactylon*, while highest abundance was reported in *Cynodon dactylon* (284100 ha⁻¹). In all three seasons, it was observed that *Cynodon dactylon* had maximum importance value index (IVI). IVI for *Cynodon dactylon* was maximum in autumn (64.20 ha⁻¹) season followed by summer (58.42 ha⁻¹) and minimum was in spring (39.39 ha⁻¹).

Keywords: grasslands, grazing, density, frequency and importance value index (IVI).**WHEAT YIELD FORECASTING IN HARYANA: A TIME SERIES APPROACH****AJAY KUMAR¹, DEEPANKAR¹, P.K MUHAMMED JASLAM^{1*}, ANIL KUMAR²***¹Department of Mathematics and Statistics, College of Basic Sciences and Humanities, CCS Haryana Agricultural University, Hisar-125004, ²Department of Statistics, Central University of Haryana, Mahendergarh-123031*

India is an agrarian country in which Agriculture is the single most important contributor to the Indian economy because of its significance in food security, trade and industry. Wheat is the most important food grains of human in India. Wheat crop is India's prime most staple harvest, placed after Rice. It is mostly consumed in the north and north-west parts of the country. At the time of independence in 1947, production and productivity of wheat were quite low at 6.46 million tones and 663 kg/hectare respectively. At present, India is the second largest producer of wheat in world after China. The purpose of this study was to fit a model that forecast the yield of wheat in Haryana by using annual time series data from 1980-81 to 2009-10. Random walk, random walk with drift, linear trend, moving average, simple exponential smoothing and ARIMA models were employed and compared for finding out a best model to forecast the yield of wheat in Haryana. A software Statgraphics is used to forecast the time series data. The best fitted model was selected based on performance in goodness of fit criterion; Akaike Information Criterion (AIC). This study found that on the basis of AIC, ARIMA(0,2,2) be the best model to forecast wheat yield in Haryana. The forecast value of yield was obtained as 4620.91 kg/hectare in 2017, 4669.28 kg/hectare in 2018, 4717.64 kg/hectare in 2019, 4766 kg/hectare in 2020, 4814.37 kg/hectare in 2021 and 4862 kg/hectare in 2022.

Keywords: ARIMA; Time Series Models; Forecast; Wheat yield; Exponential smoothing.**RESOURCE USE EFFICIENCY OF CHICKPEA PRODUCTION IN HAMIRPUR DISTRICT OF UTTAR PRADESH****AJAY SINGH* SHRADDHA SINGH ** A P SINGH YADAV ******Department of Agricultural Economics* Department of Crop Physiology** Department of Agricultural Economics *** Narendra Deva University of Agriculture & Technology, Kumarganj Faizabad (U.P) 224229.*

Chick Pea is one of the major pulses cultivated and consumed in India. It is a major and cheap source of protein. In the country, chickpea accounts for about 45 per cent of total pulses produced. It makes up more than 20 per cent of world pulse production. Chickpea is most important pulse crop of India in terms of both area and production. The study of resource productivity; resource use efficiency and optimum resources used with respect to various explanatory variables in chickpea was undertaken on small medium farm during agricultural year 2017-18 Hamirpur district of Uttar Pradesh. The data was

taken from cost of cultivation primary and secondary data collection the sample of 100 small medium farm size farmers throughout the district was tabulated and analyzed by appropriate statistical tools. The results revealed that partial regression co-efficient of human labour was 0.553 followed by that area under chickpea was (0.579) positive at 1 per cent level and partial regression co-efficient of nitrogen and machine labour were positive but non-significant. Marginal product of area under chickpea was 3.242 quintals followed by that of bullock labour (0.132 q), plant protection (0.197q) and human labour (0.231). MVP to price ratio with respect to potash was 9.87 followed by seed (7.37), human labour (2.90) and area under chickpea (2.31). Optimum use of area under chickpea was found to be 1.24 hectare and optimum use of human labour was 52.29 man days.

Keywords: Chickpea, Resource productivity, Resource use efficiency, optimum resources

AN INNOVATIVE APPROACH FOR ECO-FRIENDLY BEEKEEPING IN UTTARAKHAND, INDIA

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The utilization of cow urine for disease pest management has been utilized and appraised in vedic and holy text books since ages. Cow urine and its plant based decoctions have been successfully utilized for disease and pest management in beekeeping. The cow urine applied @ 50-100% in bee colonies gave cent per- cent recovery against bacterial disease, European foul brood of honey bee in 3-4 weeks interval, with comparable results in chemical (Terramycin) treated bee colonies. There was significant reduction in brood mite infestation (72.10%) in cow urine @ (100%), while followed by neem leaf powder @ 5g/hive (71.35%), jatropha leaf powder @ 5g/hive (69.47%) and (51.11%) in case of thymol @ 500mg/hive treated bee colonies. The utilization of smoke generated from cow dung cake gave 100% results in off season management of empty bee frames from notorious pest *Galleria mellonella* (Linn.) in semi air tight and air tight units. The application of cow urine and its plant based formulation also did not have any adverse impact on the growth parameters and foraging behavior of *Apis mellifera*. The mustard crop treated with desi cow urine @ 20% showed maximum foraging rate of (24 flower/bee/min), while the maximum foraging speed was observed in Holstein cow urine @ 20% as (5 sec/bee/flower). Thus the study conducted in Pantnagar suggested a novel thought of utilization of cow urine and its based formulation to manage the diseases and pest in bee keeping without utilization of toxic chemicals.

Keywords: cow urine, *Apis mellifera*, foraging, neem, European foulbrood, *Galleria mellonella*

INNOVATIVE APPROACHES IN APPLIES SCIENCES AND SOCIO-ECONOMIC DEVELOPMENT GOVT. POLICIES AND PLANNING FOR SUSTAINABLE AGRICULTURE AND ALLIED SECTORS

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For global agriculture systems to produce enough food to sustainably feed nine or ten billion people by 2050, there is a need to shift in consumer and producer behavior and a structural change toward more refined technologies, information and knowledge management systems and policies that promote market-led incentives for growth of farmers. Programs and policies should encourage Agri-business development and public-private partnerships, and much importance should be given other than agriculture like bee keeping, fish rearing, apiculture and other allied activities so that farming and agribusinesses can provide more economic development opportunities for rural communities. Integrating agriculture with other sectors such as bee keeping, fish rearing, apiculture and sericulture will bring greater impact. Policy and institutional reforms are necessary to align the incentives of producers and consumers toward greater sustainability. Transparency, monitoring and evaluation, and continuous adaptation to changing contexts are key point for sustainability. Regulation is an important part of good governance, but it should be focused on specific areas such as protecting the farmers from distress sale, ensuring food safety, or protecting vulnerable natural resources like forests, water, and fish stocks and encourage the farmers to involve in integrated farming system.

Keywords: Govt. policies, Sustainability and Agriculture and Allied sector

DEVELOPMENT OF VERSATILE SOLAR POWERED PNEUMATIC SEED CLEANING MACHINE

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Vegetables are important constituents of Indian agriculture due to their short duration, high yield, nutritional richness, economic viability and ability to generate on-farm and off-farm employment. The vegetable production system is linked with quality seed use. Clean seeds have better germination ability and better storability. In general, vegetable seed growers are

small and marginal farmers, thus small capacity cleaning machines are required. Vegetable seeds generally contain lighter impurities which are of the same size as seed. Pneumatic cleaning is most suitable to clean vegetable seeds because of simple construction and have less moving parts. India is having around 300 clear sunny days in a year which can be a better alternative of energy conservation for small and marginal farmers. Thus a solar-powered pneumatic seed cleaning machine was developed for which the engineering properties of selected seeds (bottle gourd, sponge gourd, garden pea, and radish) were determined. Results depicted an increasing trend in size, angle of repose, coefficient of friction and terminal velocity with an increase in moisture content but bulk density and true density showed a decreasing trend with moisture content. Terminal velocity of 10.13 m/s was found to be highest for garden pea seeds and it was selected for designing air velocity of the machine. The optimized results of blower design were 4 numbers of blades with 70° tilt angle for maximum air velocity with minimum power consumption. Performance of machine was evaluated and it was found that the cleaning efficiency of the machine was more than 90% for all seeds. Physical purity was determined experimentally before and after cleaning and it was observed that all seeds have more than 99% physical purity.

Keywords: Nutritional, Vegetable seeds, Terminal velocity, Pneumatic, solar-powered

IMPACT OF GOVERNMENT POLICIES OF SUSTAINABLE AGRICULTURE AND ALLIED SECTORS ON FARMING PRACTICES OF FARMERS

ALKA NIGAM*, PRATIMA TIWARI*, PRATIMA SACHAN*, ROHIT MAURYA**

** CSAUAT Kanpur, ** NDUAT Faizabad*

The policies of sustainable agriculture and allied sector continue to be pivotal to the sustainable growth and development of the Indian economy. Not only does it meet the food and nutritional requirements of 1.3 billion Indians, it contributes significantly to production, employment and demand generation through various backward and forward linkages. Moreover, the role of the agricultural sector in alleviating poverty and in ensuring the sustainable development of the economy is well established. The sector is, however, currently facing a dilemma. While it has made large strides in achieving the agricultural development goals of food security, availability and accessibility, it is still being challenged by a formidable agrarian crisis. This situation has recently led to fresh thinking on the developmental approach in the agriculture sector. The need for focusing on the welfare and prosperity of farmers has gained prominence. Consequently, the Department of Agriculture and Cooperation was renamed, by the Hon'ble PM on Independence Day 2015, as the Department of Agriculture, Cooperation and Farmers Welfare. In this fresh approach, priority is to be accorded to making the agriculture and allied sector not only ecologically sustainable in its use of natural resources of soil, water and forests, but also socio-economically sustainable to farmers in terms of prosperity, welfare and social security. Innovating managerial solutions to maximize farmers' welfare rather than relying solely on modern farming to raise productivity and production is the clarion call of the day.

Keywords: agriculture, allied sectors, farmers, welfare

USE OF ICTS ACTS AS A BOON FOR RURAL WOMEN IN SMALL SCALE FISH FARMING PRACTICE

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Fishery is an important aspect in India providing financial support to a large number of households and hence this reflects on economic growth of the country. As per the Handbook of Fishery statistics, Government of India, this country is the second largest producer of fish contributing 5.68% of global total during 2013-14. Small-scale fish farming practices can be adopted as a useful technique to provide high quality animal protein and other nutrients for nutritionally vulnerable groups especially for Rural women. This farming system offers increasing food production and net farm income and also improves nutritional status, promotes natural resource, providing sustainable use of resources and improving the socio economic status of Rural women. In addition to that ICTs tools play an effective role in small scale fish farming among Rural women. ICTs are sets of technologies that facilitate the capturing, storage, processing, and disseminating information by electronic means. Small scale Fish farmers for Rural women can apply ICTs to increase fish farm productivity by providing farmers with access to information which enables them in matching fish farming practices to climatic trends, use inputs and resources optimally, and ensure good fish farming practices through improved fish breeds, disease control, market access, and pond management. Success in any fish farming enterprise is largely determined by the amount of information related to fish pond management practices provided and used by Rural women in small scale fish farming practices.

Keywords: Small scale, fish and ICT.

STUDY OF THERMAL PROPERTIES OF WOOD POLYMER COMPOSITE**AMEY KALE*, RAGHU. N. GOWDA¹, ANAND¹***Institute of Wood Science and Technology, Bengaluru, *Rani Lakshmi Bai Central Agricultural University, Jhansi, U.P.*

Thermal stability of the rubber wood polypropylene composites was studied using a TA Instruments make (Q50) Thermogravimetric analyzer (TGA). To study the thermal stability, thermo gravimetric analysis of composites was done. About 10 mg of the composite granule was used for the study. Granules were heated from room temperature to 600°C at a heating rate of 10°C/min in the nitrogen atmosphere. To investigate the effect of fiber loading on thermal stability of wood polymer composite (WPC), composites blended with different fiber loading percentage (10%, 20%, 30%, 40%, 50%). TGA of wood powder and polypropylene (PP) was also taken for comparison. Weight loss data (%) was plotted against temperature. Composite degradation curves corresponding to temperature showed two different slopes; one for the matrix and other for wood. Thermal stability of the WPC was found to be decreasing with increasing wood content. In all TGA curves first decomposition curve appeared due to wood degradation and second for the PP matrix. Cellulose, hemicelluloses and lignin, the primary constituents of wood fiber degraded within the temperature range of 280- 350°C, which is evident in TGA curves, whereas, polypropylene is observed to be degraded beyond 380°C.

Key Words: TGA, WPC, thermal studies, polypropylene

ASSESSMENT OF THE PROBLEMS FACED BY THE BENEFICIARIES OF MHWDP AND THEIR PERCEPTIONS TOWARDS DEGRADATION OF NATURAL RESOURCES**AMIT GULERIA¹, AK RANDEV², KAPIL DEV¹ AND PARDEEP SINGH¹***Department of Social Sciences, Dr. YS Parmar University of Horticulture and Forestry, Nauni Solan Himachal Pradesh*

The present study has been carried out in the purposively selected Solan, Sirmour and Mandi districts of the state by selecting randomly a sample of 270 respondents comprising of 180 beneficiaries and 90 non-beneficiaries, in terms of 2:1 ratio for the comparison of both the categories of respondents. The problems related to resource utilization on beneficiary farms within the preview of project interventions have been highlighted on the basis of responses of beneficiaries and ranked using Garrett's ranking technique. The results shows that the most significant production problem has been found to be stray/ wild animal menace (72.38 %) followed by lack of knowledge about seed treatment (63.27 %). Although, different project interventions have been done in irrigation but lack of irrigation facility has been perceived as production problem by 27.91 per cent of beneficiary farms. The range of production, marketing and financial problems has been found within about 25 to 77 per cent, in case solved within budgetary constraints of the input supplying agencies may lead to enhanced inputs'/ resources' use efficiency on agricultural farms in the study area that can be further lead to overall social welfare therefore enhanced crops'/livestock production levels. In mid hills of Himachal Pradesh, 17.94 per cent of beneficiary farms have been found with the view of decrease in the cultivated land, river, stream and local water bodies; and around 19 per cent of the respondents has perceived decrease in the amount of drinking water. More irrigation has been found to be main mitigation option, i.e., 71.11 per cent, followed by construction of water harvesting structures (70.56 %) and change in crop variety (68.33%). Changing climate situations have brought forth new problems and led to mitigation options like shifting to new crops and their varieties, changing sowing planting dates and constructions of water harvesting structures.

Keywords: Watershed, problems, Garrett's ranking, and natural degradation

ECONOMIC ANALYSIS OF CAULIFLOWER CULTIVATION IN INDIA**AMIT KUMAR¹ AND M.P.GAUTAM² AND AJAY YADAV¹, MANOJ KUMAR¹***¹Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) India**²Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) India*

Cauliflower (*Brassica oleracea* L.) is a very popular vegetable belonging to cole group of vegetable. It grows in almost all the states of India but plenty of cauliflower is produced in the region of, Union Territory of Delhi, West Bengal, Haryana, Tripura, Orissa, Punjab, Manipur, etc. Cauliflower is grown on many different types of soil, but does best in a rich, well drained soil with a high moisture-holding capacity. High humus content in the soil will provide better aeration and water penetration. If a soil is low in organic matter, stable or green manures can be supplied. Cauliflower is an excellent source of vitamin C, vitamin K, folate, pantothenic acid, and vitamin B6. It is a very good source of choline, dietary fiber, and omega-3 fatty acids. It is also good source of minerals such as manganese, copper, iron, calcium and potassium. As the Indian population is increasing, the demand for fresh vegetables is also increasing. India is the world's largest producer of many vegetables but still there is a huge gap between per capita demand and supply. Vegetables compared to other food items provide low cost nutrition source. It can be produced even small amount of land and also in homestead area. It can be grown within a short time period and more than one crop can be grown within a crop season. There are a large number of vegetables

having different varieties, which can be grown throughout the year. Most of the farmers did not follow the recommended doses of input use except human labour, tillage, fertilizer and manure. In addition to that farmers need good quality seed to grow better vegetables. Go and NGO can take care of it. Finally, government should come forward to address the problems and constraints of the vegetables farmers and try to solve those in time.

Keywords: economic analysis, cauliflower, India

PLANT DEFENCE MECHANISM

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Adjustment is probably, one of the most important virtue of a system that ensures its survival, be it host or parasite. On planet earth, the green plants (autotrophs) constitute the only biological system capable of converting solar energy (electro-magnetic radiations) into chemical energy. Plants as a biological system resist this exploitation, at all levels and by all means. The co evolution, forced by co-existence with pathogen, has led to development of defence mechanism in plants. Thus, resistance against any 'deleterious act' has become a natural and universal response of plant system. The resistance against parasites/pathogen is the heritable trait of plants by virtue of which they resist attack by parasites/pathogens or their activities. The defence mechanism(s) has ensured the survival of plants in spite of living amongst some of the potentially devastating pathogens in addition to abiotic stresses. Plants have also developed ability to resist/tolerate various abiotic stresses. Plants represent a rich source of nutrients for many organisms including bacteria, fungi, protists, insects, and vertebrates. Although lacking an immune system comparable to animals, plants have developed a stunning array of structural, chemical, and protein-based defenses designed to detect invading organisms and stop them before they are able to cause extensive damage. Humans depend almost exclusively on plants for food, and plants provide many important non-food products including wood, dyes, textiles, medicines, cosmetics, soaps, rubber, plastics, inks, and industrial chemicals. Understanding how plants defend themselves from pathogens and herbivores is essential in order to protect our food supply and develop highly disease-resistant plant species.

EMPOWERING FARMERS' COMMUNITY THROUGH DIGITAL MEDIA IN INDIA

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The paper focused on empowering farmers' community through digital media to achieve India. The Indian agricultural system is a beacon of hope in present scenario. Traditionally, farmers are mostly depending upon fellow farmers as the preferred source of information in India. As per study 67% Indian population is directly or indirectly dependent on agriculture. Extension is dynamic activities in agriculture sector for transfer of agricultural research and technology among Indian farmers. Also, worked as disseminating information to the farmers enabling them to decide certain steps for their agricultural issues. For empowering farmer Government has initiated some flagship programme i.e. digital India with a vision to transform India into a digitally empowered society. There is an urgent need to do efforts to utilise the already developed agriculture extension infrastructure for urban farmers also through digital media. The use of latest digital media in agriculture extension will be beneficial for both urban and rural farmers of India. Main consideration of national extension system of India is to imparting advice, information and knowledge, and transfer technology to the rural farmers using KVK and ICT. Agriculture extension need to be more emphasised through digital media to easy and cost effective access of information. So that present agriculture extension system will be utilized for farmers in spite of enhancing socio-economic condition of Indian farmer community by providing agriculture extension information services.

TRANSFORMATION OF PEA WASTE (BY PRODUCTS) INTO VALUE ADDED PRODUCTS

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Pea is the second most consumed and important food legume in the world. In the present study, efforts have been directed to possible utilization of the pea shells, not only from the point of preservation and waste management, but as a profitable adjunct to the food processing industry. Therefore in the present investigation an attempt was made to utilize these nutrients rich pea shells by incorporating them products were evaluated organoleptically for sensory characters. The study revealed that the pea shells are a good source of crude protein, crude fiber, dietary fiber, calcium, iron, potassium, magnesium and bioactive compounds. In this connection, fibrous coat of shells separated and shells will be cut into small pieces and kept in hot air oven for drying at 40-50⁰ C and make ground to fine powder. In this research five products are prepared at different levels of supplementation to possible utilization of pea shells powder. In current study the cake were devised by substituting shells powder in place of refined wheat flour at 10% and 20% levels. The sweet biscuits, sweet and salty biscuits were

devised by substituting pea shells powder in place of refined wheat flour at 5%, 10% and 15% levels. The *macroni* and noodles were devised by substituting pea shells powder in place of refined wheat flour at 10%, 20% and 30% levels. All the product result of sensory score is 7-8 point using 9 Hedonic Scale. The result indicates that the mean scores are higher in those product which are supplemented with pea shells powder, compare to Control. The products are advantageous for people suffering from lifestyle diseases as these contain high amount of fiber and minerals. Value addition is important in meeting food requirements of growing population by eliminating avoidable losses and making food items more nutritive by processing and fortification of low-grade raw commodities. This study highlights the scope for value addition with pea shells powder. Incorporation of pea shells for value addition in bakery, confectionery and extruded products can be encouraged and popularized in order to improve the intake of protein, dietary fiber and minerals. In this way peels can also be utilized for human consumption otherwise this important source of nutrients goes wasted.

Keywords: Organoleptic, Pea shells, Sensory, Substituting, Supplementation, Value addition

SYNTHESIS OF NEWER QUINAZOLINONE DERIVATIVES AS POTENTIAL ANTICONVULSANT AGENTS

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A series of 3-([5-(alkylbenzylideneamino)-1,3,4-thiadiazol-2-yl]methylamino)-2-methyl-6-monosubstitutedquinazolin-4(3H)-one (4a-4l) have been synthesized via condensation of 3-[(5-amino-1,3,4-thiadiazol-2-yl)methylamino]-2-methyl-6-monosubstitutedquinazolin-4(3H)-one (3a-3b) with various aromatic aldehydes. Cycloaddition of thioglycolic acid with (4a-4l) yielded 3-([4-[2-(alkylphenyl)-4-oxo-1,3-thiazolidin-3-yl]-1,3,4-thiadiazol-2-yl]-methylamino)-2-methyl-6-monosubstituted quinazolin-4(3H)-one (5a-5l). The compounds were screened for their anticonvulsant activity and were compared with the standard drugs, phenytoin sodium, lamotrigine and sodium valproate. Out of the 30 compounds the most active compound was 3-([4-[2(m-methoxy-p-hydroxyphenyl)-4-oxo-1,3-thiazolidin-3-yl]-1,3,4-thiadiazol-2-yl]methylamino)-2-methyl-6-bromoquinazolin-4(3H)-one (5l).

GREEN SYNTHESIS OF ZINC OXIDE NANOPARTICLE AND THEIR ANTIBACTERIAL PROPERTIES

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The reliable, non-toxic, clean, eco-friendly method is involves in the nanotechnology for the synthesis of nanoparticles so called green synthesis of nanoparticles. In this method wide numbers of bacteria are use for the synthesis of nanoparticles to reduce the uses of toxic chemicals and extreme environment conditions involve in chemical and physical method respectively. The different sizes of nanoparticles (1-100nm) show various bioactivities that are characterize by transmission electron microscopy, UV-VIS spectroscopy etc. Zinc oxide (ZnO) had been recent in research because it has wide range of biomedical application. The antibacterial property of zinc oxide against the diarrhea disease caused by *Escherichia coli* is one of them.

Keywords: Green synthesis, nanoparticles, transmission electron microscopy, UV-VIS spectroscope, antibacterial properties.

COST AND RETURN ANALYSIS OF MENTHA OIL PRODUCTION IN SITAPUR DISTRICT OF UTTAR PRADESH

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Growing mint considered as a bonus cash crops as it does not disturb or replace the cultivation of any major winter and rainy season crop. Being a labour intensive crop, cultivation, distillation, processing and marketing of mint provide ample employment opportunities in rural areas. Sakran and Biswan block of Sitapur District having highest area in mentha cultivation was selected from 19 blocks of sitapur district. A list of 100 farmers were selected randomly from villages namely Sakran, Kutbapur, Kuttupur Nipania, Nipania Maphe based on acreage under menthe cultivation 925 from each village). The farmers were categorized in marginal, small, medium and large category for analysis and interpretation of results. The major component on which cost was incurred being machinery charges 12.58 percent and Manure & fertilizer 18.02 percent. The input output ratios reveals that one rupee invested earn rupee 2.27 to 7.44 for marginal and large farmers respectively. The economic benefit gets reduced over different cost concepts over all the size group of farmers. Benefits over cost C3 the profit got reduced to 41.85, 38.37, 40.08, and 36.15 percent for marginal, small, medium, large farmers respectively.

Keywords: Cost And Return Analysis, Mentha Oil

EFFECTIVENESS AND OPINION OF AGRI-EXTENSION PERSONNEL ABOUT IT AS AN EXTENSION ADVISORY TOOL: A CASE STUDY

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E-extension as a modern method of communication can be used to enhance the effectiveness and efficiency of extension services for agricultural sustainability. E-extension is the delivery of extension services using the internet and the latest information communication technologies (ICTs), which allow networking, online sharing, and collaboration. Agri-Extension personnel are a major factor in conducting an effective agricultural extension work plan; therefore, understanding extension personnel opinion towards the use of E-extension is important. So, the present investigation was conducted in CCS Haryana Agricultural University, Hisar. A total of 108 respondents (23 from main campus and 85 from outstation) were included in the sample of study. Primary data was collected using a self administered questionnaire and analyzed with the help of SPSS using descriptive statistics (Percentage, mean, rank order, standard deviation etc.). The results of the study revealed that internet has enhanced the practice of extension and personal contact adjudged as a most effective extension tool with a mean score of 4.19.

Keywords: E-extension, Agri-Extension personnel, Opinion, Internet, Effectiveness.

ROLE OF MEDIA IN INDIAN EDUCATION SYSTEM

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Education is the process of learning and knowing, which is not restricted to our school text-books. It is a holistic process and continues through our life. Even the regular happenings and events around us educate us, in one or the other way. It would not be an exaggeration to say that the existence of human beings is fruitless without education. An educated person has the ability to change the world, as he/she is brimming with confidence and assured of making the right moves. It Makes Better Citizens, Ensures A Productive Future, Opens New Vistas, Spreads Awareness, Helps In Decision-Making, Bolsters Confidence. The term media is derived from Medium, which means carrier or mode. Media denotes an item specifically designed to reach a large audience or viewers. The term was first used with the advent of newspapers and magazines. However, with the passage of time, the term broadened by the inventions of radio, TV, cinemas and Internet. In the world of today, media has become almost as necessary as food and clothing. It is true that media is playing an outstanding role in strengthening the society. Its duty is to inform, educate and entertain the people. It helps us to know current situation around the world. The media has a strong social and cultural impact upon society. Because of its inherent ability to reach large number of public, it is widely used to convey message to build public opinion and awareness. The role of media in education is evident today by the number of computer labs, television sets and libraries that have become part of curriculum in most schools today. Media comes in different forms and each form affects the way students learn and interpret information. Media has brought the world closer (globalization) so that now students from different universities in different parts of the world are connected through a mere internet connection. Amidst the information revolution mass media has become such a massive part of our lives.

Keywords: Education, Mass media

STUDY OF THE EFFECT OF DIFFERENT WEATHER VARIABLES ON DIFFERENT STAGES AND FINAL SEED YIELD OF SOYBEAN CROP IN THE AKOLA REGION OF VIDARBHA, INDIA

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Soybean crop is grown predominantly under rainfed conditions in Vidarbha region where weather parameters play an important role at different phenophase of the crop influencing the growth, development and final yield performance. So in order to identify such parameters and quantify their contribution, a field investigation was carried out during *kharif* season of 2014 at the All India Coordinated Research Project on Agro meteorology under Dry land Agriculture Research Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Four sowing times (27 MW-July 07, 28 MW-July 14, 29 MW- July 21 and 30 MW-28 July) to create different set of environmental conditions for weather variability and three varieties (JS-335, JS-9305 and TAMS 98-21) were laid out in Factorial Randomized Block Design with four replications and 12

treatments. Correlation coefficients of soybean yield with different weather parameters prevailed during different phenological stages of the crop were worked out. Weather parameters influencing the soybean yield were identified to develop yield prediction equation through regression technique. The correlation and regression study revealed that rainfall during pod formation to full seed development showed highly significant positive impact on soybean seed yield. Higher day time temperature (T max) during pod formation to seed development was found to have negative impact on soybean yield. The data across the total crop growing period showed that rainfall, humidity (RH-I), GDD and PTU showed significant positive association with seed yield of soybean. Thus the results of this study revealed that pod formation to full seed development stage is the most sensitive stage and rainfall and higher day time temperature (T max) are the most significant weather variables for soybean seed yield under rainfed condition in Vidarbha region.

NUTRITIONAL VALUES OF MUSHROOMS

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Mushrooms can be defined as “a macro-fungus with distinctive fruiting bodies. The mushroom fruiting body may be umbrella like or of various other shapes. Mushroom is a saprophytic fungus that grows on dead and decaying organic matter. Due to the absence of chlorophyll, it is unable to synthesize its own food and hence is dependent upon the organic substrate for food. Today, the popularity of mushrooms is due not only to their culinary value but also to their potential as a source of protein that can enrich human diets especially in some developing countries where meat may be rare and expensive. Mushrooms contain more protein than either fruits or vegetables. They can be eaten, as they are cooked or raw, unlike other protein sources such as soya. Mushrooms are also low in cholesterol. Besides their protein content, mushrooms are also high in certain vitamins such as B, C, D, riboflavin, thiamine and 5 nicotinic acid. Mushrooms are also a good source of iron, potassium and phosphorus in addition to folic acid, an ingredient known for enriching the bloodstream and prevention deficiencies. The invention of the so called “wonder drug” penicillin was a landmark in the field of medicinal uses of fungi. Since then several fungi have been well recognized for their antifungal, antibacterial, antiviral, antitumour and many others such properties of pharmacological values. In the recent past a variety of medicinal preparations in form of tablets, capsules and extracts from mushrooms have been produced and marketed.

Keywords: Mushrooms, protein, fungus and nutritional value

DIELECTRIC SPECTROSCOPIC METHOD FOR FOOD QUALITY DETERMINATION

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Food materials have different biological properties which has been a criterion to define its quality. Dielectric properties of agricultural materials are finding interesting applications in industries and laboratories. Dielectric spectroscopy is a method which provides information about the dielectric responses of materials when kept in electromagnetic field. Dielectric spectroscopy is a simple, rapid and non-destructive technique to extract information from the sample. Dielectric constant, dielectric loss factor, loss tangent and alternate current conductivity are electrical responses which are of concern in heating, drying and storage of food materials. Dielectric constant is the ability of a material to store electrical energy; loss factor is related to various absorption mechanisms of energy dissipation; loss tangent is the ratio of dielectric loss factor and dielectric constant. These responses can be measured by sensing several parameters such as frequency of alternating electric field, moisture content, temperature, bulk density, structure and constituents of food materials. These properties are very important in evaluating the penetration depth of energy and characterizing physical properties of biomaterials which helps in grading of food commodity. Moisture content in food material is the key ingredient that affects the dielectric properties. Moisture content and dielectric constant has strong correlation thus gives an idea about change in water activity during storage. Detection of adulteration in food is one of the recent applications because bulk density, viscosity and constituents may change which form a base to detect change in dielectric properties. Dielectric spectroscopy has also been applied for frying oil quality degradation. Thus, detection of change in dielectric behaviour of food is a method of qualitative determination of food material by non-destructively.

Keywords: Dielectric constant, dielectric loss factor, Moisture content, Non-destructive

GOVERNMENT POLICIES AND PLANNING FOR SUSTAINABLE AGRICULTURE AND ALLIED SECTOR**ANJALI TOMAR¹, DR. SHIJAATT HUSSAIN BHAT², TWINKLE RACHEL GEORGE³ AND TSULTIM PALMO⁴***Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir*

Agriculture has been a way of life and continues to be an most important livelihood of the masses in India. The country is the second largest economy in Asia, as measured in terms of its GDP. The performance of agricultural sector has been quite impressive, making the country self-reliant in food. But agriculture sector still needs attention from government to form some policies and planning for its sustainable growth. The World Commission on Environment and Development, defined sustainable development as 'the development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Appropriate agricultural policy, food procurement and distribution policy are needed for sustainable agricultural development. The formulation and implementation of agricultural policies in India is very complex process, involving a number of ministries, departments and institutions at both the centre and the state levels. The Union Ministry of Agriculture, under the guidance of the Planning Commission, provides the broad guidelines for agricultural policies. The state governments, however, continue to retain the constitutional authority over the sector. After independence, India pursued a policy of food self-sufficiency in staple foods — rice and wheat. The policies were initially focused on the expansion of cultivated area, community development, and restructuring of rural credit institutions. In addition, pricing of inputs such as seeds, chemicals, electricity and irrigation water must be controlled by the government. Farm subsidies should be rationalized and better targeted to benefit the small and marginal farmers. These subsidies are justified as they benefit not only small producers but the society at large. Moreover, there is a need to follow multidimensional model of development especially for small farmers, which requires integration of agri-input, agri-production, agroprocessing and marketing segments of the value chain through public or cooperative sector.

Keywords: Agriculture, Sustainable, Policy, Government**EXTENSION AND ADVISORY SERVICES IN INDIA: CURRENT STATUS****ANJU JAT¹, POOJA NAIN² AND RATAN LAL SHARMA³**¹*Department of extension education, SKNAU, Jobner (Jaipur)*²*Department of soil science and agriculture chemistry, SKNAU, Jobner (Jaipur)*³*Department of Plant Pathology, SKNAU, Jobner (Jaipur)*

Extension now a days in Indian context, includes all those agencies in the public, private, NGO and community based initiatives that provide a range of agricultural advisory services and facilitate technology application, transfer and management. The situation assessment survey of farmers conducted during the 59th round of the National Sample Survey (NSSO, 2005) provided valuable insights into reach of extension services across India. The data collected from 51,770 households in 6638 villages showed that sixty percent of farmer households did not access any information on modern technology that year. For the farmers who accessed information, progressive farmers and the input dealers were the main source of information. Broadcast media was also used a great deal to obtain information, which included radio, television and newspapers. The public sector extension worker was a source of information for only 5.7 % of farmer households interviewed and the Krishi Vigyan Kendra (KVK) accounted as an extension source for only 0.7% of the sample farmers. Private and NGO extension services were accessed by only 0.6%. The farmer household assessment surveys conducted by the International Food Policy Research Institute (IFPRI) in 5 states during recent years have also shown the importance of input dealers as an important source of information. But the IFPRI studies revealed that a significant number of farmers are also accessing public sector extension, especially the staff of the Department of Agriculture. Other public-sector extension sources put together (that is the KVK, All-India Radio, university extension, and plant protection unit) were used 18% of the time. The remaining 75% of extension comes from the private sector". All these reveal the wide diversity in extension provision and the wide variation in the way farmers access various extension sources in different states.

E- NAM: MARKETING INITIATIVE TOWARDS FARMER'S PROSPERITY**ANJU YADAV¹, SHUBHI PATEL², VIKALP SHARMA¹**¹*Department of Agricultural Economics, Rajasthan Collage of Agriculture**Maharana Pratap University of Agriculture and Technology, Udaipur (P.C 313001)*²*Department of Agricultural Economics, Institute of Agricultural Sciences Banaras Hindu University, Varanasi*

A perfect competitive market is considered to be best in terms of efficiency. Agriculture marketing though has a large number of sellers but the number of buyers is not large in its comparison. Agriculture marketing is a state subject under which the state is divided into markets and each market is controlled by an Agricultural Produce Marketing Committee (APMC) working under its own regulations. This fragmentation of markets, restricts the free movement of agricultural

commodities and multiple handling at multiple stages results in mounting up of the prices while farmers at the receiving end are still in losses. The electronic national agriculture market - eNAM was introduced in 2016 as a solution to face these challenges. The one nation one market eNAM is a pan India national agriculture market which connects 585 APMCs of the nation in an online portal. A farmer can sell through eNAM at any APMC within the national boundary. eNAM is anticipated to improve market efficiency through competitive and transparent bidding mechanism and minimized manipulations in trading practices due to the inbuilt process. This is due to fact that the role of middlemen has been reduced significantly by selling produce through e-tendering system. The realization of the goals however depends upon the successful implementation and fetching a higher price for the produce.

EMERGING POTENTIAL OF FOOD PROCESSING AND ITS PARADIGM SHIFT IN ITS CONTRIBUTION TOWARDS NATIONAL INCOME.

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Food processing is referred as rainbow industry as it is related to almost all agricultural ventures, changing food habits and dietary patterns also lead to increasing demand of processed food. Various Government interventions like Mega food park scheme, Food processing units and Agricultural and processed food products export development authority (APEDA) assistance for cold chain. Foreign direct investment (FDI) has also been increased to 100% which has attracted various foreign investors in this field leading to robust growth in it. Special economic zones (SEZ) also boosted growth of food processing leading to exemption of excise duty on foreign investors leading to free and fair trade between them. The food industry which is currently valued at US\$ 39.71 billion is expected to grow at a compounded annual growth rate (CAGR) of 11 per cent to US\$ 65.4 billion by 2018. Food processing industry is one of the largest industries in India and ranks fifth in terms of production, consumption and exports FY 16. Food processing industry contributes 14% to national GDP. Food processing industry can act as game changer in near future as it is still to be explored.

Keywords: AEDA, FDI, Processing, excise duty.

ROLE OF COOPERATIVE SOCIETIES IN AGRICULTURAL AND RURAL DEVELOPMENT

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A cooperative is an autonomous association of peoples united voluntarily to meet their common economic, social and cultural needs aspirations through a jointly- owned and democratically enterprise. Its play important role in India. Cooperatives provide agricultural credits, funds and inputs. Where state and private sectors have not able to do very much. It also helps to overcome the constraints in agricultural development. Cooperative play a dynamic role in economic growth of under developed country like India and it also promotes social welfare. It is an organization where human value are considered more important than thing else. Agricultural cooperative also know as farmers cooperative where pool their resources in certain areas of activity. A broad typology of agricultural cooperatives distinguishes between agricultural services cooperative which provide various services to their individually farming members and agricultural production cooperatives, where production resources (land, machinery) are placed and members farm jointly. Agriculture cooperatives ultimate help to reduce poverty ensure greater food security and eradicate hunger across globe. It provides opportunity to participate in the decision- making process, giving them greater negotiating process. Cooperative society helps to the farmers by providing top quality of seed, fertilizers, insecticide, pesticide etc. There are number of successful cooperatives in India like IFFCO (Indian Farmer Fertilizer Cooperative Ltd.) in the fertilizer sector another like AMUL (Anand Milk Union Limited) in dairy sector and (SHGs) Self Help Groups and many others cooperative society that are directly benefited to the farmers not only increasing crop productivity but also generate overall income and employments in farming community. Cooperative societies are now playing a very significant role in socio-economic development our country especially rural India.

IDENTIFYING THE NOVEL ANTI-MALARIAL COMPOUNDS

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Objective: The main objective of the current investigation is to model experimentally determined anti-malarial activity to identify the chemical features governing the anti-malarial activity. The present study will help overcome the short comings of

current anti-malarial compounds and offer guidance for the design of new compounds with reduced side effects. Hypothesis: Malaria is a public health problem today for 40% of the world's population. QSAR certainly decreases the number of compounds to be synthesized by facilitating the selection of the most promising candidates. Our study seeks to elucidate similarity based parameters requirement for inhibition of *Plasmodium falciparum* glutathione reductase inhibitors which has emerged as a potential target for the treatment of malaria. Methods: The molecules of the series were divided randomly into training set and test set with descriptors retrieved by data reduction. In addition to MLR, PLS analysis was also performed to check the predictive ability and robustness of the developed model. Result: The best model was selected on the basis of various statistical parameters such as coefficient of determination = 0.81, predictive power of model = 0.79. PLS analysis was also performed on the same data set to check the soundness of the MLR model. The resulted predictive power of model = 0.78 clearly demonstrates the high predictive ability of the developed PLS model. Implication: According to the developed model presented in the current work, similarity based parameters encoding the charge similarity index of the entire compounds vs compound 1 and 7 are opposite in nature due to the presence of strong and weak electronegative character respectively. Thus, on the basis of charge distribution of compounds we can conclude that weak electronegative as in 1 will produce positive effect on biological activity and high electronegative character similar to 7 will have negative effect on biological activity.

ECONOMIC STUDY ON CREDIT UTILIZATION PATTERNS OF MARGINAL FARMS IN JAUNPUR DISTRICT OF UTTAR PRADESH

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Credit is required in every type of businesses and agriculture is not exception to it. However, the need for agriculture credit becomes all the important when it moves from traditional agriculture to modern agriculture. Until 1935, the major source of funds for the farmers were the professional moneylenders. Due to their unduly high rate of interest, farmers were heavily burdened with debts. At that time, the reserve bank was very active in pursuing cooperative movements through a variety of initiatives. Despite all those efforts, the provision of credit through cooperative and commercial banks were to the extent about 4 percent of the total outstanding debt as at the end of June 1951. The present study would be carried out with the main objectives of studying the procedures of financing institutions to meet the credit requirements of the farmers and availability of credit. The data collected through personal interview by the well structured and pre-tested schedule especially designed for this purpose. The result indicated that the major problems faced by farmers in obtaining credit are the non-availability of loan in time, the procedures of obtaining credit is more expensive, and documents expenses. This study justified because of its appropriate approach to trace out the constraints in credit utilization and credit behavior of the farmers, so as to meet the credit requirements of the borrowers and availability of credit.

TO ASCERTAIN FACTORS CONTRIBUTING TO THE GRAIN LOSS DURING STORAGE IN DIFFERENT METHODS IN TIKAMGARH BLOCK OF TIKAMGARH DISTRICT

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Agriculture is one of the strong holds of the Indian economy and accounted for 12.9 per cent of the country's gross domestic product (GDP) in 2014-2015, according to the central organizations (CSO) estimates. During storage, quantitative as well as qualitative losses occur due to factors like insects, rodents, and micro-organisms. A large number of insect pests have been reported to be associated with stored grains. The occurrence and numbers of stored grain insect pests are directly related to geographical and climatic conditions. Keeping this fact in view the study's aim out at evaluation of grain storage method which was carried out in six villages of Tikamgarh block of Tikamgarh district of Madhya Pradesh. Farmers from each village were selected by proportionate random sampling to make sample size of 120. Pre structured interview schedule was used for data collection by using personal interview method. The study revealed that main causes for rat damage were burrows on mud floor (18.33%) followed by oily nature of food grains (15.00%) and external entry through burrows (13.33%). Whereas, 16.67 per cent, insect damage to food grains was caused by excess moisture in grains followed by improper drying (11.67%), improper ventilation (10.00%) and very few damage is due to access aeration (6.67%), lack of cleanliness (5.83%) and ventilation (5.00%). About 8.33 per cent of the respondents did not indicate any specific cause for damage to food grains due to insects. Hence this study highlights the groups in need of help with control.

ERGONOMIC EVALUATION OF MAIZE AND PIGEON PEA PLANTERS**ANUKUL PRAKASH ANURAG¹, RAMCHANDRA RAM²**^{1,2}*Farm Machinery and Power Engineering, VIAET, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad, UP*

A study was conducted on the ergonomic evaluation of maize and pigeon pea planters. Anthropometric data of age groups of (20, 25, 30, 35 and 40 years) subjects were measured when operating maize and pigeon pea planters at three different forward speeds of 1, 1.5 and 2 km/hr. Heart rate, oxygen consumption, power consumption and body part discomfort score of age groups were determined during working on planters. Anthropometric data of stature, popliteal, knee, elbow, and shoulder height and body mass index were determined for different age groups. Heart rate, power consumption and body part discomfort score were increasing when age increased but for subject of 40 years oxygen consumption decreased at different forward speeds. Minimum of heart rate, power consumption and body part discomfort score of subject 20 years varied from 83-111 beats/min, 60-65 W and 19-21.25 respectively on both planters at different forward speeds. Heart rate, power consumption and body part discomfort score of subject 40 years age groups were found maximum and varied from 106-129 beats/min, 65-67 W and 26.25-31.25 respectively when operating maize and pigeon pea planters at different forward speeds. Oxygen consumption of 40 years old subject varied from 1.15-1.26 lit./min and for 20 year old subject varied from 1.32-2.3 lit./min. Physiological and postural parameters for 20 years old subject was found best on both the planters.

Keywords: Heart rate, Oxygen consumption, Power consumption and Body part discomfort score.

IMPORTANCE OF UNDERUTILIZED FRUITS FOR HUMAN HEALTH BENEFITS**¹ANURADHA BHAGWATI, ²NAIKWAD DHARMENDRA, AND ³UMESH C**¹*U. A. S, Raichur-584101* ²*Department of horticulture Assam Agricultural University Jorhat-13* ³*Kerala Agricultural University-680656*

Fruits are important part of human diet. They are commercially important and nutritionally indispensable food commodity. The Fruit are consumed by man, mainly because of their organoleptic and chemical property. They play a vital role in human nutrition, by supplying the necessary growth factors essential for maintaining normal health. Major fruit crops like Mango, Litchi, Guava etc. are commercially cultivated while the wild edible fruits refer to species that are neither cultivated nor domesticated, but it come from their wild natural habitat and used as one of the sources of food. Underutilized fruits are an urgent necessity, which will definitely enrich the fruit basket. The crops, which are neither grown commercially on large scale nor traded widely, may be termed as underutilized horticultural crops. These crops are cultivated, traded, and consumed locally. Wide range of underutilized fruits are grown in India, but full potential of these fruits are not exploited, which leads to limited scope for marketing of the processed goods outside the region. Wild edible fruits can contribute significantly to the nutrition of rural inhabitants. Although these fruits can be consumed by people throughout the year in fresh and dried forms, reliance on these edible fruits increases during periods of cereal shortages. Wild edible foods include fruits, leaves, flowers and seeds from spontaneous trees and shrubs. Of these, fruits are receiving increase interest on wild edible plant species because of their nutritional value, vitamin and mineral contents. These fruits are rich in phytochemicals, especially phenolic compounds, carotenoids, terpenes, and other terpenoids. Instead of providing the attractive colors of the fruits, phytochemicals also offer protective effects against chronic diseases, such as cardiovascular diseases, diabetes, and cancers. There are many wild edible fruits which are unknown despite their nutritional and medicinal values therefore, to explore the better utilization of medicinal value wild fruits tree species. Exploitation of these crop leads to fulfilment of nutrient to the burgeoning population.

Keyword- Fruits, Food and nutritional value

ROLE PERFORMANCE OF RURAL WOMEN IN ANIMAL HUSBANDRY PRACTICES**ANURADHA RANJAN KUMARI¹, A K SINGH², M. K. PANDEY³, KAMLESH MEENA⁴ AND AJAY TIWARI⁵***SMS, Home Science, Krishi Vigyan Kendra (ICAR-IIVR) Deoria UP SMS, Animal Science, Krishi Vigyan Kendra (ICAR-IIVR) Deoria UP SMS, Plant Pathology, Krishi Vigyan Kendra (ICAR-IIVR) Deoria UP SMS, Agronomy, Krishi Vigyan Kendra (ICAR-IIVR) Deoria UP. Farm Manager, Krishi Vigyan Kendra (ICAR-IIVR) Deoria UP.*

Women play a significant role in dairy farming but their control over livestock and its products is very minimal. The income incurred from dairy animals neither remains in hands of women nor the decision making regarding sale and purchase of the varies items required in a dairy unit. The study was carried out to know the participation of rural women in dairy activities of Deoria district of U.P state. The study was carried out in two blocks i.e. Salempur and Bhatparrani families owning two to three cattle heads were selected for this study. A sample of sixty families was selected randomly from each block, thus the total sample comprised of 120 families. One female member shouldering the responsibilities in dairy management from each

family represented the study sample. The data were collected personally with the help of structured interview schedule. Data collected were statistically analyzed with the help of frequency and percentages. The data revealed that the participation of women was high in activities such as Cleaning of cattle shed, watering, feeding, milking, disposal of cow dung. The farm women participation was least in dairy related record maintenance, getting loans or credits from the banks, taking animals for grazing, fodder collection and harvesting the fodder crops. Thus there is need to educate them about scientific management practices for increasing livestock production.

Keywords: Role Performance, Rural Women, Animal Husbandry.

EXTENT OF KNOWLEDGE LEVEL OF FARMERS ABOUT PRADHAN MANTRI CROP INSURANCE SCHEME

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Pradhan Mantri Crop Insurance Scheme was announced by the Government of India on 13th January 2016. It envisages a uniform premium of only 2 per cent to be paid by farmers for Kharif crops and 1.5 per cent for Rabi crops. The premium for annual commercial and horticultural crops is 5 per cent. This scheme allowed the farmers to pay a very low premium to insure their crops. The difference between the premium paid by the farmers and the premium fixed by the insurance companies is subsidized and there is no gap on the maximum subsidy to be paid by the Government. The present study entitled "Extent of Knowledge of Farmers about Pradhan Mantri Crop Insurance Scheme was conducted in the purposely in Deoria District of Uttar Pradesh. Out five tehsils two tehsils i.e. Salempur and Bhatpar Rani were selected for this study. From each tehsil ten villages were selected purposively. From these villages 8 farmers selected on the basis of random sampling technique. Hence total sample size was 180 farmers. The data were collected from each respondent through personal interview method with the help of structured schedule. The study indicated that majority of respondents fell in medium level knowledge group. The study revealed that unit of insurance is area approach was the most important knowledge aspect as expressed by majority of the insured farmers. There was no significant difference between farmers of both selected tehsils regarding knowledge about Pradhan Mantri Crop Insurance Scheme.

Key words- Knowledge, Farmers, Pradhan Mantri Crop Insurance Scheme.

SOCIO-ECONOMIC STATUS IN C.D. BLOCK KALYANPUR IN KANPUR NAGAR (U.P.)

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The study was conducted in purposively selected one development block of Kalyanpur in district Kanpur Nagar. From the above related blocks 4 villages selected for the study selected randomly in the light i.e. specific objectives. Thus, finally 80 respondents were selected for the study. The data were collected through personal interview method collected data were tabulated and analyzed. Maximum 63.75 percent belong to the middle age groups (36 to 60 years) while 26.25 percent respondents belong to the young age group (up to 35 years). 10 percent respondent belongs to the age group of age (above 60 years) The 72.50 percent respondents belong to backward caste, while 15 percent and 12.50 percent respondents belong to schedule caste groups and upper caste group respectively. Majority 35 percent respondents have of junior high school, 15 percent graduates and above level, 11.25 percent both primary and illiterate, and 8.75 percent respondents were can read and write. The 52.50 percent of respondents belong to medium size land holding category. (2-4 ha) while 35.50 percent farmers are in category of small size of holding groups and 15 percent, farmers are in large land holding category consists above 4 ha. Majority (90%) respondents having "Agriculture" as their main occupation, while 6.25 percent respondents doing business and 3.75 percent respondents were engaged in service. as their subsidiary occupation .

OPPORTUNITIES FOR SOYFOODS IN INDIA

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A recent fact-finding mission to India, organized by the United States Soybean Export Council (USSEC), showed farmers need to pay more attention to the country's untapped soybean market as its population is expected to surpass China in the near future. 65-70% of Indian populations are vegetarian and majority of them suffer with protein-energy malnutrition. Animal proteins are very costly and also have the cholesterol risk. Also, 40% of Indian population are below poverty line and cannot afford traditional pulses. In such a situation, soybean is the only alternative to augment dietary protein supply at an

affordable price. Soybean provides a high quality protein with minimum saturated fat. Soy protein and isoflavones together contribute to a number of health benefits such as, cancer prevention, cholesterol reduction, keeping heart healthy, combating osteoporosis and menopause regulation. Being low in glycaemic index soy plays a very important role in maintaining the sugar levels in diabetics. Hence, direct food uses of soybean have good opportunities for better health and happiness of all the segment of Indian population. Protein rich defatted edible soyflour can be used in wheat and chickpea flours for higher protein content and better nutritional quality. Soy based feed can also be used for high quality and cost-effective poultry, aqua and cattle feeding. Soy protein concentrates, isolates and hydrolysates can be used in food formulations for infants, children, adult and aged persons.

OHMIC HEATING: AN ALTERNATIVE FOOD PROCESSING TECHNOLOGY

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Ohmic heating, also known as Joule heating, is a novel heat treatment process wherein alternating electric current is passed through the food materials with the primary purpose of heating them. The food material between electrodes has a role of resistance in the circuit. This produces a heating pattern from within the food, which is much faster than conventional outside heating. Heat is generated instantly and volumetrically inside the food materials (Joule effect) due to the ionic motion. The amount of heat generated is directly related to the current induced by the voltage gradient in the field, and the electrical conductivity of the materials being heated. Technology such as ohmic heating has been developed which can replace, at least partially, the traditional heating methods which rely essentially on conductive, convective and radiative heat transfer. In ohmic heating, heat is generated directly inside the food and this has direct implications in terms of both energetic and heating efficiency. It is called novel thermal processing technology meaning that the change in temperature is the main processing factor. Therefore, ohmic heating is regarded as an attractive commercial technique for food processing. The food related applications of ohmic heating include cooking, blanching, starch gelatinization, sterilization and Pasteurization, oil extraction improvement, shelf life enhancement etc.

THE ECONOMIC ANALYSIS OF AGRICULTURAL ENTERPRISES IN SUSTAINABLE DEVELOPMENT ASPECT

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The economic analysis of chosen plant production in big agricultural enterprises in sustainable development aspect is the aim of the paper. The results of the research indicated, that it is possible to use environmentally friendly technologies if economic motivation system stimulating their development is created. These technologies can be characterised by low level of direct costs with profitable indexes at the same time. The advantage of using such technologies is profitable index of production with obtaining middle yields which is essential from the point of view of food over-production and obtaining more healthy food. Initial analysis show that the problem concerns India too. First of all, the phenomenon occurs in big, transformed state farms, which are in leasing today. These enterprises are well managed, using high advanced technologies, particularly in plant production. Therefore, the economic analysis of chosen plant production in big agricultural enterprises in sustainable development aspect is the aim of the paper.

Keyword: economic analysis, enterprises in sustainable development

ANIMAL FEEDING PRACTICES AND THEIR COGNITION AMONG LIVESTOCK PRODUCERS UNDER TUTELAGE AT VETERINARY VARSITY IN PUNJAB

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Animal feeding technologies adoption is the gateway to doubling the farmers' income and vocational training courses are one of the ways to boost the cognitive domain of livestock producers so as to augment the adoption level. But in order to convert the gained knowledge into practice/adoption it needs to be retained for an extended period of time. The present study evaluated the cognitive domain in the form of awareness, knowledge level and knowledge index (KI) of livestock producers about animal feed technologies before and after training course at Guru Angad Dev Veterinary & Animal Sciences University (GADVASU), Ludhiana (Punjab) at different time intervals. A pre (0 day of training), post (immediately after training) and

delayed post-test (six months after training) study was conducted on 120 livestock producers through Knowledge test on animal feed technologies (AFTs) Mineral mixture, Urea treatment of wheat straw (UTWS), Uromin lick (UL), Silage making, Hay making, Bypass fat (BF), Bypass Protein (BP), Total mixed ration (TMR), Buffer and Probiotics. In Pretest awareness about Silage and MM was comparatively high i.e 50 & 41.7 per cent, respectively and for all other AFTs awareness varied between 2.5-19 per cent. Awareness increased significantly in Post test-I (95.8-100 per cent) and fell down non significantly in Post test-II (32.5 - 100 per cent) except for Hay, TMR, Buffers and Probiotics where the fall was significant. ($P < 0.01$). Mean knowledge score was significantly highest in Post test-I ($P < 0.01$) followed by Post test-II and Pre test (37.95/50, 20.21/50 and 4.86/50, respectively). Silage had the highest mean knowledge score in Pre test and the other two Post tests with statistically significant difference between all the three at 0.01 per cent level of significance (1.67, 4.45 and 2.62/5) followed by Mineral Mixture (0.86, 4.16 & 2.42/5) in pre, post-test I & II respectively). TMR and Probiotics had the significantly lowest score in all the three tests (pretest 0.20 & 0.21/5, post-test I 2.91 & 3.86/5 and delayed post-test score 1.39 & 1.05/5). Overall Knowledge Index for pre-test was 9.72, increased significantly to 75.90 for post-test I and decreased significantly to 40.42 for post-test II ($P < 0.01$). However overall gain of knowledge was significant. Socio-personal parameters had non-significant correlation with knowledge score. Initial improvement in KI indicates effectiveness of training and high assimilation by farmers and later loss of KI in delayed post test reflects non practice. Adoption overrides the retention of knowledge hence follow ups of tutelage is put forward to ascertain the cause behind adoption and non-adoption so as to have an unambiguous modus operandi in doubling farmers' income.

Key words: Knowledge retention, Evaluation, Awareness, Knowledge Index, Animal feeding practices, livestock producers

PLASMA TREATMENT: A SUSTAINABLE APPROACH TO INDUCE FUNCTIONALITY IN COTTON FABRIC ARCHANA BAHUGUNA* AND SHAILAJA D. NAIK**

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Among all natural fibres, cotton is pure cellulosic fabric inherently hydrophilic, thus provides maximum comfort to the wearer. But, high moisture content of this natural fibre possesses low resistance to staining and micro-organism attack. Hence, there is an urge for suitable eco-friendly and sustainable finish that could modify cotton into hydrophobic fabric. The present study is conducted with the objective to finish cotton fabric with plasma and to assess the effect of washing on the structural, durable properties and functional properties of plasma treated cotton fabric. Plasma is a dry finishing involves use of low percentage of chemicals at low level energy in absence of moisture. The plain woven bleached cotton fabric was treated with helium plasma along with a monomer, hexamethyldisiloxane which significantly altered the surface morphology of substrate from smoother to globular structure. Thus, converting the hydrophilicity of cotton into hydrophobicity without hampering its useful inherent properties. Results revealed that, plasma treatment did not alter the cloth count remarkably but thickness was reduced due to etching of the fabric surface and further lead to decrease in the corresponding GSM. The test sample attained dimensional stability after plasma treatment, thus there was no effect of multiple washes on the dimension. Though tensile strength and elongation percentage of cotton fabric enhanced significantly after plasma treatment, but did decline on multiple washes due to removal of amorphous region caused by sputtering action of plasma. Though the induced hydrophobicity is not permanent, at the same time did not revert back to hydrophilicity on multiple washes; but did retain the water repellency property. Therefore, plasma treatment is a sustainable finish to remarkable extent.

SYNTHESIS OF NOVEL QUINAZOLIN-4 (3H) - ONYL AZETIDINONES AS POTENTIAL ANTICONVULSANT AGENTS

ARCHANA

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A series of 4-(substituted aryl)- 1- [2'-methyl-6'-substituted anilino quinazolinon-4'-(3'H)-onyl] -3- chloro-azetidin-2-ones **14-25** have been synthesized by addition of substituted anilines to 4-(substituted aryl)- 1- [2'-methyl-6'-bromoquinazolinon-4'-(3'H)-onyl] -3- chloro- azetidin-2-ones **8-13** which inturn were prepared by the cycloaddition of triethylamine in dioxane to 3-(N-substituted benzylidene amino phenyl amido)-2-methyl-6-bromoquinazolin-4(3H)-ones **2-7** in presence of acetyl chloride. These compounds were screened for anticonvulsant activity and acute toxicity. Compound 4-(substituted aryl)- 1- [2'-methyl-6'-substituted anilino quinazolinon-4'-(3'H)-onyl] -3- chloro-azetidinone showed most potent activity. The structure of all the synthesized compounds were delineated by elemental (C, H, N) and spectra (IR, proton magnetic resonance and mass) analysis.

Keywords: Quinazolinones, azetidinones, anticonvulsant activity, toxicity studies.

NANOTECHNOLOGY: REVOLUTIONIZING PEST MANAGEMENT IN FUTURE**ARCHI ROY¹; DIPANJALI BAG²; SADIA PERWEEN³***(Department of Plant Protection (Entomology); Faculty of Agricultural Science, Aligarh Muslim University, Aligarh, U.P.**² (Department of Plant Pathology); Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P., India**³ (Department of Plant breeding & Genetics); Bihar Agricultural University, Sabour, Bihar., India*

Nanotechnology is based on the Greek prefix 'nano' meaning 'dwarf'. It's one billionth part of a metre. Nanoparticles display properties like chemical and physical reactivity, electrical conductance, magnetism etc. differently from the bulk. Nanobiotechnology, nanopesticide, nano-pheromones and inert nanoparticles can play a pivotal role in managing agricultural pests. Site targeted delivery, stability of active ingredient and increased solubility are added benefits reducing excess run off of pesticides. Nanocarriers, nano-emulsions and nano-formulations are also used in their management. Nanoparticle mediated gene transfer also has promising applications in delivering desired DNA into tissues of host plants inducing resistance against pests. Recent studies are conducted by the application of silver nanoparticles (SNP), aluminium oxide (ANP), zinc oxide and titanium oxide in the control of rice weevil and grasserie disease of silkworm (*Bombyx mori*) caused by *Sitophilus oryzae* and Baculovirus BmNPV (*B. mori* Nuclear Polyhedrosis Virus) (Goswami et al., 2010). Nanotechnology helps in increasing the shelf life of pheromones. Nanogel of pheromones are superior to hydrogels and microcapsules as they are insoluble in water, can be used in managing pests like fruitflies in rainy season also. Successful application of nano-alumina against two stored grain pests, *S.oryzae* and *Rhyzopertha dominica* have been recently done (Stadler et al., 2010) With so many advantages, still there are challenges in commercialisation and market adoption of nanotechnology based products. It also possesses threats like nano-pollution and mass poisoning. We hope that nanotechnology will emerge as a boon to agriculture in near future.

COST & RETURNS OF POTATO CULTIVATION IN AGRA DISTRICT**ARJUN SINGH^{1*}, RANJANA², SHRAWANI³ AND RIMJHIM⁴***Department of Agricultural Economics, College of Agriculture, RBS College, Bichpuri, Agra Sanskriti University, Mathura*

The study reports the economics of potato production based upon the primary survey of 44 growers grouped into small (20), medium (14) and large (10) based upon the area of cultivation of potato crop from Agra district during 2011-12. The overall total cost of cultivation of potato came to Rs. 140303.7 per farm, Rs. 78657.98 per hectare. Among all the inputs, per hectare value of seed of potato was 25%, human labour 14% to total cost that varies directly with farm size because of more hired labour employed on larger farms. The total variable cost 78% on overall farms, showed decreasing trends with the farm size. Total fixed cost was 22% per ha to the total cost on overall farms. Overall total cost C₃ of potato was Rs. 154334.07 per farm, Rs. 86523.78 per hectare. The gross income received by farms with overall average of Rs. 188370. Analysis of the efficiency of potato production under different categories of farms showed overall cost of production of potato was Rs. 292.3 per quintal. Overall the output/input ratio was 1:2.39, being 1:3.42, 1:2.61 and 1:2.21 on small, medium and large farms respectively. Thus, it can be concluded that with the investment of one rupee in potato cultivation small, Medium and large farmers earned Rs. 3.42, Rs. 2.61 and Rs. 2.21, respectively.

Keywords: Cost, Returns, Potato, Agra, Cultivation, Output/input ratio.**SOCIAL MARKETING: IMPLICATIONS IN EXTENSION****ARPIT HURIA¹ & NEELAM BHARDWAJ²***^{1,2}Department of Agricultural Communication, G.B.P.U.A.&T., Pantnagar, U.S.Nagar, Uttarakhand*

Social marketing is the explicit use of marketing skills to help translate present social action efforts into more effectively designed and communicated programs that elicit desired audience response. Marketing techniques are the bridging mechanisms between the simple possession of knowledge and the socially useful implementation of what knowledge allows. Social marketing applies marketing knowledge, concepts and techniques to increase social and economic ends. Extension is said to be "one of the world's most successful change agencies" and a major purpose of the Extension model is to solve individual problems at the local level, delivering solutions in the form of research-based information. Congruently, social marketing intends to benefit the community by using an understanding of the clients' needs, perceptions, and preferences to encourage positive behavior changes. Thus, a synergy between the social marketing approach and Extension program-planning process has been identified. Both focus on influencing behaviors as the bottom line and both are successful due to the act of tailoring programming to specific audience needs. Bringing about change through planned programs is a primary responsibility among Extension professionals and a complex task in itself and it may therefore be an area of great opportunity to provide support and professional development programs for Extension. Some professional development activities have revealed a successful increase in Extension agents' confidence and ability to plan programs to change behaviors and

influence audience characteristics. Hence, this paper aims to blend the Conceptual Programming model with the social marketing process as a means of structuring Extension program planning while using social marketing principles.

ECOTOURISM AND ITS ROLE IN SUSTAINABLE DEVELOPMENT

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Ecotourism, as an alternative tourism, involves visiting natural areas in order to learn, to study, or to carry out activities environmentally friendly, that is, a tourism based on the nature experience, which enables the economic and social development of local communities. Ecotourism is a sub-component of the field of sustainable tourism. It focuses primarily on experiencing and learning about nature, its landscape, flora, fauna and their habitats, as well as cultural artifacts from the locality. Carefully planned and operated ecotourism sites, especially if it is village-based and includes local participation, is able to provide direct benefits that might offset pressure from other less sustainable activities that make use of natural and cultural resources. Therefore, ecotourism and its natural assets and raw materials to create, as well as directing people to travel is an attractive force. Ecotourism helps in community development by providing the alternate source of livelihood to local community which is more sustainable. Its aim is to conserve resources, especially biological diversity, and maintain sustainable use of resources, which can bring ecological experience to travelers, conserve the ecological environment and gain economic benefit. However, achieving the aims in ecotourism depends on whether they are environmentally and ecologically sustainable and economically applicable.

Keywords: Ecotourism, development, cultural resources and conservation.

NANOTECHNOLOGY: A BOON FOR REVOLUTIONIZED AGRICULTURE

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In the present scenario, nanotechnology shows promising role in agriculture through providing new tools for enhancing the crop production, food processing and safety efficiency. Nanotechnology provides several advances in research related to agriculture with special reference to agricultural and food wastes conversion to energy as well as prevention of disease and treatment in plants and animals. Materials which possess special characteristics at the nanoscale could offer a tremendous breakthrough for pathogen and contaminant detection. Nanotechnology possesses the ability to revolutionize the agricultural and food industry with new tools for molecular treatment and rapid detection of diseases as well as enhancing the ability of plants to absorb nutrients etc. Agriculture industry is helped by smart treatment delivery system and smart sensors to combat viruses and pathogens associated with crops. Nanostructured catalysts will be available in future which increase the efficiency of pesticides and herbicides. Nanotechnology will be efficient enough to protect the environment indirectly through the use of alternative (renewable) energy supplies, and filters or catalysts to reduce pollution and clean-up existing pollutants. Controlled Environment Agriculture (CEA) is an advanced as well as hydroponically-based form of agricultural methodology which is broadly used in USA, Europe and Japan for crop management. CEA technology also provide an excellent platform for nanotechnology introduction to agriculture. Various nanotechnological devices for CEA that provide "scouting" capabilities could tremendously improve the grower's ability to determine the best time of crop harvest, crop vitality and security of food issues involving microbial or chemical contamination. Thus, it can be concluded that agriculture nanotechnology has tremendous potential to revolutionize food and agriculture systems. Security of agricultural and food systems, delivery systems for disease treatment, new materials for pathogen detection and protection of the environment are examples of application of nanotechnology to the science and engineering of agriculture and food systems.

FARMER'S KNOWLEDGE LEVEL ABOUT RECOMMENDED BRINJAL PRODUCTION TECHNOLOGY

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The present study was conducted during 2016-17 to assess the knowledge level of farmers about Brinjal production technology. A total of 120 Brinjal growers were selected randomly from 10 villages of Gohad block of Bhind district (M.P.). For data collection, the respondents were interviewed with the help of a structure interview schedule containing questions on Brinjal production technology. Each component has been assigned a particular score to assess knowledge level of Brinjal growing farmers. The collected data were analyzed with suitable statistical methods. The study concludes that more than fifty percent (62.50%) respondents had medium level of knowledge while only 19.17% falls in the category of high level of

knowledge about recommended Brinjal production of technology. This may be due lack of exposure towards agricultural messages from interpersonal and mass media channels.

WOMEN ENTREPRENEURSHIP IN INDIA; PRESENT STATUS, DIRECTIONS AND ACHIEVEMENTS

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The development of women entrepreneurship has become an important aspect of our plan priorities. Several policies and programmes are being implemented for the development of women entrepreneurship in India. There is a need for changing the mindset towards women so as to give equal rights as enshrined in the constitution. In the words of president APJ Abdul Kalam "empowering women is a prerequisite for creating a good nation, when women are empowered, society with stability is assured. Empowerment of women is essential as their thoughts and their value systems lead to the development of a good family, good society and ultimately a good nation." At present, women's entrepreneurial role is limited in the large scale industries and technology based businesses. As per the third all-India census of Small Scale Industries, only 10.11% of the micro and small enterprises were owned by women, and only 9.46% of them were managed by women. While the number of women operating their own business is increasing globally, women continue to face huge obstacles that stunt the growth of their businesses, such as lack of capital, strict social constraints, and limited time and skill. Entrepreneurship among women, no doubt improves the wealth of the nation in general and of the family in particular. Women entrepreneurship must be molded properly with entrepreneurial traits and skills to meet the changes in trends, challenges global markets and also be competent enough to sustain and strive for excellence in the entrepreneurial arena. The unexplored talents of young women can be identified, trained and used for a variety of types of industries to increase the productivity in the industrial sector. If half of the population i.e. Women is mobilized to bear the responsibilities as an entrepreneurs or contributes in the development of nation as such the growth in terms of money would reflect the prosperity of the country.

Keywords: Women Entrepreneurship, Empowerment, Business, policies and programmes.

IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON SOIL HEALTH AND CROP IMPROVEMENT

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Integrated nutrient management (INM) is not a new concept. It is an age-old practice when almost all the nutrient needs were met through organic sources to supply secondary and micronutrients besides primary nutrients. This may be achieved through combined use of all possible sources of nutrients and their scientific management for optimum growth, yield and quality of different crops and cropping systems. Integrated nutrient management practice is beneficial for sustaining soil health in terms of build-up of organic carbon, macro and micronutrient and enhancing the crop equivalent yield. Organic manures act as nutrient reservoir and upon decomposition produce organic acids thereby absorbed irons release slowly for the entire crop growth leading to higher plant height. FYM works as soil conditioner in addition to supplying plant nutrients and resulting in improvement in plant height at different stages of plant growth. The organic residues that are added to the soil undergo microbial decomposition and in this process, various organic products of decay like polysaccharides are released which act as strong binding agents in the formation of large and stable aggregates which helps to improve the physical properties of the soil. Addition of farm yard manure along with mineral fertilizers is helpful in maximum improvement of NPK status of soil. The increased uptake of nutrient due to NPKS fertilization and organic manure application is due to added supply of nutrients and proliferous root system developed under balanced nutrient application resulting in better absorption of water and nutrients along with improved physical environment.

FOOD SECURITY IN INDIA: PROBLEMS AND PROSPECTS

ASHOK KUMAR KUSHWAHA AND ANUJ PRATAP SINGH

Food security is access to enough food by all people at all time for an active and healthy life. India is truly developing now and its income, infrastructure, per capita income has also developed. But the major problem faced by India is "the problem food management and its distribution". Agriculture is very important to India, employing 55% of its population and providing 16.5% of its annual GDP. Today, India ranks second worldwide in farm output..India is the largest producer in the world of milk, cashew nuts, coconuts, tea, ginger, turmeric and black pepper. It also has the world's largest cattle population (more than 281 million). It is the second largest producer of wheat, rice, sugar, groundnut and inland fish. It is the third largest producer of tobacco. India accounts for more than 10% of the world fruit production with first rank in the production

of banana. Despite ensuring ample availability of food, existence of food insecurity at the micro-level in the country has remained a formidable challenge for India. In the recently released Global Hunger Index of 2017, India ranked 100 out of 120 countries and this report is quite disturbing because India is one of the largest producers of food in the world. Still India is not in the condition to meet the basic food requirements of people. There are many people in India who strive hard even for the square meals. I don't say that people in village areas are facing this problem, but also people in major cities face the same problems!! Lack of food supply and the nutritional deficiency causes not only a bad mark for the country's image in the international level, but also causes adverse effect on country's developing economic policies and its structure. Mismanagement of food products and its supply also puts country under many dreadful diseases too! This paper is focused on the several food security issues prevalent in the Indian scenario. Data are taken from relevant sources to analysis the gravity of the food security issues in India. It also covered the several development programmes taken up by the Indian government to counter various food security issues including several schemes and yojanas. India's biggest challenge still remains ensuring food and nutritional security to its masses.

Keywords: Food security, Challenges, **Global Hunger Index (GHI).**

ECONOMICS OF SUGARCANE CULTIVATION IN GHAZIPUR DISTRICT OF UTTAR PRADESH

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One hundred respondents were selected from Mardha, block of District Ghazipur through purposive, cum random sampling. Data were collected through personal interview on structured schedule. Tabular and functional analysis was done for presentation of the result. Selected respondents were distributed as 55, 30, and 15 percent from marginal, small and medium category. Overall land holding size was found 1.180 hectare. Hundred percent cultivated area was irrigated. Sugarcane stood on second place in cropping pattern to paddy and wheat which covered 14.40 percent of gross cropped area. Overall cropping intensity was recorded to 239.90 percent which was indirectly related with holding size. Per farm investment was directly related and per hectare was indirectly related with holding size. Per hectare cost of cultivation on overall farm came to Rs. 93290.98 and net income was Rs.63156.54. Sugarcane cultivation was comparatively more profitable on overall farm having highest input-output relationship is 1:1.67. Sugarcane cultivation on sample farms was found as decreasing returns to scale of nature and most of the input factors considered for functional analysis were having significant association with dependent variable. MVP of all the included factors came to more than unity indicating further scope for their investment in order realizes more income. Problems related with technical knowledge and skill was ranked first and financial problem was reported on second place. Farmers also reported about managerial problem which affects the sugarcane cultivation. Most of the problems can be solved if Government made policy decision.

COMPARISON OF SOIL DATA OF AMANIGANJ BLOCK, FAIZABAD WITH SATELLITE IMAGERY USING GIS

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The soils samples from different villages of Amaniganj block including 40 composite samples (0-15 cm depth) taken randomly and ten soil profiles each from each villages were described in the field for their morphological properties, analyzed for physical and chemical properties in laboratory and classified up to family level in order to assess their land use capability, soil fertility status and the comparison of surveyed data with the IRS LISS-IV satellite imagery. About 87.98 % (225.74 km²) of total area of Amaniganj block soils was found under cultivable land which is indicated by pinkish red colour in the satellite image. Saline to saline alkaline nature of soils of Amaniganj block was found from the analysis part of investigation coincides with the satellite image which indicate the presence of salt affected soils by bluish white colour with distribution of 6.76% (17.35km²) of total area of Amaniganj block, Faizabad. Forest area appears as reddish brown colour in the satellite image. The area of distribution of forest was found as 0.84 % (2.16 km²). A good number of water bodies which includes pond and other water recourses clearly observed which is 2.64 % (6.78 km²) of total area. Main water canal also seen. The built-up is about 1.78 % (4.56 km²) of total area of Amaniganj block, Faizabad was also found.

Keywords: *Satellite Imagery, GIS*

AGRICULTURAL POLICY IN INDIA

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There are substantial empirical evidences on the positive relationship between agricultural growth and economic development. The transformation of agriculture from its traditional subsistence roots induced by technical change to a modernizing and eventually industrialized agriculture sector is a phenomenon observed across the developing world. During the last five to six decades Indian agriculture has witnessed numerous changes. Innovation coupled with investments in, irrigation infrastructure, expansion of credit, marketing and processing facilities led to a significant increase in the use of modern inputs. The discussion in this chapter is focused on the agricultural sector in India in relation to the production dimensions of major agricultural commodities and their export potentials and agricultural policy in India.

Keyword- Agriculture, agricultural policy, credit and developing.

USE OF BIOFORTIFIED FOOD IN HUMAN WELFARE

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Biofortification, enrichment of micronutrients in staple food by plant breeding, is an alternative which looks promising approach for human welfare along with sustaining the agriculture. Transgenic plant breeding approaches is used for the simultaneous incorporation of genes involved in the enhancement of micronutrient concentration and reduction in the concentration of antinutrients. Laboratory experiments show that biofortification is possible without damaging agronomic productivity. Over the past 15 years, conventional breeding efforts have resulted in the development of varieties of several staple food crops like rice [*Oryza sativa* L.], wheat [*Triticum aestivum* L.], maize [*Zea mays* L.], cassava [*Manihot esculenta* C.], beans [*Phaseolus vulgaris* L.], sweet potato [*Ipomoea batatas* L.] containing high levels of the three micronutrients most limiting in diets: zinc, iron, and vitamin A. Success stories of biofortification include lysine and tryptophan rich quality protein maize (World food prize 2000), Vitamin A rich orange sweet potato (World food prize 2016); generated by crop breeding. Biofortification could prove to be a cost-effective and sustainable strategy for alleviating micronutrient deficiency in rural areas of many developing countries, where a majority of the poor households diets is comprised of staple foods, and where access to food supplements and commercially marketed fortified foods is limited. But due to use of some biotechnological tools the adoption and use is not very much popular so far. Besides these challenges biofortified crops offers good role to address the malnutrition problem in developing countries.

Keywords: Transgenic, Genes, Micronutrient, Malnutrition.

NONLINEAR DYNAMICS AND CARBON NANOTUBES

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In mathematics and science, a nonlinear system is a system in which the change of the output is not proportional to the change of the input. Nonlinear problem are of interest to engineers, biologists, physicists, mathematicians and many other scientists because most systems are inherently nonlinear in nature. As nonlinear dynamical equations are difficult to solve, nonlinear systems are commonly approximated by linear equation (linearization). This works well upto some accuracy and some range for the input values, but some interesting phenomena such as solitons, chaos and singularities are hidden by linearization. It follows that some aspects of the dynamical behaviour of a non linear system can appear to be counterintuitive, unpredictable or even chaotic. Although such chaotic behaviour may resemble random behaviour, it is in fact not random. For example, the weather is seen to be chaotic, where simple changes in one part of the system produce complex effects throughout. This nonlinearity is one of the reasons why accurate long term forecasts are impossible with current technology. Carbon nanotubes were assumed to behave as perfectly straight beams or straight cylindrical shell. However images taken by transmission electron microscopes for carbon nanotubes show that their tiny structures are not usually straight, but rather have certain degree of curvature or waviness along the nanotube length. Since the discovery of carbon nanotubes (CNTs) by Iijima in 1991, CNTs have come under ever increasing scientific and technological scrutiny. Nano structured carbonaceous materials have recently become one of the most active research fields in the domain of materials science and engineering. CNTs have shown great promise for nano-electronics, nano-electromechanical systems, reinforced composite structures and nano-devices because of their excellent and unique physical properties such as high mechanical strength, high elastic modulus, remarkable flexibility and chemical sensing, effective field emission

characteristics, quantum conductance, capability of storing large amount of hydrogen and highly anisotropic polarization. Current research for modern applications include :- (i) using carbon nanotubes as a scaffold for diverse microfabrication techniques. (ii) energy dissipation in self-organized nanostructures under influence of an electric field. (iii) using carbon nanotubes for environmental monitoring due to their active surface area and their ability to absorb gases. Due to technological applications of CNTs, intensive investigations have been carried out by researchers to elucidate the growth mechanisms, microstructure and novel functional properties. During my talk, I would like to discuss the aging process in Single Wall Carbon Nanotubes by using Poicare surface of sections, time series, phase portraits and Liapunove exponents techniques.

FORESTS AND SUSTAINABLE LIVELIHOOD DEVELOPMENT

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Forest resources play an important role in food security, fodder/ livestock security, agricultural support, bio-energy security, housing security, cottage industry, health security, socio-cultural security, income security, and employment security for local people in developing countries. Community forestry program have improved livelihood opportunities while addressing sustainable forest resource management. Human capital improves skills development and training. Natural capital gets improved through development of farmers' woodlots (FWLs), home gardens and other agricultural land. Household welfare development, widening of the sources of energy for cooking and improvement of infrastructure are to be considered as physical capital. Social capital includes formation of groups and networks; trust and solidarity development; development of social cohesion, inclusion and empowerment; and information and communication improvement. This helps in increasing household annual income, promoted household ability in self-financing forest and agricultural activities, and improved capabilities in formal banking transactions, under financial capital development. In 2005, World Development published a Special Issue on "Livelihoods, Forests and Conservation." Its editorial introduction concluded with a "Looking into the Future" section that called for more research on "the role of forests in socioeconomic development" and "the degree of dependence on forests by the poor". Thus, it is imperative to develop forest resources integrated with agricultural and industrial progress to enhance livelihood security, poverty reduction and food security.

Keywords: Forests, Capital, Livelihood and security.

OPINION OF FARMERS TOWARDS PRADHAN MANTRI CROP INSURANCE SCHEME IN UDAIPUR DISTRICT OF RAJASTHAN

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Looking to the importance of insurance scheme, the present study entitled "Knowledge and opinion of farmers towards Pradhan Mantri Crop Insurance Scheme in Udaipur district of Rajasthan" was conducted in the purposely selected Salumber and Sarada tehsils of Udaipur district of Rajasthan. Five villages from each selected tehsils were taken on the basis of maximum number of beneficiary farmers. Thus, total ten villages were selected for the study. Out of the prepared list, 10 farmers were selected from each village on the basis of random sampling technique. Thus, total 100 farmers were selected for present investigation. Data were collected through pre structured interview schedule. The study indicated that majority of respondents fell in had favourable opinion about this insurance scheme. The study revealed that most favourably opined that most of the time claim is not paid in case of crop is damaged was the most important opinion aspect as expressed by majority of the insured farmers. There was no significant difference between farmers of both selected tehsils regarding opinion about Pradhan Mantri Crop Insurance Scheme.

Keywords: Pradhan Mantri Crop Insurance Scheme, beneficiary, Opinion.

THE EFFECT OF INCOME AND EMPLOYMENT ON DIVERSIFIED FARMS OF KANPUR DEHAT (U.P.)**BALWAN SINGH*, NIRMAL KUMAR AND BIRENDRA KUMAR***CSAUAT, Kanpur, (U.P.)*

The aims of the study to analyse the trends and patterns of agricultural diversification to commercial crops/commodities become an essential strategy that can increasing income in agriculture minimize risk due to crop failure and above all earn foreign exchange. It can also suggest as a means for rapid rural of small and marginal holdings to help poverty alleviation and a planned diversification increases both individual and social gains.

Keyword: commercial crops, income, diversification and etc.

ZERO BUDGET NATURAL FARMING IN INDIA**BANKERLANG KHONGWIR*, VIKAS******Department of Agronomy, JNKVV, Jabalpur (MP) **Department of Agricultural Economics, JNKVV Jabalpur (MP)*

In India, use of modern chemical fertilizers, better management of seeds, along with new and modern techniques for farming boosted the country's food grain production. However, continuous use of modern farming methods including chemical fertilizers, pesticides and herbicides has caused serious environment pollution and global health consciousness. Organic farming has been suggested as one of the alternative and remunerative solutions to this problem but faces some limitations. As a whole, it is an expensive process that involves constant expenditure. The modern scenario of the Indian economy shows a deep agrarian crisis that is making small scale farming an unviable vocation. Privatized seeds, inputs, and markets are inaccessible and expensive for peasants. Indian farmers increasingly find themselves in a vicious cycle of debt, because of the high production costs, high interest rates for credit, the volatile market prices of crops, the rising costs of fossil fuel based inputs, and private seeds. Debt is a problem for farmers of all sizes in India. Under such conditions, 'zero budget' farming promises to end a reliance on loans and drastically cut production costs, ending the debt cycle for desperate farmers. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming *with* Nature and *without* chemicals. Zero Budget Natural Farming (ZBNF) is a set of farming methods, and also a grassroots peasant movement, which has spread to various states in India. It has attained wide success in southern India, especially the southern Indian state of Karnataka where it first evolved. Zero Budget Natural Farming also aims to create the human and social capital necessary for vibrant and inclusive agricultural production.

Keywords: Zero Budget Natural Farming, organic farming, etc.

GEOGRAPHIC INFORMATION SYSTEMS AS AN INSTRUMENT OF RESOURCE MANAGEMENT FOR THE INTERESTS OF SOIL AND WATER CONSERVATION**BASU DEVI YADAV* JAYSHREE JHALA** OMPRAKASH******Department of soil science* Department of Horticulture*** College of Agriculture-Bikaner, SKRAU-334006**Department of Entomology** Rajasthan Agricultural Research Institute, Durgapura, (SKNAU) Jaipur-302018*

Soil and water conservation are cross-sectional assignments. The respective objectives of the individual interest groups cause conflicts of use and lead to different assessments of the soil's potential. Necessary decisions and the practical implementation of soil and water conservation measures require the use of data. These data, which are both spatial and temporal, characterise past, present and, in the case of predictions, also future environmental conditions. The multitude of relevant data necessitates the use of geographic information systems as an instrument for successful resource management. With the use of problem-oriented case studies, it was possible to show that an improved understanding of the system is necessary for both optimisation of the site-specific resource management within the framework of Precision Farming and for the assessment of local to regional conflicts of use with regard to land usage and soil and water conservation. By changing the method, sufficient respective measures regarding documentation, prevention and risk assessment were able to be introduced and implemented. With the objective of practical implementation of a sustainable resource management, the possibilities of short- to long-term initiation of self-organised systems through the networking of available geographical information as well as the respective interest groups involved in the conflict of use formed the focal point of this investigation. The creation of networks linking agriculture, water extractors and nature conservation promotes necessary synergies and emergences, due to increased communication. Not the conveyance of knowledge alone, but rather new forms of understanding cause the interest groups involved to change their behaviour, thus facilitating efficient resource management for the interests of soil and water conservation.

Keyword- Soil, water conservation, Precision Farming, geographic information etc.

DECISION MAKING PATTERN OF RURAL WOMEN IN FARMING AND ALLIED ENTERPRISES IN REWA BLOCK OF DISTRICT REWA (M.P.)

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The present study was conducted in Rewa district M.P. Out of these Rewa block was selected randomly. Rewa block five villages namely Kitvariya, Karhiya, Bisar, Bhitwa, Mandhi and Total 120 respondents randomly selectecd. Highest 43 % women were from middle age group followed by 31.67 % respondents middle level of education, 46 % belonged to the medium cosmopolitnss, 43.33 % OBC category, 43 percent low social participation, 43.33% small size of land holding, 45 percent low annual income, 46 % medium source of information. 45.00 % low risk orientation, 46.67 % medium economic motivation, 43.33 percent low decision making in home affairs. it was observed that the women decision making pattern of farming activities was highest in storage (1.13) followed by weed management , land preparation , harvesting and threshing, application of manure and fertilizer, Plant protection measures , application irrigation, Methods of sowing, selection of seed variety and seed treatment and Soil testing and soil treatment. Regarding the allied activities of rural women decision making pattern was highest in Value addition (1.23) followed by Marketing, Seed formation, Vegetable production, Fruit production, dairy and cattle production, nursery decision making process , goat farming, Poultry farming and lowest mean score was fish farming (0.12).Out of 120 respondents, 45.00 per cent exhibited low level of decision making process followed by 30.83 per cent had medium and only 24.16 per cent showed high decision making process of farming and allied enterprises in rural women. It was found that the age, caste, social participation, had non - significant association but hypothesis accepted and Education , Cosmopolitnss , size of land holding, Risk orientation, economic motivation, annual income , Decision making in home affairs, Source of information had significant association but hypothesis rejected with the decision making process in farming and allied enterprises.

Keywords: Decision making pattern, women , farming and allied activities.

AWARENESS REGARDING ASPECTS OF SUN PROTECTION AND DEVELOPED SUSTAINABLE UV PROTECTIVE CLOTHING FOR COLLEGE GOING GIRLS

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Increased outdoor activities and habits of humans frequently result in more exposure to ultraviolet radiations which consist of different electromagnetic radiations namely ultraviolet radiation (UVR), visible light and infrared radiation. Small amount of solar radiation are beneficial for people and essential for natural production of vitamin D in body. But UV radiation is a known carcinogen and is also responsible for tanning. Hence the study was aimed at collecting data on awareness of respondents regarding different aspects of sun protection and their prevalent practices for sun protection. Different types of sun protective clothing were designed and assessed for their suitability. The data revealed that most of the respondents were not aware of different aspects of sun protection like range of UV radiations, UPF, characteristics of sun protective measures in relation to UV protection. The study also revealed that very less no. of respondents were aware of the availability of textile related sun protection accessories in markets other than scarf and dupatta. Sustainable UV protective clothing was developed in four different styles (shirt, shrug, mask with cap and scarf based). Selected designs were constructed and suitability of protective clothing was assessed on the basis of structural features, aesthetic features and functional features by wear trial. All the items were highly appreciated by the respondents for the intended use.

Keywords: UV radiation, UPF, Sunburn, Tanning, UV Protective Clothing

INTELLECTUAL PROPERTY RIGHTS (IPRS): IT'S ROLE IN PROTECTION OF AGRICULTURE TECHNOLOGY AND INNOVATION

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The Intellectual Property Rights (IPRs) are legal rights established over ideas, inventions, and creations. IPRs provide certain exclusive rights to the inventors or creators of that property in exchange of disclosure of the work. IPRs provide legal rights that allows right holders to exclude the unauthorized commercial use of their creations/innovation by third persons and commercial benefits from their creative efforts or reputation. There are several types of IPRs which has been classified in two broad categories: First, industrial property covering IPRs such as patent, trademarks, geographical indication and industrial designs and Second, copyright and related rights covering artistic and literary works performance. Various international treaties/agreement also protect biological innovation and agriculture technologies. For example: Budapest treaty 1977:

International recognition of the deposit of microorganism for the purpose of patent procedure, Patent cooperation treaty (PCT): Patent for an invention simultaneously in each of a large number of countries by filling an international patent application, International convention for the protection of new varieties of plants, 1978 & 1991: for grant and protects breeders rights, Convention on biological diversity, 1992: for conservation of biological diversity and sustainable use of biological resources, International Treaty on Plant Genetic Resources for Food & Agriculture of FAO, 2001: conservation and sustainable use of plant genetic resources for food and agriculture. Other important IPRs related international treaties/agreements: Hague agreement, Lisbon agreement, Madrid agreement (Marks), Paris convention, Convention on International Trade in Endangered Species of wild Fauna & Flora, 1975, Cartagena Protocol and Trademark law treaty etc. The following IPRs laws are most appropriate to protect biological innovation and agriculture technology: Patent are probably the most important IPR today for agriculture goods and services as they provide the strongest protection for patentable plants gene, genetically modified plant (GM plant) and biotechnological process for their production. Patent mainly give the patentee the right to prevent third parties from making, using or selling the patented products or process. Patent is recognition for an invention, which satisfies the criteria of global novelty, non-obviousness, and industrial application. However, in India plants or their parts thereof are not patentable. The Plant breeder's rights (PBR), also known as Plant Varieties rights (PVR), are rights granted to the breeder of a new variety of plant that give the breeder exclusive control over the propagating material seed, tissue culture and harvested material of new variety for a number of years. Plant breeder's right is weaker than patent protection in that the right holders can only prevent third parties from commercially exploiting the protect material. Marks and signed in commerce can be applied to both agriculture and industrial products and services. The trademarks owner can be an individually, business organization, or any legal entity. A trademark may be located on a package, a label, a voucher, or on the product itself. The geographical indication (GI) is a name or sign used on products and which corresponds to a specific geographical location or origin a town, or region and give legal right a certification that the product possesses certain qualities, is made according to traditional methods, or enjoys a certain reputation, due to its geographical origin. Most GI relates to agriculture products or those derived from them, as in the case of wines and spirits. The various products in agriculture get geographical indication like as 'Basmati' for rice and 'Darjeeling' for tea. Protection of such marks prevents third parties from passing off their products as those originating in the give region. Broadly, any confidential business information which provides an enterprise a competitive edge may be considered a trade secret. Trade secret protection can be used by the agriculture sector to protect, for plant material, agriculture harvesting machine, industry output, technical know-how and confidential information. However at present, there is no trade secret act in India. Today's, developing countries in IPRs, a play vital role in increase economy and developed infrastructures. Policymakers need to pay close attention to the role that IPRs can play in agriculture developments by providing incentives for both domestic and foreign investments. Each industry should evolve its own IPR policies, management style, strategies, and so on depending on its area of specialty. Agriculture research institute, Agriculture University and industry currently have to evolve IPR strategy for a better focus and approach in the global of competition.

Keyword: IPRs, Patent, Trademark, Geographical Indication, Agriculture, Technology, Innovation, Trade Secret, Industrial design, Copyrights etc.

IMPACT OF NEW TECHNOLOGY ON AGRICULTURE IN INDIA

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Agriculture is a pivotal sector in almost all the developing countries of the world. Thus, it has got its own importance in development of economic conditions of any country. Similarly, Agriculture is back bone of Indian economy. So, agricultural practices must be improved. Agricultural development has been a challenging of question posing a continued threat a view of its complex and multidimensional nature. Popularization of new scientific technology in field of agriculture of rural development in India, several massive extension approach and programme have been launched since early part of 20 century. The modified approach was extended to several parts of the country in the form of intensive cultivation with modern technologies. Availability of information on various production technologies in simplified manure and their uses is vital for their acceptance and adoption. Higher yield of agricultural crop mostly depend on the technological development by various scientists and is being an important factor, which is needful for adoption of technology. So knowledge and technology adoption by farmer needs betterment to understand. The recommendation of scientist improve the practice, generally use by farmer. Based on the study and suggestion, a suitable strategy may be developed of improving agricultural development. This information may be helpful for the policy maker, planner for promotion of crop production. This will enable to the owners of agricultural industries and different industrial producers associated with it to draw their attention to improve their present functioning. Above all, this study will also provide a feed back to the scientist for their future research and to build an adequate theory of technological impact.

PHYSIOCHEMICAL CHARACTERISTICS OF RIVER KRISHNI WATER IN PRE-MONSOON SEASON

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India is a developing country and facing its worse water crisis in the past few decades. To mitigate these water crises Rejuvenation of River is the need of Hour. Several action plans take place for the rejuvenation of North flowing River like Ganga, Yamuna and also for Hindon but there is a lack of efforts in case of small rivers or tributaries. Tributary Rivers merges into Large River at the end of their journey and puts their polluted water into the large River. No matter how many action plan for cleaning of large river take place, but it can't be rejuvenated until its tributary facing huge pollution. One such polluted River is Krishni, which is a tributary of Hindon River. Pre-monsoon sampling of Krishni River water was performed as per APHA standard. 20 Samples were collected from different sites of Krishni River. Physiochemical parameter such as pH, Conductivity, Total alkalinity, Total hardness, COD, TDS and Heavy metals have been analysed and the results were compared with BIS-10500. The pH of drinking water in the study area varies from 4.6-6.6. COD of the water samples varies 28.8-576 ppm. Conductivity in the River water sample varies from 230- 1087 μ S. The value of TDS varies from 99.7-544. The Values of Alkalinity and Hardness varies from 1000-3000 ppm and 150-480 ppm respectively. Heavy metals like As and Cd concentration varies 0.412-3.98 ppm and 0.037-0.075 respectively. As these results shown the Krishni River is highly polluted due to presence of high amount of TDS, COD, Alkalinity and Heavy metals.

Keywords: Krishni River, COD, TDS, Heavy metals, Polluted

NANOTECHNOLOGY: AN ADVANCED APPROACH IN IMPROVING THE IRON CONTENT OF POTATOES

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Dietary anaemia is one of the major global concern as there is a lack of iron in people's diet. Globally, about 46% of people suffer from dietary anaemia. It possess a great threat to the society as it reduces the ability to work. Nanotechnology can significantly solve the problem of dietary anaemia. Nanoparticles are the microscopic particles which range in size less than 100nm. Supplement of nanoparticles through modern nanotechnology is one such approach in improvement of dietary nutritional requirement. Potato is one of the world's most economically important tuber crop. It is a rich source of starch, vitamins, minerals, etc. The availability of iron to tubers through soil is very poor so chelated iron fertilizers are used in some regions but it may hamper the soil health. The use of liquid ferric oxide based on nanoparticles not only help to enhance the availability of iron in tubers but also reduce the leaching losses from the top soil and contamination of surrounding watercourses and untreated water can be avoided. It may also help in controlling soil bacteria which cause soft rot in potatoes. It is a cost effective approach in improving the quality of potatoes. The recycling of nanoparticles can be done by suspending nanoparticles in biodegradable polysaccharide matrices which would facilitate the further use of these particles for future consumption.

Keywords: nanotechnology, nanoparticle, potato, iron

ROLE OF AGRICULTURAL CREDIT IN INDIA

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This study will emphasize a focus on the nature of relationship between agricultural credit and agricultural GDP in India, specifically the role of the agricultural credit in support of agricultural growth, using the data covering the selected study. The study will use a analysis framework to build the pathways through which credit will relate to agricultural GDP depending on a control function approach to tackle the problem of endogeneity. The findings from the analysis will suggest that over this period, all the inputs will be highly responsive to an increase in institutional credit to agriculture. An increase in credit flow in nominal terms will lead to a considerable increase in fertilizers (N, P, K) consumption in physical quantities, increase in the tonnes of pesticides, increase in tractor purchases. Overall, it is quite clear that input use will be sensitive to credit flow, where as GDP of agriculture is not credit seems therefore to be an enabling input, but one whose effectiveness will be undermined by low technical efficiency and productivity. Notwithstanding these aggregate findings detailed micro studies would be necessary to provide insights in to this issue. So, finally the study will analyse farmers credit allocation behaviour and their effects on technical efficiency. Data collected will be via multistage sampling procedure. Study results will reveal that the farm revenue collection with land acreage, quantity of labours, cost of fertilizers and insecticides. Farmers that get updated and use the credit optimally to purchase better inputs are likely to improve their farm efficiency. This efficiency can

be technically improved by better access to education. This condition will make them willing to accept for improvements of their agricultural materials.

CONFRONTATIONS WITH AGRIBUSINESS IN INDIA

C. KISHORE

Agribusiness denotes the collective business activities that are performed from farm to fork. It has come to be seen not just as economically important, but as a critical part of society. Sustainability of agribusiness to ensure consumer and producer's welfare is the need of the time. One of the major reasons resulting in inefficiencies in agribusiness is due to lack of skilled management. The consumer is more conscious of a number of product attributes rather than considering about low nutritive value, good taste, packaging etc. In addition to these problems, there is almost absence of promotions for Indian brands in international market. The other equally important issue relates to the entry of global agribusiness firms in the Indian market for trade, particularly the retail sector. Various other related issues can be solved by the improve in existing marketing system that reduces cost by saving the losses in the marketing channel thereby creating additional employment opportunities in Agri-marketing system. Other suggestions to be considered are bringing new technologies from foreign partners for mass production, advising government for revision of policies, Improve the functioning of factors of production & marketing. Our scientific analysis should lead to carving out a path out of poverty, food insecurity etc.

TESTICULAR DEVELOPMENTAL PROGRESSION DURING ANNUAL REPRODUCTIVE CYCLE IN *CHANNA PUNCTATUS*

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The study embodies the testicular development in *Channa punctatus* under varying habitat conditions. Specimens for the study were collected from two different sources natural and ponds. Indices of testicular development showed the significant variation regarding GSI, HIS, CF and SCF. The values for GSI from the natural resources were found highest (3.57 ± 0.360) in July and lowest (0.1020 ± 0.008) in November, while GSI in specimens under captive conditions were also highest (3.189 ± 0.188) and minimum (0.0454 ± 0.001) during February. The values of HSI in specimens from the natural resources were recorded highest (1.5365 ± 0.14) and lowest (0.2654 ± 0.025) in the month of December and June respectively whereas in the specimens of captive condition highest ($1.157 \pm \dots$) value in December and lowest value (0.7399 ± 0.020) in the month of July. Condition Factor in the specimens from natural resources were recorded highest and lowest ; $1493 \pm 125.28, 573.732.2 \pm 177.01$ in the month of February and November respectively while in case of captive condition values for highest and lowest : $993.88 \pm 239.7; 573.493 \pm 84.44$ in the month of July and October respectively. Somatic Condition Factor for specimens from natural highest (1488.43 ± 125.62) and lowest (729.75 ± 176.39) values were recorded during February and November whereas in the specimens from captive conditions highest (962.233 ± 232.10) and lowest (573.175 ± 84.38) values were recorded. The result regarding GSI, HIS, CF and SCF showed the significant variation owing to the variation in the habitat conditions and natural and artificial food available to the specimens .

MELIA DUBIA: UTILITY FOR PULP INDUSTRY IN INDIA

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During 2010 - 2014 global pulp and paper demand has grown by 7.6 million tonnes. Except China rest of the world fell from 300.3 to 295.8 million tonnes as growth in Latin, East Europe and other emerging Asia was offset by declines elsewhere. Though India's per capita consumption is quite low compared to global peers, things are looking up and demand is set to rise from the current 13 million tonnes to an estimated 20 million tonnes by 2020. An India Ratings report estimates India's per capita paper consumption at 9 kg, against 22 kg in Indonesia, 25 kg in Malaysia and 42 kg in China. The global average stands at 58 kg. This indicates there is a lot of headroom for growth in India. Paper demand in India is constantly increasing due to increasing literacy rate and area need to grow more pulp wood is decreasing due urbanization. One way to meet the increasing pulp demand for more paper production, with the sinking land area is by increasing pulp and pulp wood yield per unit area. In this review we have identified a short rotational *Melia dubia* pulp wood clone with lower lignin content. The screened pulp yield of *Melia dubia* of two and three years old was 54.63% & 55.36% whereas screened pulp yield was 53.66 % and 54.85%. Keeping constant bleaching condition of *Melia dubia* wood pulps can improve the pulp bleachability without affecting pulp strength properties, optical properties, and physical properties and improved bleach filtrate characteristics. Two

and three year old *Melia dubia* clone can be used as short rotation pulp wood by the pulp and paper industry and this can improve environmental and economic performance of the mill.

Keywords: *Melia dubia*, pulp industry, consumption and production.

GEOGRAPHIC INFORMATION SYSTEM FOR GENERATING NATURAL STREAMS AND SPATIAL PATTERN OF SOIL EROSION: A CASE STUDY IN NAINITAL, INDIA

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Accelerated soil erosion is major problem in all over the world and it requires prevention as soon as possible. Heavy rainfall areas suffer from very severe soil erosion condition. In this study, watershed boundaries, natural streams and gross soil erosion were estimated using QGIS 2.18.4, ArcGIS 10.2.2 and ENVI 4.7 image processing software with proper ground truth techniques. Revised universal soil loss equation was used to determine soil erosion potential. ENVI 4.7 image processing software has been used for taking out the shape of study area from the LANDSAT 8 satellite imagery, for making land use land cover image and normalizes difference vegetation index images. QGIS 2.18.4 image processing software has been used for delineating sub-basins of study area and for creating natural streams inside the sub-basins. ArcGIS 10.2.2 image processing software has been used for applying mathematical equations to determine six factors of revised universal soil loss equation and to get spatial soil loss pattern of the study area. The range of rainfall erosivity factor, soil erodibility factor, slope length factor, slope steepness factor, crop cover factor and conservation practice factor were found between 0 to 3934 t m ha⁻¹ cm hr⁻¹, 0 to 0.0493586 t ha⁻¹ yr⁻¹ R⁻¹, 0.972726 to 108858, -0.5 to 16.3, 0.184094 to 1 and 0.0 to 0.2394, respectively. The potential soil loss in the Nainital district was found between 0.0 to 219.65 ton ha⁻¹ yr⁻¹, in which maximum area is under 40 to 80 ton ha⁻¹ yr⁻¹ soil loss rate which comes under severe soil erosion potential. It was demonstrated that expansion of agriculture, excess rainfall, urbanization and deforestation are causing severe soil erosion in study area.

Keywords: Sub-basin boundaries, Natural streams, Remote sensing, Geographic information system, Annual soil erosion

PROBLEMS AND PROSPECTS OF TRIBAL YOUTH WITH SPECIAL REFERENCE TO AGRICULTURE AS LIVELIHOOD

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Tribal youth constitute a numerically dominant, potentially resourceful and also adventurous segment of the population. Unlike urban youth who are mostly educated, organize in many forms and have access to facilities and institutions meant for youth services, tribal youth are mostly illiterate are burdened with the needs of their families, lack of opportunities for organizing them to engage in constructive work and also lack guidance for participation in development activities (Rana and Verma, 2017). Agriculture and allied activities support the livelihoods of nearly 70 percent of India's rural population. In recent years, land based livelihoods of tribal farmers are increasingly becoming unsustainable. Freak climatic conditions, lack of ownership rights on lands, ignorance and illiteracy, chronic indebtedness and evil mechanism of money lenders made the living of tribals more difficult (Roy Burmon, 1993). Agrarian issues stand at the center of development in tribal areas and tribal agrarian issues cannot be treated in isolation (Sinha, 1968). In order to cope up with the changes in agriculture, the tribal youth need a motivational shift. Large cohort of tribal youth currently entering the labour force at an early age in order to support their family. Agriculture is uniquely positioned to absorb these workers, although farming does not often occur to policy makers as a solution to the challenge of job creation. Tribal areas are still predominantly hilly and secluded, most young people are born into farm families. In order to appeal tribal youth and deliver them good job opportunities, agriculture must break through a number of constraints that impede growth and competitiveness. The problems related to tribal youth are on the rise, and likely to increase in the coming years. Thus, there is a necessity to develop good and qualitative vocational training programmes for the welfare of the tribal youth in India. Youth perception about benefit of choosing agriculture as an option for livelihood is a burning issue as majority of them preferred agriculture as the first vocational choice in several studies.

Keywords: Tribal Youth; Livelihood; Training; Agriculture

A REVIEW ON BIODEGRADATION OF MELANOIDINS FROM SUGARCANE MOLASSES BASED DISTILLERY EFFLUENT**DEEKSHA YAJURVEDI***Department of Chemistry, R.G.P.G. College, Meerut*

Many industries are playing a crucial role in water pollution such as textile industries, dairy industries and distillery etc. Distilleries are the major agro-based industries, which utilize molasses as raw material for the production of rectified spirit. This distillery effluent or spent wash is a major source of aquatic and soil pollution. The spent wash is highly acidic in nature and has a variety of recalcitrant colouring compounds as melanoidins. Dark colour of distillery effluent may be attributed due to the presence of these coloured compounds called melanoidins, phenolics and metal sulphides. Melanoidins are high molecular weight amino-carbonyl compounds which are produced by non-enzymatic browning reactions called as Maillard reactions during the food processing and preservation. Biological decolourisation by using fungi such as *Coriolus*, *Aspergillus*, *Phanerochaete* and certain bacterial sp. as *Bacillus Lactobacillus* have been successfully achieved and thus can be applied as a bioremediation techniques. In this review, we aim to emphasise on composition of spent wash and melanoidins providing a simple understanding of various methods of degradation. Bioremediation by use of bacteria and fungi is greatly emphasised and work done by various group of researchers has been compiled for better understanding of greener technologies.

Keywords: Spent wash, distillery effluent, melanoidins, BOD, Maillard Reaction, biodegradation

THE ROLE OF ICT ON EMPOWERING WOMEN**DHEERENDRA KUMAR^{*1}, JAGATPAL², ANKIT SINGH YADAV³ AND SHANKAR DAYAL BHARTI⁴**^{1, 2, 3&4}*Department of Agricultural Extension and Communication, College of Agriculture**Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut-250110 (UP)*

Information and Communication technology is used as an extended synonym for information (IT) but is a more. A specific term that stresses the role of unified communication and the integration of telecommunications. Computers as well as necessary enterprise software, storage, and audio-visual systems, enable users to access, store, transmit, and manipulate information. Information and Communication Technologies (ICTs) are a diverse set of technological tools and resources to create, disseminate, store, bring value addition and manage information. The ICT sector consists of segments as diverse as telecommunications, television and radio broadcasting, computer hardware, software and services and electronic media, for example, the internet and electronic mail. The necessary condition for women empowerment can be different depending on the social and economic milieu. For rural women, participation in the social network, relevance in society, freedom of movement, leadership in rural institutions, control on family formation decisions and assets are a key precondition. Empowering them to participate in economic and social progress, and make an informed decision on front-line issues that affect them. Every second recruit entering the \$60 billion Indian IT industry is a woman. Currently, Infosys employs the largest percentage of women at 33.4%, followed by TCS at 30% and Wipro 29%. The major players in the IT industry are now offering an environment that will retain the talented women workforce. Education is an area where both developed and developing countries are applying a combination of traditional and new ICT, adapting, for example, the use of a computer, the Internet, radio and television, in formal and informal learning, distance education and in establishing e-learning centers to support education and training of women and girls. International Institute for Communication and Development (IICDs) agricultural livelihood sector project is aimed at improving the incomes of a small-scale farmer and improving levels of efficiency in the agriculture sector, using ICT. This sector is the largest focus for IICD, with a total of 65 project, programme and policies. The project has 180,000 active user and fewer than 2,500,000 direct and indirect beneficiaries.

EXTENT OF ADOPTION AND ATTITUDE OF THE FARM WOMEN TOWARDS IMPROVED ANIMAL HUSBANDRY PRACTICES**DIKSHA SHARMA¹, SONIKA SHARMA², SUMAN SHARMA³, NAKUM POOJA⁴,***College of Agriculture, SKRAU., Bikaner, 2 MPUAT, Udaipur, 3 SMS, KVK, Sirohi, 4 JAU, Junagadh*

This current scenario of dairying in India calls for intensive efforts directed towards enhancing the milk production, productivity and the acceptance of recommended dairy farming practices at the household level. Present study was conducted in two district i.e. Junagadh and Gir somnath of Saurashtra region to measure the Extent of adoption and Attitude of the farm women towards improved animal husbandry practices. Data were collected from 120 respondents using structured interview schedule which contains the different areas of improved animal husbandry practices. Majority of the respondents possess medium level of adoption (67.50 per cent) towards animal husbandry practices. Majority of farm women possess moderately favourable attitude (70.00 per cent) towards improved animal husbandry practices.

Keywords- Adoption, Attitude, Animal Husbandry, Farm Women

EXTENSION STRATEGIES INCLUDING E-INITIATIVES TOWARD FARMER PROSPERITY

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Despite a wide range of reform initiatives in agricultural extension in India in the past decades, the coverage of, access to, and quality of information provided to marginalized and poor farmers is uneven. This paper aims to ascertain why farmers are not accessing information and where information gaps exist, despite the variety of extension approaches in India. Using information provision and access as the basis for analysis, the paper reviews some of the major agricultural extension programs in India by considering their ability to provide information and facilitate information sharing and use in farming communities. The review gives a broad overview of the current extension scene in India while providing a synthesis of recent debates and the observations of various authors as well as working groups in the Ministry of Agriculture and the Planning Commission. The paper examines the challenges and constraints of each agricultural extension approach as it attempts to provide farmers with access to information that is relevant to their farm enterprises. As a result of this analysis, opportunities are identified for increasing extension services' effectiveness and efficiency in reaching smallholder farmers. Research gaps are also identified. The review concludes that there is an increasing need to work in partnership and to share knowledge and skills in order to provide locally relevant services that meet the information needs of marginal and smallholder farmers in India.

Keywords: India, agricultural extension, knowledge, information, innovation, public-private partnership

NANOTECHNOLOGY: AN EMERGING TECHNOLOGY FOR PLANT DISEASE MANAGEMENT.

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Nanotechnology is nowadays most rapid growing and advancing sciences and it has the potential to revolutionize many sectors of science, technology, medicines, and agriculture. Nanoparticles are produced by both biological and chemical methods. The chemical method is commercially used. Nanoparticles can be efficiently & potentially used for crop protection, like in plant disease and insect pest management. Nanoparticles can work just like as the chemical control methods in controlling pathogen and pest population. As nanoparticles are of ultra small size, they can be used directly to target virus particles, viral pathogen and many other small sized pathogens and pest. Nanoparticles can be used as carriers of active ingredients of pesticides, fungicides etc.. Nanoparticles can be used for disease diagnosis, pathogen detection and residual analysis in a much more easier way than the earlier methods. Nanotechnology has many more applications in all stages of production, packaging, storage, processing and transport of agricultural produces. In future years, Nanotechnology will surely prove itself as an emerging technology for plant disease detection and plant disease management.

A STUDY OF SOCIO PSYCHOLOGICAL FACTORS ASSOCIATED WITH THE CREDIT BEHAVIOUR OF FARMER IN ETAAH DISTRICT OF U.P.

AUSAN SINGH

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To Study of Socio Psychological factor associated with the availabilities and utilization Pattern of credit of borrowing farmer. there farmer categories wise small farm medium farm and large farm are associated in agri crop loan, agri crop and term loan and both in this way available under crop loan 71.26 percent and agri term loan about 28.74 and crop loan as well as agri term loan about 12.89 percent and utilization of crop loan as well as agri term loan in small farmer in crop loan about 68.51 percent and medium farmers in crop loan about 21.55 percent and large farmer in crop loan about 9.94 percent. Agri term loan utilized under to fertilizer as well as small farmer about 54.55 percent medium farmer about 58.33 percent and large farmer about 55.56 percent in other things utilized loan for more than one things under small farmers about 77.42 percent, medium farmer about 23.08 percent and large farmer about 50.00 percent. farmer showing of utilization crop loan in different purposes. Maximum respondent have utilized loan for both purpose seed and fertilizer in case small farmer and large farmer of farm size. majority of 75.00 percent respondent have avail loan range of Rs. 50000 to Rs. 100000

A STUDY ON RELATIONSHIP BETWEEN SOCIO-ECONOMIC STATUS AND LEVEL OF AWARENESS OF THE FARMERS ABOUT LAND USE PATTERN IN WESTERN U. P.

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The present investigation entitled "Study on Relationship Between Socio-economic Status and Level of Awareness of The farmers of Western U.P." is done with the objectives; (i) To study the socio-economic profile of the farmers and (ii) To study the relationship/association between socio economic profile and level of awareness of the farmers. The study was conducted in Meerut and Bulandshahar districts of Western Uttar Pradesh. From each district two blocks, from each block four villages and from each village 10 respondents were selected randomly. Thus the total sample size was of 160 respondents. The data were collected by personal interview through structured schedule and analyzed using statistical techniques like percentage, standard deviation and correlation of coefficient. Results regarding socio-economic status revealed that the majority (53.10%) of the respondents were belonged to Upper middle age group ranged between 45 to 60 years, maximum (42.10%) were high school passed, highest number of the farmers (33.10%) were found in the small land holding category (1-2 ha), maximum (43.10%) respondents using private tube well for the irrigation, maximum 32.50% respondents' annual income was above 2 lakhs, majority of the farmers (75.00%) were having scooter/motorcycle for transportation and most of the respondents (95.60%) getting information through progressive farmer/neighbors. The socio-economic variables viz. education, social participation, material possession and information sources had highly significant and positive correlation with extent of awareness and adoption of land use practices. The variables having non-significant positive relationship were age, housing pattern, land holding annual income and occupation; whereas marital status, type of family and size of family were negatively correlated with general knowledge of land use pattern.

IDENTIFICATION OF INDUSTRIAL HAZARDS USING ALOHA

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Generally Hazard is a potentially damaging phenomenon that may produce harm or other consequences to a person or thing like the loss of life or injury, property damage, social and economic disruption or environmental degradation. Industrial hazards are an increasing source of risk to people and their environment. Now days this is an effect of globalization of production, an increasing of industrialization and a certain level of risk o accidents connected with production, process, transportation and waste management. Aerial Location of Hazardous Atmospheres (ALOHA) is a programme designed with collaboration of NOAA (National Oceanic Atmospheric Administration) and EPA (Environmental Protection Agency), USA to respond hazardous condition in case of release of toxic chemicals, fire and explosion. It is able to response for emergency planning in hazardous conditions. ALOHA is user-friendly software to generate scenarios of different hazardous conditions. Its primary purpose is to provide emergency response personnel estimates of the spatial extent of some common hazards associated with chemical spills. ALOHA provides estimates of the spatial extent of some of the hazards associated with the short-term accidental release of volatile and flammable chemicals. There are three types of Industrial hazardous categories: dispersion of toxic gas, fire and explosion which modelled by using ALOHA. With the help of Dispersion model in ALOHA we estimate the concentration and duration of release of flammable or toxic chemical in nearby areas of chemical release. Gaussian model in ALOHA also help to estimate the dispersion of gases that have same buoyancy as air. ALOHA runs heavy gas model to estimate the concentration of release of gases, which are heavier than air. ALOHA uses a graphical interface for data entry and display of results. Finally with the help of ALOHA we can easily identify the hazards scenario for fire, explosion and toxic releases in the Industry and identify the area where there is a possibility of exposure to toxic vapors, a flammable atmosphere, overpressure from a vapor cloud explosion, or thermal radiation from a fire are represented graphically as threat zones.

Key words: Industrial Hazards, ALOHA, Dispersion model, Gaussian model, Heavy gas model.

INNOVATIVE STRATEGIES FOR DOUBLING FARMER'S INCOME

PARVEEN KUMAR, R. K. ARORA, PAWAN KUMAR, VIJAY KUMAR, KUNAL JAMWAL,

The year 2022 will mark the completion of 75 years of the country's independence. The year 2022 now is also in the news for another reason also. It will be the year culmination of the Prime Minister ambitious programme of doubling of farmer income. Within 6-7 years the target has to be achieved.. The task is challenging but not impossible. Experts claim that if anything is to be doubled by the year 2022-23, it will require annual growth of 10.4 per cent. It will require innovative

strategies, different location specific diversification models, out of box solutions, reorientation of interventions both in the farm and non-farm sectors to double the income of the farmers by 2022. We have to come out of the traditional maize wheat or paddy wheat cycle and move towards diversification. Diversification besides providing regular income throughout the year it also keeps family labour engaged in various activities of different farm enterprises. Dairy husbandry for example is a boon for small farmers, as a family with three cows or buffaloes can earn an annual income of Rs. 50,000 to 60,000, while conserving our precious native breeds. With stall-fed, high yielding animals, the dung availability will also increase by 3 to 4 times, giving a boost to biogas and agricultural production. Another crucial component in raising productivity is the availability of water to crops. Unfortunately about 60 per cent of the area in the country is rainfed and the irrigation potential in the country is less. The only option left to us is to produce more crop per drop. Besides watershed management, constructing check dams and farm ponds should be taken up extensively. Micro-Irrigation should be encouraged to save water and input costs, increase productivity and improve quality of output. The provision of quality seed and nutrients based on soil health of each field is also very necessary. Farmers in the country still use old traditional and local varieties which result in less production. The average seed replacement ratio in the country is less. It is at 25 per cent. In case of pulses and oilseed crops it is still less. In some pulse crops it is even less than 10 per cent. The country faces a problem of ware housing and proper storage facilities. The country needs storage facility for more than 60 million metric tonnes but the storage capacity is only for 30 million tonnes. As a result of this huge amount of food grains get wasted. In the absence of proper storage facilities the food grains have to be kept in the open where they are attacked by insect pests thereby severely deteriorating their quality. Larger investments in ware housing and storage structure at the village/Panchayat level will not only help in solving the problem of rotting of food grains but will also enable us to distribute the food grains among the needy thereby reducing hunger and ensuring food security for all. Presently there is a very low level of food processing and value addition in the country. The value addition in the country ranges from 5 to 20 per cent. This is very less as compared to developed world where a good percentage of food products are processed and value added. Value addition facilities can be provided by strengthening food grain storage infrastructure, cool chain systems for perishables, post harvest processing and marketing facilities. The government has started the electronic-National Agricultural Market. It will enable the farmers to sell their produce to distant places without being physically present there. Presently about 250 markets in the country are connected with the e-NAM. The government has also now introduced a new crop insurance scheme to mitigate various climatic and man made risks at affordable cost:

STRATEGIES FOR REDUCING EMPLOYMENT VULNERABILITY OF RURAL YOUTH IN THE HILLS OF UTTARAKHAND

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Employment vulnerability among the youth, is one of the major challenge faced by developing countries. Most of the youth work in informal sector, which are typified by low levels of income and productivity, poor working conditions, absence of social protection and limited opportunities for their development. Existing youth policies often do not cater for poor rural youth. The capacities of youth to contribute to rural development and transformation remain largely untapped and their potential unrecognized. International Labour Organization (2014) is taking action to tackle the youth employment crisis through a multi-pronged approach for employment growth and decent job creation. Hence, it is important to design the strategies for employment vulnerabilities among rural youth. The present study was conducted in 10 villages of Almora and Pauri Garhwal districts of Uttarakhand state. Data was collected from 210 rural youth (15-24 years) through interview schedule. Vocational education, skills and training, roles and responsibilities of government, role of local leader and local institutions, resources and physical facilities, small scale enterprises, social protection and gender equality were the major strategies which will help to reduce employment vulnerability among rural youth. The study will help to the extension policy makers to frame training programmes for rural youth regarding employment opportunities in hills of Uttarakhand and other areas.

Keywords: Employment, Rural Youth, Strategy, Vulnerability, Uttarakhand

ROLE OF PARAMPARAGAT KRISHI VIKAS YOJANA IN AGRICULTURAL DEVELOPMENT

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The Paramparagat Krishi Vikas Yojana (PKVY), an initiative to promote organic farming in the country, was launched by the NDA government in 2015. PKVY is an elaborated component of Soil Health Management (SHM) of major project National Mission of Sustainable Agriculture (NMSA). Under PKVY Organic farming is promoted through adoption of organic village by cluster approach and PGS certification. Fund allotted under the scheme is in the ratio of 60:40 by the Central and State

Governments respectively. In case of North Eastern and Himalayan States, Central Assistance is provided in the ratio of 90:10 (Centre: State) and for Union Territories, the assistance is 100%. The objectives of the PKVY is to produce agricultural products free from chemicals and pesticides residues by adopting eco- friendly, low- cost technologies. Promote organic farming among rural youth/ farmers/ consumers/ traders, Disseminate latest technologies in organic farming, Utilize the services of experts from public agricultural research system in India and Organize a minimum of one cluster demonstration in a village.

ORGANIC ELECTRONICS: IMPORTANCE TO SUSTAINABLE DEVELOPMENT

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The biggest responsibility today is to shape the environment for our future generations: electronics are an indispensable part of life, both in present and in future -- forthcoming generations. The natural and nature inspired materials allow for "green" technologies that seem perfectly suited for achieving the sustainability goals in the electronics field. They embody low energy and have bio-degradability and biocompatibility. "Green" electronics represents not only a novel scientific term but also an emerging area of research aimed at identifying compounds of natural origin and establishing economically efficient routes for the production of synthetic materials that have applicability in environmentally safe (biodegradable) and/or biocompatible devices. Researching into the emerging class of "green" electronics may help not only the original promise of organic electronics that is to deliver low-cost and energy efficient materials and devices but also achieve unimaginable functionalities for electronics, for example benign integration into life and environment. The organic semiconductors are receiving nowadays increasing prominence in the field of OLED (ORGANIC LIGHT EMITTING DIODES) display, the only real presence of organic semiconductors in large scale electronics production worldwide. Nevertheless the low charge mobility and air stability of organic semiconductors remain the two (key) limiting factors in delivering high performance for organic electronic devices comparable to their inorganic counter- parts based on silicon or gallium arsenide for OPV (ORGANIC PHOTOVOLTAICS) and OFET (ORGANIC FIELD EFFECT TRANSISTORS) applications. This paper reviews recent research advancements, their integration in unconventional organic electronic devices and the factors limiting this field.

Keywords: OLED; OPV; OFET

SUBJECT MATTER KNOWLEDGE OF ANGANWADI WORKERS (ICDS) IN DIFFERENT AREAS OF COMPETENCIES

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ICDS scheme, devoted to the welfare of women and children started with objective to provide a package of services to women and children at their door step. The grass level unit of ICDS is Anganwadi and a centre is run by Anganwadi Worker (AWW). The AWW is the main functional unit and on her, rests the penultimate responsibility of making the scheme a grand success. The accomplishment of the objectives set forth requires a number of jobs/activities to be carried out by AWW and for that she must possess subject matter knowledge. The study was conducted in Kalyanpur block of Samastipur District in Bihar by randomly selecting 90 Anganwadi Workers (AWWs). The research aimed at assessing the subject matter knowledge possessed by AWWs in six areas of competencies and to know the relationships and relative contributions of their characteristics. The findings revealed that the overall knowledge of AWWs varied between low-medium to high-medium. The level of formal education of AWWs was positively and highly significantly correlated which also contributed significantly in their subject matter knowledge.

IMPACT OF NUTRITION TRAINING ON KNOWLEDGE OF RURAL WOMEN

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Malnutrition is still a widespread health problem in India. As the present scenario indicates that millions of children are still victims of protein- energy malfunction and lack of certain micro- nutrients. Besides children, women are also the neglected segment of the society. So, there is a need to give a serious attention on the efforts to raise the health & nutritional status of entire family. Poverty, low purchasing power, lack of nutrition knowledge, wrong cooking practices followed and prevalence of social taboos are important factors contributing to the malnutrition. Even the available foods are not utilized properly due to the wrong cooking practices followed by women. Researchers have indicated that mother's level of nutritional knowledge contributes significantly in improving the health & nutritional status of entire family. This provides a condition to plan and impart such training in nutrition for women to bring desirable changes in their level of knowledge. This paper examines the

impact of training related to nutrition education imparted by Krishi Vigyan Kendra (KVK), Jehanabad to rural women in terms of knowledge component of behaviour. The study was conducted in five adopted villages of KVK, Jehanabad in Bihar state. The training was imparted to women for seven days on different components of nutritional practices such as balanced diet, infant feeding & weaning, deficiency diseases, conservation of nutrients during cooking, food preservation, food hygiene and food fads & fallacies. . Training was given using appropriate teaching methods and aids and by following 'Before and after' experimental design. Random sample of 20 women in each training group from each adopted village was taken. The sample thus consisted of 100 women in experimental group and 25 respondents served as control group. The findings indicated that there were considerable variations in mean knowledge scores of respondents with respect to different nutritional areas. The data showed that the respondents had very low knowledge in all five areas of nutrition at pre training phase. But after the training, there was considerable gain in knowledge level of women. The findings of the study revealed that the nutrition training had a definite positive impact in increasing level of knowledge about nutritional practices. This led to conclude that, there is a strong need to educate and to impart training to rural women about different components of nutrition and nutritional practices in order to improve health and nutritional status especially of the vulnerable groups of the society.

A COMPREHENSIVE STUDY ON IMPACT OF FACILITY BASED NUTRITIONAL CARE ON MALNOURISHED FEMALE CHILDREN

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Malnutrition is a condition that results from eating a diet in which one or more nutrients are either not enough or are too much such that the diet causes the problem. In rural India, not getting enough nutrients is the main cause of malnutrition. The gender based ratio of malnourished children is higher in female child. This condition leads a malnourished female child to malnourished adult girl who again give birth to a malnourished child; and the cycle repeat itself again and again. The Indian government plan to make India malnutrition free. So government made the "Nutrition Rehabilitation Centre" scheme all over the affected states. The facility based study done at "Nutrition Rehabilitation centre, Etah (UP)" over malnourished female children (0-5yr) to access the impact of nutritional care on the beneficiaries health. In the study, the beneficiaries stayed in facility for 10-15days under observation of skilled team of doctor, dietician, and staff nurses. In this period of time beneficiaries goes under 10 steps of nutritional management; after getting discharge, beneficiaries goes through short term and long term follow-up process to continuous assessment. This study will show, how nutrition leave its impact on a life. "How a well-nourished mother deliver a well-nourished child who made a healthy society which leads a healthy INDIA."

KUPOSHAN BHARAT CHHORO: A STUDY ON THE PREGNANT WOMEN AND IMPACT OF ANEMIA ON THEIR HEALTH

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Anemia in pregnancy is a frequent manifestation and an important health problem in the developing countries. A hospital-based, cross-sectional study will be conducted among 400 pregnant women, to assess the impact of anemia. The study will be carried out at the Dev Nandini Hospital, Hapur. Anemia is classified as per the WHO grading criteria. A WHO expert Group proposed that anemia or deficiency should be considered when hemoglobin is below 11g/dl for pregnant women. This study will demonstrate the impact of anemia among the pregnant women. These findings are useful for our maternal health program planners and implementers to target and evaluate the interventions.

Keywords: WHO – World Health Origination. g/dl – Gram per Decimal liter.

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) USE IN AGRICULTURE

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Agriculture is the backbone of India's economy. Research in agriculture in our country is growing fast but because of many odds and speed-breakers, the speed of Agricultural communication is very slow. Information and Communication Technology (ICT) has been one of the most ambitious field in agriculture sector. 21st century is the era of technology, in agriculture the information and communication technology is a new approach for development of agriculture through dissemination of new technology and agriculture information, timely and in appropriate format to the each and every farmer of country. Mobile phone is a tool of ICT with high potential of dissemination of information and aims to provide current rates of crops to farmers choose suitable time and market to sell their crops for maximum profit. Information and communication Technology (ICT) can improve farm management and farming technologies by efficient farm management.

Information and Communication Technology (ICT) helps in better marketing exposure and pricing and reduction of agricultural risks and enhanced incomes. The crop forecasting, input management, command area management, watershed management, land and water resources development, drinking water potential mapping precision management, natural disaster management, fishery management hill area develop and post harvest management are the key areas, where Information Technology can play its imperative impact. Information plays an important role in the field of agricultural development by informing the farmers about new techniques in agriculture.

FEATURE SELECTION USING MATRIX CORRELATIONS AND ITS APPLICATIONS IN AGRICULTURE

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Dimensionality reduction techniques are broadly categorized as feature extraction and feature selection. Feature extraction techniques select features in the transformed space while feature selection techniques consist of finding a subset of original features or variables that is optimal for a given criterion for adequate representation of the whole data. Principal Component Analysis (PCA) is often the most common choice for reducing dimensionality of multivariate data through feature extraction. However, dimensionality reduction using PCA does not provide a real reduction of dimensionality in terms of the original variables, since all of the original variables are used in projection to the lower dimensional. Several criteria have been proposed for selecting the best subset of features which can preserve the structure and variation of the original data. However, little is known about the applications feature selection techniques in agricultural and biological research where many measurements are taken on each individual. In the present study, applicability of matrix correlation based feature selection techniques has been examined for identification of informative and redundant features in wheat data. RV-coefficient (Robert and Escoffier, 1976) and Yanai's Generalized Coefficient of Determination (Ramsay *et al.*, (1984) have been used to measure the similarity between two data matrices. Subsets selected using different criteria have been compared in terms of the measure of overall predictive efficiency. For identification of important features, secondary data of 67 wheat genotypes recorded for 14 characters have been used. Models built with subset of best features are expected not only to reduce the model complexity but also require less time and resources.

Keywords: feature selection, feature extraction, dimensionality, PCA, matrix correlation, agriculture

PROBLEMS ENCOUNTERED BY THE RESPONDENTS IN ADOPTION OF AGRO-FORESTRY

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The study was conducted in Kaithal and Yamuna Nagar districts of Haryana state during the year 2013-14 randomly selected. A total number of 120 respondents performing agro-forestry constituted the sample of the study. The information about respondents' socio-personnel traits, problems and prospects regarding Agro-forestry adoption were collected with the help of structured interview schedule. The study conducted on problems encountered by the respondents in adoption of Agro-forestry revealed that there were more than half of respondents were facing medium level of problems such as financial, technical, production and input management. Study revealed that problems related financial aspects in adoption of agro-forestry 'Marketing risks for Agro-forestry produce' was found to be highest as it first ranked followed by the statement 'Lack of respondent's knowledge about credit sources. And the results pertaining to the technical problems encountered by the respondents in adoption of Agro-forestry are 'Marketing risks for Agro-forestry produce' got 1st rank followed by 'Lack of respondent's knowledge about credit sources. Lack of interest among respondents due to long duration of return' was ranked first with highest mean score of production problems. Main input management problems of Agro-forestry were 'Lack of quality seedling for AFS' followed by 'Lack of knowledge about proper finishing of wood for market respectively.

Keywords: Constraints and Agro-forestry

NUTRACEUTICAL AND THERAPEUTIC PROPERTIES OF AEGLE MARMELLOS (L.): AN OVERVIEW

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Aegle Marmelos (L.) Correa (A. marmelos), is a medicinal plant of Rutaceae family having a long history of curative property in traditional medicine. This plant is a rich source of bioactive compounds and natural antioxidants which can be isolated from its various parts such as fruit (carotenoids, tannins, flavonoids, ascorbic acid, marmelosin, marmelide, psoralen, aurapten, luvangetin); leaf (phenols, lupeol, skimmianine, citral, aegeline, eugenol, citronella, marmesinine) and bark

(marmin, skimmianine, fagarine) etc. Many clinical and pre-clinical researches suggests the neutraceutical and therapeutic applications of *A. marmelos* such as anti-bacterial, anti-fungal, anti-viral, anti-ulcer, anti-diabetic, anticancer, anti-inflammatory and antioxidant properties which plays a potential role in the prevention and treatment of various diseases. This review article focuses on exploring novel bioactive compounds of the *A. marmelos* plant possessing potential therapeutic and health promoting applications.

Keywords: *Aegle marmelos*, Bioactive compounds, Nutritional properties, Therapeutic potential.

ECONOMICS ANALYSIS OF GARLIC

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Garlic (*Allium sativum* L.) is one of the most important and widely consumed bulbous spice crops both in India and world. Garlic crop of commercial importance in India is valued for its flavor and has been used for thousand years as spice or condiment throughout the country. The bulb can be consumed as a spice or condiment in the form of different processed products such as garlic paste and pickles. Garlic cultivation in India is under horticulture, which is an important sector of Indian agriculture. Horticulture occupies 8.50 per cent area of the cultivable land and contributes about 28.00 per cent of gross agricultural output during 2010-11. As per FAO estimates the world area under garlic (2008-09) is 12.04 lakh ha and production is 156.86 lakh tones. The main garlic growing countries in the world are China, India, Korea, Spain, Egypt, Russia, USA, Argentina Myanmar, Ukraine and Pakistan. China ranks first in area and production (6.92 lakh ha and 120.8 lakh tones). In productivity, Egypt tops the list (22.4 t/ha) followed by USA (18.39 t/ha), China (17.45 t/ha), Korea (11.81t/ha), Spain (8.97 t/ha) and India (4.07 t/ha) (FAO, 2011). India is the second largest producer of garlic in the world. India on an average produces 10.59 lakh tones from an area of 2.00 lakh hectares (2010-11). Garlic is grown commercially only in few states in India. The major garlic producing states in the country during 2010-11 are Madhya Pradesh (25.80% of country's area and 18.30% of its production), Gujarat (19.11% of area and 21.74% of production), Uttar Pradesh (16.74% of area and 15.06% of production) and Rajasthan (11.94% of area and 11.86% of production). The net income from garlic crop not only depends on the level of production but also on its efficient marketing. The analysis of cost of production and inputs is important to cut costs and increase profit.

Keywords: *Allium sativum* L, Net income, cultivation

VALUE ADDITION OF UNDERUTILIZED FRUITS: CASE OF INCREASING FARMER'S INCOME

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Minor, traditional, neglected, orphan, promising, underdeveloped fruits are not so extensively cultivated, and their consumption and trade remain to be more limited. In India, there are almost 150 of consumable species of such underutilized fruits and accounts for about 27% of fruit production. These neglected fruits are enriched with nutritional and medicinal value and can be grown even in arid regions without much care. These fruits were an important source of food for mankind before dawn of civilization and domestication of present day fruits. Cavemen in forests also depended on these fruits and passed on valuable information on utility and choice of wild species of fruits from generation to generation. The scattered nature of production and processing of underutilized fruits has been a constraint to the emergence of an organized marketing network for the produce. However they are freely available to the consumer and comparatively very cheap in price to use as raw material. Nutrient rich, innovative products can be possible from these economically cheaper fruits which are seasonal and naturally available. For any enterprise, good marketing of their products at better prices is very much essential. Digital marketing offers small businesses an affordable and efficient mode of advertising. This is the web era and as we may have noticed that there have been a rising number of populations browsing internet on a daily basis. Therefore, internet marketing automatically becomes a great tool to market the business on web. So, there is a good potential for more innovative products to produce and empower through small scale entrepreneurship.

Key words: Underutilized fruits, value added products, digital marketing, income generation

UTILISATION OF BACKYARD FARM POND THROUGH PISCICULTURE FOR ENHANCING NUTRITIONAL FOOD SECURITY OF RURAL WOMEN

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Pisciculture has prospered rapidly since the 1970s, and was the fastest growing food production industry in many countries for the past two decades, overtaking terrestrial farm animal meat production and landings from capture fisheries. It supplied around 40% of fish products globally and in Asia is the most important aquaculture region in the world, which currently contributes 92% of the world aquaculture production. Fish is a low-fat high quality protein. Fish is filled with omega-3 fatty acids and vitamins such as D and B2 (riboflavin). Fish is rich in calcium and phosphorus and a great source of minerals, such as iron, zinc, iodine, magnesium, and potassium. It is recommended that eating fish at least two times per week as part of a healthy diet. Fish is packed with protein, vitamins, and nutrients that can lower blood pressure and help reduce the risk of a heart attack or stroke. In Rural areas deficiency of nutrition is a major concern especially for rural women. Utilising backyard pond for pisciculture has unique features in effectively addressing the need of improving nutritional food security and the livelihood of rural population in highland and remote areas of India. In order to maximize its contribution with limited resources, it is highly suggested that development efforts on the part of various organizations should be in line with the priority goals of the national development plans.

Keywords: Pisciculture, fish and nutritional food security.

RELEVANCE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATION

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Education is considered as one of the most important sectors for economic and human capacity development. ICTs are important tools that enables and support the move from traditional 'teacher-centric' teaching styles to more 'learner-centric' methods. Information and Communication Technology defines the role of telecommunications i.e. wireless signals and telephone lines, computers as well as necessary enterprise software, hardware, storage, and audio-visual systems, which enable the users to store, transmit, access and manipulate information. Education has undergone extreme transformations due to advancement in recent technology and also made transformations in agriculture sciences. Tools such as word processors, databases, spreadsheets, and presentation software when integrated into student-centered classroom can promote the development of contemporary skills such as communication, and analytical thinking. Information and Communication Technology (ICT) plays an important role in supporting powerful, efficient management and administration in education sector. It is specified that in education sector technology can be used right from student administration to various resource administration. ICTs help students in browsing contents through e-books, sample of previous examinations and articles. When appropriate use of ICTs are done, it helps in expanding access to education, strengthen the relevance of education to the increasingly digital workplace, raise educational quality and helps in making teaching and learning into an engaging, active process connected to real life. The rapid growth of information and communication technologies (ICTs) offers a good opportunity to educational institutions worldwide to enhance the learning process at all levels of education which will help in producing positive outcomes.

PRADHAN MANTRI JAN DHAN YOJNA (PMJDY) – A NEW WAY FOR MAINSTREAMING THE FINANCIALLY EXCLUDE

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Most recently a national mission on financial inclusion called "PRADHAN MANTRI JAN - DHAN YOJANA" was launched on the 28th of August 2014. Under the direct supervision of the Indian Prime Minister and the Department of Financial Services, Ministry of Finance, the objective of this mission is to enrol over 70 million households and open their bank accounts along with providing them as a first step a RuPay debit card with a Rs. 1,00,000/- accident cover. In the due course of time the plan is to also cover these account holders with insurance and pension products. About 60% of the population in India does not have access to a bank account. The urban population of financially excluded category mainly

comprises of low income groups like urban labourers, slum dwellers of the cities and socially excluded communities. Poverty as a result of absence of income or irregular income, low education, lack of financial education, and location of financial service providers beyond close proximity make it difficult for the service providers to provide financial services which in turn becomes a primary reasons of financial exclusion. It is also believed that financial exclusion also leads to social inclusion.

Keywords: Financial Literacy, Poverty, Urban Poor

FARMERS' PERCEPTIONS ON PRODUCTION AND MARKETING OF MEDICINAL AND AROMATIC PLANTS IN KULLU DISTRICT OF HIMACHAL PRADESH-INDIA

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Medicinal and Aromatic Plants played a significant role in the subsistence economy of the people of Himachal Pradesh, especially those living in the rugged and impoverished hills, mountains and rural interiors. The collection, simple processing and trading of medicinal plants contribute significantly to the cash income of the poor and women in this region. There is a growing demand for M&APs at the global level. The export of M&APs brings nominal money to the farmers at the local level. Fair benefit from the trade has not been initiated yet. The challenging problem prospecting is not only to make a comprehensive inventory of M&APs, but also to address the social, economic and environmental issues in an integrated approach. A proper study of the market and up-to-date market information can make the trade a highly profitable option while increasing the livelihood options and diversifying the portfolio of products. For this research, sample size of 60 farmers of Kullu District of Himachal Pradesh was taken. A structured questionnaire was prepared for the present study. Findings revealed that the level of awareness on production and marketing of medicinal and aromatic plants among the farmers was moderate. Even for the moderate usage, respondents were enjoying some benefits like better income and better market information. This highlights the scope of production and marketing of medicinal and aromatic plants highly useful in the coming future.

Keywords: Medicinal and Aromatic, Production and marketing,

ECONOMIC ANALYSIS OF AGRICULTURAL PRODUCTION AND MARKETING OF MUNSYARI REGION GEETA AND CHHAVI ARYA

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Johari Shoka traders of Munsaryi used to have strong trading relationships with Tibet. From ancient time agricultural, animal rearing, trading with Tibet and wool industry is the base of economic life of Johari Shoka community. They always excelled in Tibet trading. Johari Shoka used to fulfill their daily needs through Tibet trading. Johari Shoka and Tibetan traders had very old relationship. Both community imported and exported trading goods. Tibetan traders exported wool, borax, all kinds of woollen goods, animals (sheep, goat, mule, dogs, horses) etc to Shoka Johari traders and Shoka Johari traders used to export cereals (rice, pulses, wheat, millets), potato, tobacco, sugar, salt, spices, cloths etc. Shoka traders could only exchange salt and borax for cereals. Tibetan traders had to pay cash for rest of the goods. No credit transaction was allowed to Tibetan traders. The main trading markets of Shoka traders were Munshiyari, Ramnagar, Madkot, Tanakpur, Bageshwar etc. They used to travel impossible routes to reach out to markets which were very unsafe. Trades between Johari Shoka and Tibet traders got extinct due to closing of Tibet trading in 1962. This led to social and economic decline among Johari communities.

EVALUATION OF PRODUCTION POTENTIAL OF PEARL MILLET (*Pennisetum glaucum* L.) ACCESSIONS AS AFFECTED BY DIFFERENT CUTTING MANagements AND IRRIGATION WATER QUALITY

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A pot experiment was carried out in 2015-16 under transparent shed facility of ICAR-CSSRI, Karnal Haryana. The experiment was conducted in Factorial RBD with three Replications to assess the fodder production potential of 20 Pearl millet accessions derived from ICRISAT with three cutting management (as single, dual and multicut purpose) under two qualities of irrigation water [0.69 (I₁-Fresh water/Best available water/tap water) and 6.0 dS m⁻¹ (I₂-Saline water)] scheduled at 1.2 ID/CPE ratio. Total green fodder yield was affected significantly due to main effect of irrigation water quality, cutting managements and accessions and their interactions. Use of saline water (319.0 g/pot) for irrigation had significantly reduced the green fodder yield as compared to tap water irrigation (377.0 g/pot). Significantly lower green fodder yield was found in C₁ (319.8 g/pot) in comparison to C₂ (347.1 g/pot) and C₃ (377.0 g/pot). The maximum green fodder yield was observed in ICFH-15 (357.5 g/pot) followed by ICFH-16 and ICFH-17; minimum in ICFH-04 (341.9 g/pot). The highest value for growth attributes were also noticed in ICFH-15. From our study we conclude that ICFH-15 and ICFH-16 accessions of pearl millet may be adapted under either C₃ and C₂ cutting management strategy for green fodder purpose as a choice for getting higher yield as compare to other accessions under saline environment of north-western region in India and elsewhere under similar agro-climatic conditions.

Keywords: Pearlmillet accessions, cutting management, salinity and Fodder

ROLE OF WOMEN IN SERICULTURE

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Sericulture is essentially a village based industry that provides employment to both skilled and unskilled labour, women and aged persons at homes at minimum risk. India continues to be the second largest producer of silk in the world and has 16.58% share in global raw silk production. Among the four varieties of silk produced as in 2016-17 the production increased up to 30265 MT. The employment generation in the country is raised to 8.51 million persons in 2016-17 compared to 7.65 million persons in 2012-13. The present article will mainly explore the role of women in sericulture and includes the concept of work, division of labour, segregation of occupations, and dimension of labour and household activities. This article will further discuss the preparation of women toward silkworm, feeding and so on. Women are mostly favoured because of their industrious nature. They are employed in a mulberry garden or silkworm rearing or in a grainage. Coming to the post cocoon technology, the involvement of the women is greater, commencing from silk reeling, weaving and garment manufacturing industry. However, their work has not always been properly recognized or suitably rewarded. Thus the analysis clearly establishes the importance of sericulture over other crops in the generation of fresh employment opportunities in rural areas.

KEY WORDS-Women, Sericulture, employment, tribal, income.

PERFORMANCE OF MAIZE SHELLER IN DIFFERENT VILLAGES OF EAST KAMENG DISTRICT, ARUNACHAL PRADESH

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Experiment on performance of maize sheller compare to traditional method was conducted during 2013-2014 and 2014-2015 in ten villages of East Kameng District, Arunachal Pradesh. All total 40 farmwomen were selected, four from each village. The trial showed that by the use of maize sheller the efficiency has increased as large size maize takes 21-23 second to shell per cob, medium size maize takes 18-20 second per cob and small size maize takes 15 – 16 second per cob whereas in traditional method, where farmers use their fingers to shell the maize, it takes 1min.15s to 1min.25s per cob for large maize, 1min. to 1min. 5s per cob for medium maize and 30s to 1min. per cob for small maize. The maize sheller has very good ease of shelling in compare to traditional method as farm women had complain about the cuts and swelling of fingers while shelling maize, but after use of maize sheller, zero cuts and swelling of fingers. Thus, it can be conclude that maize sheller has very good efficiency, ease of shelling and is drudgery reduction equipment.

Keywords: Maize sheller, Efficiency, Ease of shelling.

STRATEGIES FOR CONSERVATION OF DOMESTIC ANIMAL DIVERSITY IN INDIA

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The genetic resources of farm animals in India are represented by a broad spectrum of native breeds of cattle, buffaloes, goat, sheep, swine, equines, camels and poultry. The genetic biodiversity among this livestock needs to be conserved. Conservation is effective management of genetic resources for human use and it is always better to keep the live populations of animals or in situ conservation, which may go on improving not only in production potentials but also in their adaptation to the changing environment. In situ conservation of Beetal goat and Kilakarsal sheep breeds has been successfully undertaken in their native tract, which resulted in addition of animals to their dwindling population. In another approach of conservation, different forms of germplasm has been cryopreserved, which offers great advantage for conserving large livestock biodiversity. Frozen Semen is ideal for genetic resources utilization activities and NBAGR stores semen doses of 44 indigenous livestock breeds belonging to 7 species in its repository. Cauda epididymal sperms banking has been started for conservation of caprine and ovine genetic resources. The somatic cells are being conserved for species like camel, where conventional semen freezing and artificial insemination is not well characterized. Considering the large breeds of livestock to be conserved, many agencies are planned to be involved for participation in this venture and exchange of germplasm among them.

Keywords: Livestock, Biodiversity, and Conservation

DEMONETIZATION AND ITS IMPACT ON INDIAN ECONOMY

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The present government took an enormous step to terminate Rs 500 and Rs 1000 notes with prompt effect on November 8, 2016. Proceed was aimed to control the fake currency circulation, black money and terror financing movements in the country. India has the highest level of currency in circulation at nearly 13% of GDP. The act of demonetization is expected to have a marked impact on various sectors. The sectors which are based on cash transactions will witness more disturbances. Therefore an attempt has been made to analyze the impact of demonetization on various prominent sectors of Indian economy that are automobile, pharmaceutical, agriculture and consumer market sector etc. also compare performance of the sectors for pre and post period of demonetization. Demonetization of INR 500 and INR 1,000 notes in India on November 8, 2016 is different from many other countries' scrapping of high value notes in two respects – the withdrawal of their legal tender status and continuation with INR 1,000 and INR 2,000 notes. It has resulted in a cash shortage. Non-cash medium of payments may be encouraged by this shortage, but, with supplies only from the domestic currency presses, the shortage is unlikely to disappear by the end of 2016. Import of currency printed abroad may provide a solution for ending it sooner. The impact of the shortage, if it continues, will be fully felt in the last quarter of 2016-17. Its growth impact in 2016-17 is 0.7-1.3 percent depending on how much shortage continues and for how long. The big painful jolt of demonetization creates the right psychological milieu for the war against black money to start.

Keywords: Demonetization, currency circulation, Cash shortage.

NANOTECHNOLOGY AS A TOOL FOR MANAGING INSECT PEST IN AGRICULTURE

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Nanotechnology is a promising field of interdisciplinary research. It opens up a wide array of opportunities in various fields like insecticides, pharmaceuticals, electronics and agriculture. The potential uses and benefits of nanotechnology are enormous. These include management of insect pests through the formulations of nanomaterials-based insecticides. Traditional strategies like integrated pest management used in agriculture are insufficient, and application of chemical pesticides have adverse effects on animals and human beings apart from the decline in soil fertility. Therefore, nanotechnology would provide green and efficient alternatives for the management of insect pests in agriculture without harming the nature. A number of formulation types have been recommended including nanoemulsions, nanocapsules and products containing immaculate engineered nanoparticles, like metals, metal oxides, and nanoclays. The atom by atom arrangement allows the manipulation of nanoparticles thus influencing their size, shape and orientation for reaction with the targeted tissues. It is now known that many insects possess ferromagnetic materials in the head, thorax and abdomen, which act as geomagnetic sensors. It includes either development of more effective and non-persistent pesticides and new ways of application, which includes controlled release formulation (CRF). There is a great concern regarding the nonmaterial which have potential to exert hazardous effects on human and the environment and when we have a nano-pesticide, it becomes a double edged weapon. Nanomaterials need to be evaluated, so that this novel technology does not meet the same apprehensions and bottle-neck as faced by genetically modified crops (Gopal et al. 2012).

Keywords: Nanotechnology, controlled release formulation, genetically modified crops.

ECONOMIC ANALYSIS OF INPUTS USE PATTERN IN WHEAT CROP IN SEMI-IRRIGATED ZONE OF HARYANA**HEENA¹, LUHACH V. P.², SUNITA***Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125004 (Haryana), India*

This study pertained to the semi-irrigated zone of Haryana state. The study is based on the data collected under the comprehensive scheme to study the cost of cultivation of wheat crop. Under this scheme from each of the 30 centers the data from ten farmers representing 5 size holdings that were up to 1 ha, 1 to 2 ha, 2 to 4 ha, 4 to 6 ha and above 6 ha were collected by the Agriculture Inspectors in different zones. The inputs included in this study are seed, irrigation, fertilizer, insecticide, pesticide and herbicide. Each size of holding represents a sample of 60 farmers. This study is related to agricultural year 2013-14. Data related to actual use of inputs in the wheat crop on each size of holding and in semi-irrigated zone has been tabulated and presented in absolute as well as percentage form in simple and cross tables. The quantity and value of different inputs used per ha in all five size of holding in dry zone are presented. The state average for all the inputs used also calculated. The actual input use has been compared with the recommended dose to find out gap. To estimate the response of the input in the wheat crops grown on the farms, the Cobb-Douglas production function is used. The marginal value productivities of all the inputs (at their mean levels) are estimated by taking partial derivative of the production of the concerned crop and multiplying with the price of its output.

NON-TRADITIONAL PRODUCTS FROM KOKUM: INLAND AND GLOBAL OPPORTUNITIES FOR DOUBLING FARMERS INCOME**HEMALATHA^{*1}, G. CHANDRAMOHANA REDDY² AND SHIVAKUMAR, S.N.³***^{*}Department of Postharvest Technology, College Of Horticulture, University of Horticultural Sciences Campus, Bangalore, Karnataka.**²Department of Horticulture, College of Agriculture, CCS Haryana Agricultural University, Hisar, Haryana.**³Department of PSMA, College Of Horticulture, University of Horticultural Sciences Campus, Bangalore, Karnataka.*

The Genus *Garcinia* is one of the tropical underutilized medicinal fruit crops. It contains around 200 species, out of which 35 species are available in India and are rich source of nutrients, minerals, vitamins, and dietary fibers. They are also abundant with bioactive compounds namely xanthenes, benzophenones, hydroxycitric acid and anthocyanins. Many studies have detailed that these compounds possess antioxidant, anti-inflammatory, anticancer, antimicrobial, antiallergy, antiulcer, antiparasitic, and antihelminthic activities to aid in human health and also weight loss. Therefore, bioactive compounds extracted from *Garcinia* fruits could be used in the preparation of pharmaceuticals and nutraceuticals. *Garcinia indica* as biochemically one of the most creative plant species. Appropriate utilization of the non-traditional products like HCA, Garcinol, wine, purified pigments and processes such as organogelation would create more domestic and International demand. This review presents an overview of the bioactive compounds derived from *Garcinia* fruits and their biological activities for promoting human health as food and drug as well as enhances the farming income.

Keywords: *Garcinia*, Garcinol, Hydroxycitric acid, Nutraceuticals.**EFFECT OF SALICYLIC ACID ON PLANTS UNDER ABIOTIC STRESS****HEMENDER, V. S. MOR, SUSHMA SHARMA, JITENDER AND ¹SONALI SANGWAN***Department of Seed Science and Technology, CCS HAU, Hisar-125004**¹Department of Molecular Biology, Biotechnology and Bioinformatics, CCS HAU, Hisar-125004*

Salicylic acid occurs naturally as a derivative of group of phenolic compounds distributed in many monocot and dicot species, including many cereal crops. The regulatory role of salicylic acid is well seen in the various stages of plant life, like seed germination, growth and development, flowering, fruiting etc. Salicylic acid application also affects the uptake and transportation of ions, photosynthetic rate, stomatal conductance and transpiration. Certain stresses like biotic and abiotic, impose primary and further, secondary levels of stress to the plants by the generation of reactive oxygen species (ROS). The role of the SA in defense mechanisms under both biotic and abiotic stresses suggests that it alleviates the salt stress in plants and also multiplies the ROS generation under stress. It's exogenous application alters the antioxidant enzyme activities and imparts tolerance to plants towards abiotic stress. Treatment with SA increased the fresh and dry weight of wheat seedling and also increased the level of catalase and peroxidase activity in leaf and root samples. SA treatment decreased the H₂O₂ content. The pre-soaking treatment of seeds with SA positively affects the osmotic potential, shoot and root dry mass, K⁺/Na⁺ ratio and contents of photosynthetic pigments in wheat seedlings, under both saline and non-saline conditions. Exogenously sourced SA was reported to improve salt tolerance in wheat due to an enhanced transcript level of antioxidant genes viz. GPX1, GPX2, DHAR, GR, GST1, GST2, MDHAR, and GS, and an increased activity of ascorbate (AsA)-GSH

pathway enzymes. It does not affect the DNA of cell but induce the membrane defence genes which play important role in resistance against salinity stress.

Keywords: Abiotic stress, salicylic acid, antioxidant enzymes, salt tolerance

DEVELOPMENT OF HANDICRAFT PRODUCTS THROUGH HAND EMBROIDERY: AN INNOVATIVE APPROACH

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Handicraft, more precisely expresses by an artisans and it is a type of work where useful and decorative items are made completely by hand or by using only simple tools. The success of handicrafts depends on how well the artisans can produce the articles in keeping with the tastes and preferences of consumers. Hand embroidery is one of the oldest methods of surface enrichment and provides base to creative ideas and challenges in the development of handicraft products. Indian fashion designers recently focused on fusion of traditional art and craft of India to produce novel designs effects along with maintaining the essence of traditional designs on handicrafts and fashionable trendy products. The original Kumauni folk art i.e. *aipan* designs were collected and adapted according to their suitability for hand embroidery technique. Total ten handicraft products namely photo frame, jewellery box, book mark, document file, pen holder, hand bag, mobile pouch, belt, wallet and wrist band were selected. A total of fifty line design patterns (five for each product) were prepared and out of fifty, total of ten line design patterns (one for each product) were selected for the preparation of design arrangements. The selected design arrangements were applied on handicraft products using hand embroidery technique. Further, these prepared products were visually assessed on four parameters i.e. aesthetic, innovation in design and production, quality and craftsmanship and performance parameters. All the products were widely accepted by the consumers and most of the respondents stated that they would definitely purchase these products if available commercially in the market.

Keywords- Handicraft, *Aipan*, Product development, Hand embroidery

NUTRIENT EXPERT SYSTEM: PROS AND CONS

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Nutrient Expert system (NE) is a fertilizer recommendation decision support system being developed by International Plant Nutrition Institute (IPNI) is an easy to use, interactive computer-based decision tool that can rapidly provide nutrient recommendation for rice, wheat and maize for individual farmers' field in presence or absence of soil testing data. The core of the fertilizer recommendation method in Nutrient Expert is based on: Yield response Agronomic efficiency The method used the site-specific nutrient management (SSNM) principles, which included the use of the Quantitative Evaluation of the Fertility of Tropical Soils (QUEFTS) model to determine crop nutrient uptake requirements (Xu, *et al.*, 2014). The QUEFTS model was transformed and validated to estimate the optimum nutrient requirement at a target yield. This nutrient expert is a unique tool for large scale implementation of SSNM in India where farmer's are not access to soil testing lab. This tool estimates the attainable yield based on the growing condition, nutrient balance in the cropping system, residue management and fertilizer/manure applied in the previous season. This system has the capability to provide location specific nutrient recommendation on the basis of farmer's resource availability. The NE method utilizes soil indigenous nutrient supply in an attempt to avoid excessive nutrient accumulation in the soil. Easy to use Can utilize locally available nutrient resources Can provide nutrient recommendation in an individual farmer's field Can be useful in presence or absence of soil testing data Increase profit through optimal fertilizer use. Sustain soil fertility through balanced application of nutrients (fertilizers). Reduce pest and disease incidence through balanced nutrient use. Protect soil, water and environment from contaminations by avoiding excess fertilizer use. Can be a source of mitigation of GHG emission from agricultural fields Requires computer based decision support system Requires skillful knowledge to operates this Have not yet developed for all the crops Nutrient Expert for Hybrid Maize was proved to be an effective, promising and sustainable fertilizer recommendation method, and considered to be an alternative method that can be used without soil testing, which is quite feasible for small-holders that could not afford soil testing or soil testing is not timely or available. Although NE is currently developed to be used for those who have access to a computer as a starting point, future work should be considered to reach more users. Xinpeng Xua, Ping Hea,, Mirasol F. Pampolinoc, Adrian M. Johnstond, Shaojun Qiua, Shicheng Zhaoa, Limin Chuana, Wei Zhoua, (2014).

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IMPACT OF GREEN CHEMISTRY ON ENVIRONMENT

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Green chemistry reduces pollution at its source by minimizing or eliminating the hazards of chemical reagents, solvents, products and feedstocks. This is unlike cleaning up pollution which involves treating waste streams or cleanup of environmental spills and other releases. Majority of research in green chemistry aim to reduce the energy consumption required for the production of desired product whether it may be any drug, dyes and other chemical compounds. It aim to reduce or even eliminates the production of any harmful bi-products and maximizing the desired product without compromising with the environment. The most simple and direct way to apply green chemistry in pharmaceuticals is to utilize non-hazardous, reproducible and efficient solvents and catalysts in synthesis of drug molecules, drug intermediates and in researches involving synthetic chemistry.

SUSTAINABLE LIVELIHOOD SECURITY INDEX: A TOOL FOR ESTIMATION OF SUSTAINABILITY IN AGRICULTURE

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Agriculture is the main activity in developing countries like India, where the majority of rural poor depend on it for income and livelihood. Therefore, sustainability of agriculture cannot be defined in isolation to the issue of livelihoods. Livelihood security means secured proprietorship of, or access to, resources and income-earning activities, including reserves and assets to countervail risks. Sustainable Livelihood Security is the livelihood options that are ecologically secure, economically efficient and socially equitable. It signifies the protection or assurance of the means of livelihood for the masses not only at present but also in future. Sustainable Livelihood Security Index can help to identify whether necessary conditions for sustainable development exist in a given region/ecosystem or not. SLSI is a composite of indices representing individual indicators under three components, viz. Ecological Security Index (ESI), Economic Efficiency Index (EEI) and Social Equity Index (SEI), which is used to evaluate the sustainability status at farm level and the value of the index varies between 0 and 1. A value close to zero shows low level of sustainability and value close to 1 will denote high level of sustainability. The Sustainable Livelihood Security Index not only identifies the general primacy for development but also the nature and types of policies to be pursued in each study unit to enhance livelihood security. The SLSI aids consensus among different expert group like economists, environmentalists, and egalitarians by balancing their relative concerns which could offer guidelines for ensuring sustainable development. It acts as an educational and a policy tool for promoting integration among planners, administrators, and development workers.

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Pradhan Mantri Ujjwala Yojana (PMUY) aims to safeguard the health of women and children by providing them with a clean cooking fuel Liquefied Petroleum Gas (LPG), so that they don't have to compromise their health in smoky kitchens or wander in unsafe areas collecting firewood. Pradhan Mantri Ujjwala Yojana was launched by Hon'ble Prime Minister Shri Narendra Modi on May 1st, 2016 in Ballia, Uttar Pradesh. Under this scheme, 5 Crore LPG connections will be provided to Below Poverty Line (BPL) families with a support of Rs.1600 per connection in the next 3 years. Ensuring women's empowerment, especially in rural India, the connections will be issued in the name of women of the households. Rs. 8000 crore has been allocated towards the implementation of the scheme. Identification of the BPL families will be done through Socio Economic caste census data. PMUY is likely to result in an additional employment of around 1 Lakh and provide business opportunity of at least Rs. 10,000 crore over the next 3 Years to the Indian Industry. Launch of this scheme will also provide a great boost to the 'Make in India' campaign as all the manufacturers of cylinders, gas stoves, regulators and gas hose are domestic. This scheme is being implemented by the Ministry of Petroleum and Natural Gas. The budget that has been allotted by the government is Rs. 2000 crore for the financial year 2016 to 2017. These LPG connections will be provided to over 1.5 crore families living below poverty line. The government has provided an additional allocation of Rs 4,800 crore the Pradhan Mantri Ujjwala Yojana (PMUY) and the enhanced the target was to release 3 crore connections by

the end of Financial Year 2017-18, but as a result of efficient scheme implementation and monitoring, more than 3.35 crore connections have been released.

SWACHH BHARAT ABHIYAN

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Swachh Bharat Abhiyan is a national cleanliness campaign established by the Government of India. This campaign is covering 4041 statutory towns in order to clean roads, streets, and infrastructure of the India. It is a mass movement has run to create a Clean India by 2019. It is a step ahead to the Mahatma Gandhi's dream of Swachh Bharat for healthy and prosperous life. This mission was launched on 2nd of October 2014 (145th birth anniversary of Bapu) by targeting its completeness in 2019 on 150th birth anniversary of Mahatma Gandhi. The mission has been implemented to cover all the rural and urban areas of the India under the Ministry of Urban Development and the Ministry of Drinking Water and Sanitation accordingly the first cleanliness drive of this mission was started by the Indian Prime Minister, Narendra Modi to its launch. This mission has targeted to solve the sanitation problems as well as better waste management all over the India by creating sanitation facilities to all. Swachh Bharat mission is very necessary to run continuously in India until it gets its goal. It is very essential for the people in India to really get the feeling of physical, mental, social and intellectual well-being. It is to make living status advance in India in real means which can be started by bringing all over cleanliness. The tagline of this mission is "Ek Kadam Swachhta Ki Ore." The Swachh Bharat Mission of Gramin areas aims to the construction of 11 crore household toilets in villages. The ministry had already announced 1,34,000 crore rupees for construction of individual household toilets. Swachh Bharat Mission of Gramin areas target achieved about 853.70 lakhs individual household toilets constructed, 4.60 lakhs villages, 459 districts and 21 states/UTs were free from open defecation till September 2018. Swachh Bharat Mission of urban areas aims to cover 1.04 crore household in order to provide them 2.6 lakhs of public toilets, 2.5 lakhs of community toilets in every town. Where the Swachh Bharat Mission Urban areas target achieved about 44.39 lakhs individual household toilets, 4.09 lakhs community and public toilets constructed and 2767 cities were free from open defecation till September 2018.

ANALYSIS OF PRICES AND ARRIVALS OF APPLE FRUIT IN NARWAL MARKET OF JAMMU

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The present study was conducted with an intention to study the behavior of prices and arrivals of apple fruit in Narwal market of Jammu and also to estimate their trend. This study is based on the secondary data of one decade collected from Directorate of Horticulture, Planning and Marketing, Narwal, Jammu. Ten years monthly data i.e. from 2007-08 to 2016-17 on prices and arrivals of apple have been utilized for modeling purpose. For analytical framework Linear Regression Equation were used to study the Trend of the time Series Data on prices and arrivals and seasonal indices were calculated to study the periodic movements in business activity which occur regularly every year and have their origin in the nature of the year itself. The results showed positive trend in both prices and arrivals of apple. Moreover the prices and arrivals are anticipated to increase at the rate of ₹ 220.06 per annum per quintal which is 15969.42 quintals of apple arrivals per year. The main season for arrivals of local as well as non-local apple from other regions and states in Narwal market was from August to January. Prices for apples were found lowest in the month of April (₹ 6707.00/qntls.) and contrary in the month of August with highest price rate (₹ 100892.50/qntls.). The seasonal indices of arrivals of apple in Narwal market were recorded maximum during the month of October (471.00) and minimum in the month of April (0.19). The seasonal index for prices being lowest in the month of April (0.19) and the highest in August (160.66).

Key words: Trend, Prices, Arrivals, Time series, Seasonal variation, Jammu.

E-LEARNING EDUCATIONAL SYSTEM FOR DEVELOPMENT

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Education is constantly changing the way students learn and how instructors teach. Technology is often the driving force behind many of the world's changes and innovations. In education, creating an e-learning culture is more about developing

and tweaking what already exists, sharing a common vision, and doing things a little differently. E-learning presents numerous research opportunities for faculty, along with continuing challenges for documenting scholarship. Innovations in e-learning technologies point toward a revolution in education, allowing learning to be individualized (adaptive learning), enhancing learners' interactions with others (collaborative learning), and transforming the role of the teacher. E-learning refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. E-learning is also called Web-based learning, online learning, distributed learning, computer-assisted instruction, or Internet-based learning. Historically, there have been two common e-learning modes: distance learning and computer assisted instruction. Distance learning uses information technologies to deliver instruction to learners who are at remote locations from a central site. Computer assisted instruction (also called computer-based learning and computer based training) uses computers to aid in the delivery of stand-alone multimedia packages for learning and teaching. Early e-learning systems, based on Computer-Based Learning/Training often attempted to replicate autocratic teaching styles whereby the role of the e-learning system was assumed to be for transferring knowledge, as opposed to systems developed later based on Computer Supported Collaborative Learning (CSCL), which encouraged the shared development of knowledge.

AGRICULTURAL MARKETING, ENTREPRENEURSHIP DEVELOPMENT, IMPORT-EXPORT AGRI-COMMODITIES

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The framework under which agricultural produce markets function and factors which influence the prices received by the farmers now need to be understood in a different perspective compared to that in the past. The agricultural marketing system plays a dual role in economic development in countries whose resources are primarily agricultural. To achieve higher growth and move the sector in long term sustainable growth trajectory, market reforms in agriculture need to be undertaken. Entrepreneurship development programs are developed for both aspiring as well as existing entrepreneurs. This is because these programs are also designed to help the entrepreneur expand their existing enterprise. These programs are more effective on the existing entrepreneurs. It is because they already know a lot about their markets and industry. Hence can effectively apply the leanings in their business and analyze the results more quickly, entrepreneurship development is basically the process of improving the skill set as well as the knowledge of the entrepreneurs. Agri-exports face certain constraints that arise from conflicting domestic policies relating to production, storage, distribution, food security, pricing concerns etc. Unwillingness to decide on basic minimum quantities for export makes Indian supply sources unreliable. Higher domestic prices in comparison to international prices of products of bulk exports like sugar, wheat, rice etc. make our exports commercially less competitive. It is generally the policy that imports duties should be low for those sensitive essential products where there is a large domestic shortfall in production. Pulses are a typical example, where there is zero import duty.

Keywords: Agricultural marketing, entrepreneur, import, exports.

CROPPING PATTERN OF THE AWARDEE FARMERS FOR IMPROVING THE AGRICULTURE IN THE KONKAN REGION

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Present study was conducted in Ratnagiri, Raigad, Sindhudurg, Thane and Palghar districts of of Konkan region. The sample was constituted 60 'State agricultural award' received farmers drawn from different villages of Konkan region. The ex-post-facto research design was used for the present study. The analysis of data revealed that, majority (73.33 per cent) of the respondents was 'middle' age, 40.00 per cent had 'higher secondary' education, 'medium' (73.33 per cent) farming experience, 'medium' (40.00 per cent) size of land holding, 'medium' (46.67 per cent) annual income and undergone 'medium duration' (56.66 per cent) training. Nearly three fourth (70.00 per cent) of the respondent had 'fair' cropping pattern, whereas 11.66 per cent had 'best' and 8.34 per cent respondent had 'poor' cropping pattern. The cropping pattern of awardee farmers were quite diversified as they were found cultivating up to twenty different crops. They followed the sequential cropping pattern like 'rice- fruit crops' (10.00 per cent), 'fruit-flowers' (3.34 per cent), 'fruit-vegetable' (10.00 per cent), 'rice-fruit-vegetables' (45.00 per cent), 'rice-fruit-flower' (6.66 per cent), 'rice-fruit-vegetables-flowers' (25.00 per cent). It was seen that majority (83.33 per cent) of the awardee farmers were growing rice and finger millet (6.60 per cent) in *khari* season. In *Rabi* season, the they were found growing various crops namely, lablab bean (30.00 per cent), cowpea (23.33 per cent), okra (28.33 per cent), capsicum (31.66 per cent), brinjal (35.00 per cent). The awardee farmers from Konkan were growing watermelon (31.66 per cent) crop in summer season. They were also growing papaya (6.66 per cent) crop annually. Perennial crops, mango (71.66 per cent), coconut (26.66 per cent), cashew nut (48.33 per cent), sapota (43.33 per cent), arecanut (31.66 per cent) and banana (33.33 per cent) were dominated in the field of awardee farmer. Flower crops like lily (26.66 per cent) and *Michelia champaka* (11.66 per cent) were grown in nursery areas of awardee farmers for commercial purpose.

GOVERNMENT POLICIES AND PLANNING FOR SUSTAINABLE AGRICULTURE AND ALLIED SECTOR

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Agricultural growth can be sustained by promoting conservation and sustainable use of scarce natural resources (soil and water) through appropriate specific measures. Indian agriculture predominantly rain-fed covering about 60% of the country net sown area and accounts for 40% of the total food production. Thus Conservation of natural resources in conjunction with development of rain-fed agriculture holds the key to meet burgeoning demand for food grain country. New agenda in Indian agriculture should have a goal that explicitly focuses on improving agricultural system and addresses rural development in an integrated manner. Towards this end, National Mission for Sustainable Agriculture has been formulated for enhancing agricultural productivity especially in rain-fed areas and focusing on integrated farming, water use efficiency, soil health management and synergizing resources conservation. National Mission on Sustainable Agriculture planning has been designed by converging, consolidating and subsuming all ongoing as well as newly proposed activities and programmes related to sustainable agriculture. NMSA is expected to transform Indian Agriculture into more climate resilient production system through suitable adaptation and mitigation measures in domains of both crops and animal husbandry, so that agricultural production continues to grow in a sustainable manner. This paper describes the objectives, strategies, and structure along with the component of National Mission on Sustainable Agriculture and review the performance of it.

Keywords: Sustainable Agriculture, NMSA

IMPACT OF MID-HIMALAYAN WATERSHED DEVELOPMENT PROJECT ON EMPLOYMENT GENERATION AND PROBLEMS FACED BY BENEFICIARY FARMER'S IN HIMACHAL PRADESH

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The present study was analyzed "Impact of Mid-Himalayan watershed Development project on employment generation and problems faced by beneficiary farmer's in Himachal Pradesh", the results revealed that the beneficiary farms labour employed on agriculture, horticulture, forestry, livestock and off farm activities for 172 mandays, 28 mandays, 33mandays, 247.50 mandays and 10 mandays, respectively with a total of 490.50 mandays and non- beneficiary farmers was 97 mandays, 24 mandays, 26 mandays, 157.50 for different activities in a year. Thus, it can be concluded that as the farm size increased the employment of labour (mandays/family /year) also increased. Therefore, under overall farm situation the number of labour employed on agriculture, horticulture, forestry, and livestock was 77.32 per cent, 24 percent, 26.92 per cent and 57.14 per cent higher on beneficiary farms as compared to non-beneficiary farms. The major problems coming in the way of watershed development areas were the inadequate training of the farmers about the use of watersheds (70 %), lifting of water from check dam (66.67%), lack of market facilities for farm output (63.33%), lack of knowledge about seed treatment (63.33%), lack of outside field visits (50%), lack of coordination among beneficiaries (50%) and lifting of water from check dam (66.67%) in the study area.

Keywords: Impact, Watershed, employment, beneficiary, non-beneficiary

ENTREPRENEUR'S QUALITIES AND ENTREPRENEURIAL SKILLS FOR AGRIPRENEURSHIP

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Entrepreneurs are those people who exhibit common traits such as single-mindedness, drive, ambition, creative, problem solving, practical, and goal-oriented. An entrepreneur is an individual who recognizes an opportunity or unmet need and takes the risk to pursue it. He needs to develop these abilities, managing productivity and seeking out new markets. Personal qualities of an agri-entrepreneur significantly affect the agribusiness Self-criticism, leadership, market orientation and creativity is important for successful entrepreneurship development. Entrepreneurship skills are considered to be those competencies required to accomplish tasks and activities related to the farm business. These can be developed by learning and experience. Hanf and Muller suggest that in a dynamic environment with fast technical progress, open minded farm entrepreneurs will recognise more problems than they are able to rationally solve. Man et al., (2002) categorized entrepreneurial competences in six key areas which includes opportunity recognition skills, relationship building, Organizing, Strategic competences, conceptual thinking and problem solving skills. Lauweres (2002) study of weaknesses in entrepreneurship and selected seven critical success factors which are management and strategic planning, knowledge of the ecosystem, capable and professional staff, understanding of the value chain perspective, craftsmanship, ability to learn and

seek opportunity and enterprising personal characteristics. Thus, management skills are the complete package of skills that a farmer would use in order to develop the farm business.

Key words: Agriculture, Entrepreneurship

ROLE OF EDUCATION IN WOMEN EMPOWERMENT

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Education increases people's self-confidence and enables them to find better jobs and they can work shoulder to shoulder with men. They engage in public debate and make demands on government for health care, social security and other entitlements. In particular, education empowers women to make choices that improve their children's health, their wellbeing, and chances of survival. Education informs others of preventing and containing disease, and it is an essential element of efforts to reduce malnutrition. Furthermore, it empowers women to make choices that can improve their welfare, including marrying beyond childhood and having fewer children. Crucially, education can increase women's awareness of their rights, boost their self-esteem, and provide them the opportunity to assert their rights. Despite significant improvements in recent decades, education is not universally available and gender inequalities persist. A major concern in many countries is not only the limited numbers of girls going to school, but also the limited educational pathways for those that step into the classroom. More specifically, there should be more efforts to address the lower participation and learning achievement of girls in science, technology, engineering and mathematics (STEM) education.

Keywords: Education, Knowledge, Entitlement, Skills, Technology, etc.

HACCP IMPLEMENTATION ON BEER PRODUCTION FROM BARLEY

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The production of beer is called brewing, beer is considered a safe beverage; however, its degree of safety may be comparable to many other food products. Many hazardous situations may arise during the production of beer. The major steps in producing malt & beer include: barley intake, cleaning & grading, drying, steeping, germination, kilning malt, roasting, milling, mashing, boiling, fermenting, maturing, filtration and packaging or bottling. These steps should be analyzed to effectively apply the HACCP (Hazard Analysis and Critical Control Points) method to control food safety. It is in the public interest that beer producers, especially at brewing pubs and microbreweries, develop and implement HACCP plans to ensure the safety of beer. The most effective way to active food safety is to focus on prevention of possible hazards and to improve the process. HACCP can be considered as a management tool. It is a simple but specialized method designed to prevent health hazards resulting from the consumption of contaminated food and beverages. Health hazards may originate at any point in a production process, including receipt of raw materials, food handling, storage, packaging and transportation. The knowledge of the product formula and the details of the process are basic tools necessary to apply the HACCP method. It is very important to remember that HACCP is an analytical approach to food safety, focusing on critical points or areas of a food process which may present a hazardous situation in need of control.

Key word: - beer, hazards, HACCP, food safety.

ROLE OF DIFFERENT SOCIO-ECONOMIC FACTORS IN FARMER SUICIDES AND ITS MITIGATION

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Agriculture is the backbone of Indian economy still agriculture is not a profitable occupation for many who are practicing it, resulting in increasing number of suicide by farmers. The lacuna in the agricultural sector is small land holdings, over dependency on monsoon, insufficient irrigation facilities, lack of proper credit and insurance facilities, etc. The erratic climatic changes during last decade have aggravated the problems in farming sector; manifestations of these in extreme situations can be seen in the form of farmers' suicides. During the duration of 1998-2018, nearly 300,000 farmers have committed suicide in our country, often by consuming pesticides. In India, 11.2% of the total suicides are by farmers. In 2015, 795 out of 1,562 suicides committed by farmers/cultivators due to farming related issues were reported in Maharashtra alone, accounting for 50.9% of total such suicides in the country during that year. There can be many reasons behind a farmer suicide. According to a survey in India, 38.7% suicides are due to bankruptcy or indebtedness followed by farming related issues (19.5%), illness (10.5%), drug abuse (4.1%), marriage related issue (2.0%), poverty (1.1%) and property dispute (1.1%). Government have introduced many policies like subsidies, loan waivers, crop insurance and other welfare schemes but they have failed due to improper implementation and their reach to the farmers. Problem of farmer suicides can be mitigated by educating farmers, protecting them from falling into trap of spiraling debt by providing easy loan by government banks, fair compensation, training in agriculture and allied activities to obtain a secondary income, protection from crop failures and making farming profitable. Small and marginal farmers should be encouraged to form farming cooperatives by pooling their land resources and get advantages that come with larger land holdings such as farm mechanization, better water and crop management. This paper aims to study and comprehend different reasons and current scenario in our country that is leading to farmers' suicide and also suggesting ways to mitigate these problems.

ROLE OF MOBILE PHONE TECHNOLOGY IN IMPROVING SMALL FARM PRODUCTIVITY

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Telecommunication, especially mobile phones have the potential to provide solution to the existing information asymmetry in various lagging sectors like agriculture. India's agricultural sector suffers from low growth rates and low productivity. Issues in access to information are weak points at every stage of the agri-supply chain. For small farmer-based economy like India, access to information can possibly enable better incomes and productivity to the farmers. This paper through focus group discussions and in-depth interviews with farmers, has tried to find answers to the use and impact of mobile phones and mobile-enabled services on agricultural productivity. The answers to these questions are of relevance to develop better policy environment conducive for small and medium farmers and have implications for mobile phone operators, information service providers, and policymakers. The study has shown that although, mobile phones can act as catalyst to improving farm productivity and rural incomes, the quality of information, timeliness of information and trustworthiness of information are the three important aspects that have to be delivered to the farmers to meet their needs and expectations. There exist critical binding constraints that restrict the ability of the farming community to realize full-potential gains and it is more so for small than large farmers. Information-based, decision-making agricultural system (Precision Agriculture) is designed to maximize agricultural production and is often described as the next great evolution in agriculture. The combination of Global Positioning System (GPS) and mobile mapping are supposed to provide farmers with the information for implementation of decision-based Precision Agriculture (Michael, 2008).

IMPACT OF GST ON FARMERS

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In 1991, India saw an LPG blast — liberalization, privatization and globalization that changed the face of the country permanently. After 25 years from 1991, a fortnight ago, we experienced another revolutionary reform — GST with the promise of "One country-One tax". I really wish the Government thought more wisely about essential technology tools for climate-smart farming such as drip irrigation, greenhouses and shade nets. They should ideally be designated under the 'Zero GST' category along with food, milk, etc, as this will be essential for us to ensure farmer prosperity. The impact of GST on agricultural sector is foreseen to be positive. The agricultural sector is the largest contributing sector the overall Indian GDP. It covers around 16% of Indian GDP. The implementation of GST would have an impact on many sections of the society. One of the major issues faced by the agricultural sector is the transportation of agriculture products across state lines all over India. GST is essential to improve the transparency, reliability, timeline of supply chain mechanism. Under the model GST law, dairy farming, poultry farming, and stock breeding are kept out of the definition of agriculture. Therefore these will be taxable under the GST. Fertilizers an important element of agriculture was previously taxed at 6% (1% Excise + 5% VAT). In the GST regime, the tax on fertilizers has been increased to 12%. The same impact is on Tractors. Implementation of GST is going to benefit a lot, the farmers/ distributors in the long run as there will a single unified national

agriculture market. GST would ensure that farmers in India who contribute the most to GDP, will be able to sell their produce for the best available price.

GERIATRIC NUTRITION: IMPORTANCE

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Old age is one of the vulnerable and prone stages in terms of health status. Nutrition is essential determining factor of elderly mass specifically over the age of 60 years. Geriatric nutrition has been always underreported, though everyone wants to make the senescence easy. Adequate nutrition is always important for better ageing. Physical activities are also in the same queue of building the ageing an easier process. Health conditions like hypertension, cholesterol, renal failure, joint problems and cardiac problems should be taken into consideration before starting any kind of physical activity. The magnitude of malnutrition among the elderly in India is underreported. Studies have shown that more than 50% of the older population is underweight and more than 90% has an energy intake below the recommended allowance. Therapeutic diets should be inculcated in any kind of bodily ailment. It is found that in India elderly are usually suffered from micro nutrient deficiency, which should also be given emphasis. Scarcity of awareness, prejudice, depression and loneliness are some of the factors behind the increased vulnerability of nutritional deficiency related ailments. Small interventions can make the ageing better. Reduced sodium intakes become important, as blood pressure tend to increases in women over age 60. Serum cholesterol levels peak for men at age 60 but continue to rise in women until age 70. Immunity decreases with progressing age and make the body less able to fight infections and malignancies. Vitamin E, zinc, and some other supplements may increase immune functions.

Key words: Geriatric population, Malnutrition, Ageing, Nutrition, Awareness.

ROLE OF FARM WOMEN: NEED OF AWARENESS GENERATION

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Women plays a dynamic role in India's agro based economy and household chores. In western Uttar Pradesh 95% of rural women are involved in agricultural practices. The rural women are involved in activities starting from land preparation to harvesting. If we talk about home then also women is efficiently managing all the chores without any expectation. Still in India women are not that free to move out of their farms and homes. At home level also they face so many obligations regarding their managerial qualities. Productivity in terms of health, time management, work simplification and drudgery reduction can be increased by making them aware of using the existing technologies with utmost efficiency. Therefore it is essential to provide them the relevant information on improved home and farm managerial practices through trainings which is actually an important mandate of KVKs. To be effective, trainings must be based on the need and interest of the learner and should deal with their real problems. Organizing on and off farm trainings on potential oriented technologies will be helpful in increasing the rate of technological adoption. Therefore identification of training needs of farm women is very important before organising a training programme for them. Seven areas of Home and farm practices namely diet efficiency, storage loss minimization, income generation, drudgery reduction, Women and child care, health and hygiene are there.

HOUSEHOLD FOOD AND NUTRITIONAL SECURITY FROM LOCALLY AVAILABLE FOODS

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According to World food summit 2008, all people, at all times, have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Good nutrition means eating the right food, at the right time, in the right amounts (quality and quantity) to ensure a balanced diet. Food should be prepared in a clean, safe way and stored safely. To ensure good nutrition, households must be careful to keep enough food or money to meet the family's dietary needs, or the household may face malnutrition. As per Committee on World Food Security, 2012, all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and **quality** to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life. Whole grains are included in staple Indian diet and is easily available. Whole grains provide us energy giving carbohydrate, vitamin B complex, dietary fibre, minerals and essential fatty acids. Polishing rice removes the bran and germ & uncovers the endosperm. This raises rice's glycaemic index & strips away vitamins (A,B,K,E), fibre, magnesium and essential amino acids that can help prevent diabetes. Beans and lentils such as rajma, kabuli chana, soybean, moong contain certain anti carcinogenic compounds and are also loaded with fiber which maintains digestive health, keeps blood sugar under control and reduces cholesterol levels. Bananas are high

in soluble fibre, magnesium, potassium and natural sugars. Summer vegetables include bottle gourd pumpkin, beans, egg plants etc have antioxidant properties which also helps to minimize skin damage that is caused due to exposure to sun in summer. Flaxseed is very essential for vegetarian eaters as they are abundant in omega 3 which is not highly available in other vegetarian food items. They aid in lowering blood pressure, triglycerides and blood cholesterol levels

GENDER MAINSTREAMING IN AGRICULTURE AND ALLIED SECTORS FOR ENHANCING FOOD AND NUTRITIONAL SECURITY

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Agriculture is by and large an enterprise which engages women and men in different activities with varying degrees of their participation. Productivity of women compared with men farmers remains low relative to their potential as they are left behind in trainings, extension support services etc. Research shows that women farmers are as efficient as men farmers, controlling for other characteristics, agriculture is becoming feminized, attention to gender facilitates the achievement of economic and social objectives. Ignoring gender can lead to lopsided development and project failure. In India 65 per cent of food is produced by women. 44 per cent of total world food production is done by women. But only 2 to 10% of agriculture support services are received by them.. Gender equity entails the provision of fairness and justice in the distribution of benefits and responsibilities between women and men. The concept recognizes that women and men have different needs and power and that these differences should be identified and addressed in a manner that rectifies the imbalances between the sexes. Women comprise 65 percent of the agricultural workforce, with 79 percent of rural women engaged in agricultural activities. Women farmers generate a significant proportion of their household's income, leading to improved quality of life, health and education. She produce a large proportion of food consumed locally and contribute to the food and nutrition security of families. Women's equal access to agricultural inputs will increase their agricultural productivity by 20 to 30 percent. Gender parity in agriculture can reduce the number of hungry people in the world by 12 to 17 percent, thereby contributing to global food security.

WASTE MANAGEMENT OF FRUITS

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During the canning of fruits and preparation of juices, jam, jellies, etc., large quantity of waste material is generated and In some fruits discarded portion can be very high eg. Mango 30-50%, banana 20%, pineapple 40-50% and orange 30-50% and a producer has to dispose of the peel, rags and seeds of citrus fruits, the core and the peel of guavas and seed, the peel and stones of mangos, rind and seed of jackfruit. But from these waste material products can be made like candied peel, oils, pectin, reformed fruit pieces, enzymes, wine/ vinegar etc. Peel from citrus fruits (orange, lemon and grape fruit) can be candied for use either in baked goods or as snack food. Shreds of peel are used in marmalades and the process is similar to candying. The stones of fruit contain appreciable quantities of oil or fat, used for culinary or toiletry applications. Palm kernel oil is well established as both as cooking and industrial oil. Fruit pulp can be recovered and formed into synthetic fruit pieces. We can extract enzymes from fruits like papain from papaya, bromelain from pineapple and ficin from figs these are protein degrading enzyme used as meat tenderisers, washing powders, leather tanning and beer brewing. Beers and wines are also possible products although these are produced from fresh, high quality fruit juices to obtain high quality. By using these all practices we can manage our fruit wastes.

ASSOCIATION BETWEEN CONSTRAINTS ENCOUNTERED BY THE FARMERS IN ADOPTION OF DRIP IRRIGATION SYSTEM AND THEIR SELECTED INDEPENDENT VARIABLES

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Rajasthan has largest geographical area having only 1% water resources of country. Due to arid and semi-arid climate i.e. negative moisture index, poor soil quality and traditional agriculture practices, the food security, nutritional security, Irrigation scenario of Rajasthan is characterized by erratic or /sporadic/scanty rainfall, dwindling ground water resources increasing alternative demand of municipal and industrial sector that means less water available for agriculture. In Rajasthan, Water is the most precious natural resource, vitally important for agricultural development and for day-to-day living. In the changing agricultural scenario world over and shift towards precision farming, drip irrigation happens to be the technology capable of providing more efficient utilization of water. The study was conducted in eight selected Gram Panchayat of Jhotwara Panchayat Samiti of Jaipur District of Rajasthan. Two villages were selected from each selected Gram Panchayat of Jhotwara Panchayat Samiti having maximum number of drip irrigation sets. Thus, sixteen villages were selected purposively. Ninety six farmers were selected from sixteen selected villages on the basis of proportional allocation to the size of sample. The seven variables viz. socio-economic status, caste, occupation, education level, size of land holding, age and extension participation were identified as the important variables to measure the association between the constraints encountered by the farmers in adoption of drip irrigation system and selected independent variables and following results were found. It was observed that 'socio-economic status', 'caste', and 'education level' were found to be negative and significantly where as 'occupation' and 'extension participation' were positive and significantly associated with the constraints encountered by the farmers in adoption of drip irrigation system while the variables like 'size of land holding' was negative and 'age' was positive but both were non-significantly associated with the constraints encountered by the farmers in adoption of drip irrigation system.

NANOTECHNOLOGY –A NOVEL APPROACH IN AGRICULTURE

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Nanotechnology is one of the most fascinating and rapidly advancing science in agriculture that contribute to sustainable competitiveness and growth in several industrial sectors. The current challenges of sustainability, food security and climate change are engaging researchers in exploring the field of nanotechnology as new source of key improvements for the agricultural sector. Conversion of macromaterials into nanosize particles(1-100nm) gives birth to new characteristics and the materials behaves differently. Nanotechnology has various applications in plant protection especially in smart drug delivery systems in plant disease management, disease diagnosis by using nanosensors, chemical residual analysis and in the production of nanostructured devices in plant breeding and genetic transformation. On the other hand, industry experts stress that agricultural nanotechnology does not demonstrate a sufficient economic return to counterbalance the high initial production investments. However, recent studies demonstrate that public opinion is not negative towards nanotechnology and that the introduction on the market of nanotech products with clear benefits will likely drive consumer acceptance of more sensitive applications. The rapid progress of nanotechnology in other key industries may over time be transferred to agricultural applications as well, and facilitate their development.

IMPACT OF MUSHROOM CULTIVATION ON SOCIO-ECONOMIC STATUS OF RURAL WOMEN IN SAMASTIPUR DISTRICT OF BIHAR

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The main purpose of this study was to determine the impact of mushroom cultivation on socio-economic condition of rural women. Recently unemployment is increasing rapidly both in developed and developing countries. In this situation, self-employment can be one important way to increase employment rate for small, marginal poor farm households for generating employment and earning extra money. They can easily cultivate mushroom in their home yard because it requires small piece of land where mushrooms can be grown. Mushroom cultivation might serve as means of generating employment, particularly for rural women and youths in order to raise their social status. By practicing mushroom cultivation farmers can contribute successfully and significantly to the economic development. Women constitute almost fifty percent of the entire population. Rural farm women are invisible in statistics while women are extensively involved in agricultural activities. Mushroom are the natural gift to human being which is rich in vitamin B complex including folic acid and B12 high protein with negligible starch and sugar high potassium sodium ratio low fat. Mushroom cultivation does not require very high investment or heavy infrastructural

background. Mushroom cultivation might serve as means of generating employment, particularly for rural women and youths in order to raise their social status. By practicing mushroom cultivation farmers can contribute successfully and significantly to the economic development. It will also provide additional work for the farmers during winter months when the farming schedule is light. So, mushroom cultivation plays a vital role for socio-economic development of mushroom beneficiaries. The study was conducted in Samastipur district of Bihar. Total 75 rural women were selected from adopted villages. Relevant data were collected with the help of personal interview. The data were analyzed using appropriate statistical tools. The finding indicates that majority of the respondents i.e. 44 percent were 15-35 years aged belong to backward cast having medium educational level and medium size of landholding. Majority of them were from large family size with medium level of family income and farm size. Our study was the impact of mushroom cultivation training programme on socio-economic status of rural women and constrain faced by them.

MANAGEMENT OF INTELLECTUAL PROPERTY RIGHTS IN INDIA

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The World Trade Organization's agreement on Trade-Related Aspects of Intellectual Property Rights set global minimum standards for the protection of intellectual property, substantially increasing and expanding intellectual property rights, and generated clear gains for the pharmaceutical industry and the developed world. IPR can be held only by legal entities, i.e. those who have the right to sell and purchase property. In other words, an institution that is not autonomous may not be in a position to own an intellectual property. IPR as a collective term includes the following independent IP rights, which can be collectively used for protecting different aspects of an inventive work for multiple protection: Patents, Copyrights, Trade secrets, Trademarks, Registered (industrial) design and Protection of IC layout design. Geographical indications and Protection of undisclosed information. The evidence in this study of innovation and intellectual property rights (IPR) protection strongly supports the view that effective economic institutions matter, even in India. In order to successfully transition the country from a development model dependent on cheap labor and physical investments to one that is innovation-driven, these results suggest that the role of the private sector will be crucial. Private firms are more innovative both in terms of quantity and quality of patents, and are more so in cities with strong IPR protection.

Keywords: Copyright, geographical indication, industrial design rights, patents, trade secrets and trademark.

MARKETING CHANNEL OF MENTHOL MINT (MENTHA) IN SITAPUR DISTRICT, UTTAR PRADESH

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The present study has been conducted in order to access the marketing of menthol in the state of Uttar Pradesh, India. Multi-stage sampling technique was used to select blocks, villages and the respondents from the four villages of two blocks in Sitapur district. A pooled list of all mentha growers was prepared for all selected villages and a sample of 60 farmers was obtained using probability proportion to size method. Two distribution channels were identified. The marketing of menthol is dominated by processor (Channel-1). Around 73 per cent produce was marketed through channel I. Marketing cost varied from Rs. 156 per kg in channel 1 to Rs. 162 per kg in channel II. A component of the marketing cost of the producer was cost incurred on distillation and processing of menthol. Producers' share in consumer Rupee is high i.e. 87.30 per cent in channel 1 while it was 83.10 per cent in channel II respectively. Even though the mentha cultivation is profitable, there are lot of lacuna in marketing of mentha oil like lack of awareness about export market and existence of intermediaries between farmers and processors/industries. Hence, there is immediate need to organize marketing of menthol through cooperative lines in the study area.

Keywords: Menthol mint, Mentha, Marketing efficiency, Marketing margins, Price spread

FARM ENERGY BALANCE AND MANAGEMENT: THE SOCIO- ECOLOGICAL, ECONOMIC AND ENVIRONMENTAL ANALYSIS

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Rice is not only the staple food of many countries but it is also a source of earning of millions of people. In India, rice farming is the major source of income of the farmers which is highly dependent on the energy inputs. Energy is the prime mover of economic growth, and is vital to sustaining a modern economy and society. Energy management is the judicious and effective use of energy to maximum profits (minimum costs) and enhance competitive positions. Efficient usage of energy in agriculture will minimize environmental causes, prevent destruction of natural resources and promote sustainable agriculture. The fundamental goal of energy management is produce goods and the least environment effect. Keeping this energy entropy in view, the present study on "Farm Energy Balance and Management: The Socio-ecological, Economic and Environmental Analysis" has been selected to study the energy balance i.e., metabolism, consumption and production in rice and efficient energy management as well as its overall impact goes on social, economic, ecological spheres of ecosystem. The study was conducted at villages namely Tulsi, Tarighat and Sipkonha of Patan block in Durg district of Chhattisgarh. It includes a set of depended variables i.e. Energy consumption in rice crop(Y_1), Energy balance in rice crop(Y_2), Energy metabolism in rice crop(Y_3), Adoption level of efficient energy management in rice crop (Y_4), Perception of energy management in rice crop at community level(Y_5) and Economic cost-benefit ration of rice crop(Y_6) to be estimated through a set of 24 exogenous variables i.e. Age(X_1), Education(X_2), Gender ratio(X_3), Size of family(X_4), Farm size(X_5), Occupation(X_6), Cropping intensity(X_7), Irrigation index(X_8), Expenditure allotment (X_9), Annual income(X_{10}), Amount of cow dung applied in farm(X_{11}), Implement use(X_{12}), Farm materials(X_{13}), No. of fragments(X_{14}), Distance of fragments(X_{15}), Training received(X_{16}), Crop diversity(X_{17}), Animal husbandry(X_{18}), Farming experience(X_{19}), Harvest index(X_{20}), Production per unit area(X_{21}), Communication media interaction(X_{22}), Market interaction(X_{23}) and Crop energy efficiency(X_{24}). The respondents have been 105 by count and have been selected through both purposive and random sampling approaches to ultimately derive and elicit their behavioral traits in characterizing energy balance and management of social, economic, physical ecological setup. The results show that following factors Age, education, Cropping intensity, Expenditure allotment, Annual income, Farm materials, No. of fragments, Distance of fragments, Training received have led to consciousness about the energy balances in social ecology and impact of these energy balance on the ecosystem as whole. All these analytical outcomes can be replicated to other enterprises as well to calculate energy balances. The principle components analysis has isolated 5 factors through an operationally conglomeration of 24 explanatory variables responsible for farm energy balances. All theses outputs can be replicated to other enterprises as well to calculate energy balances. The present study has been a modest attempt to audit on the happening energy metabolism, that is, a subtle balance between energy invested and energy generated from per unit area farm functioning. This will ultimately lead to a sustainable production function in agriculture and allied sectors' with ecological implication as well. So level of energy consumption and the elements of modernity are also to be reticulated and operationally orchestrated.

Keywords: Farm Energy Management, Energy Balance, Energy Metabolism, Energy Consumption, Social Ecology, Entropy.

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH

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The agriculture based Indian Economy needs high agriculture income for the farmers who feed the 1.25 billion Indian population. Not only this like developed countries who despite having much lesser area under cultivation, export number of farm products, This will attract more and more people towards agriculture, the backbone of the country. The Prime Minister Narendra Modi said that his government has decided to double the farmers' income by 2022 when India would celebrate 75 years of Independence The goal is achievable if the farmers adopt and use modern technology in cultivation like drip irrigation as it will direct the maximum utilization of water with minimum quantity. The Prime Minister said "Water is like God, we have no right to waste it.". The focus will then be on "More crop per drop", "Hark khet ko pani" (water for every farm), "Doubling farmers' incomes". Laying the route map to double the farmers income, the Prime Minister said "Centre has decided to double farmers' income by 2022 by improving technology, increasing milk production, use of solar light, honey production. The NITI Aayog has already come out with its 'Three Year Action Agenda' – a plan that covers a time period up to the 2019. In its chapter on agriculture titled '*Agriculture: Doubling Farmer's Incomes*', the economic think-tank has put forth a 4-point action plan to double the incomes of India's farmers. A subsidy would be provided on targeted produce in case the price falls below MSP-linked threshold. One advantage of this, as highlighted by the action plan, is that it would spread price incentives to producers in all the regions and all the crops considered important for providing price support. NITI Aayog has also called for substantive investment in irrigation, seeds & fertilisers and new technology coupled with a shift into high-value commodities such as horticulture, poultry and dairying to double incomes.

Keywords: NITI Aayog, "Hark khet ko pani", "Doubling farmers' incomes", Indian Economy

HALOXYLON SALICORNICUM - A SOURCE OF NUTRITION IN ARID RAJASTHAN**MALA RATHORE AND HEMANT KUMAR***Silviculture & Forest Management Division Arid Forest Research Institute, Jodhpur (India)*

In spite of significant improvements in the past few years, a great number of malnutrition related illnesses are still present in the county and remain a major public health issue as per the Rapid Survey on Children (RSoC), performed between the year 2013 and 2014. Among one sixth of the global population residing in India, about two billion people are suffering from vitamin and micronutrient deficit. Wild edible plants are critical for the sustenance of ethnic communities and are also a source of their income. They can provide the most needed micronutrients if incorporated in daily food diet as supplement. However, wild edible plants have till today received a little attention in research activities, economic development and biodiversity conservation. With a view of tapping the hidden potential resources of wild edible plants of Rajasthan, for their proper utilization, exploitation and sustainable management, a study on important arid zone plant, *Haloxylon salicornicum* (sajji) was carried out to investigate its nutritional potential. It is a shrub belonging to family Chenopodiaceae and occurs in saline areas. Since early times its seeds have been mixed with other grains for bread making in Jaisalmer during famine. Many medicinal applications of *Haloxylon salicornicum* viz. antidiabetic, antiseptic, anti-inflammatory are reported in literature. Hence, to determine their nutritional value, Sajji seeds were collected from Phalodi and three places in Jaisalmer viz. Nachna, Lathi & Siyamber. They were analyzed for moisture, ash, sugar, fat, fibre, vitamins and minerals using standard AOAC methods. Higher ash was obtained in samples from Siyamber (26.19%). Samples collected from phalodi gave higher fat content (3.51%). Higher sugar was obtained in samples from Lathi, Jaisalmer (6.11%). Mean protein content was higher in samples from Nachna (18.3%). Maximum Vitamin C was obtained in samples from Phalodi (47.96 mg/100g). Mineral analysis showed that *Haloxylon salicornicum* seeds were rich sources of Fe, Mg, Cu Zn and can be advocated as diet supplements for micronutrients. Thus, the importance of *sajji* as food supplement is highly significant.

Key Words: Nutritional, Proximate, Food, Supplement, Wild Edible, Forest

ROLE OF SOIL PHYSICS FOR ENHANCING SOIL PRODUCTIVITY**MALLO DEVI***Department of Physics, College of Basic Sciences & Humanities, CCS HAU, Hisar – 125001, Haryana*

Soil in its natural state rarely provides the most favourable physical conditions for crop growth. Plants require soil to obtain water and nutrients for growth and stability. Seeds will germinate, seedlings emerge and grow to produce a crop under a great variety of conditions. For satisfactory plant growth, it is essential that the soil provides a favourable physical environment for root development that can exploit the soil sufficiently to provide the plant's needs for water, nutrients and anchorage. Agricultural production depends very much on the physical properties of the soil, and mainly on those related to the soil's water holding and transmission capacities. These properties affect the availability of water to crops and may, therefore, be responsible for crop yields. The knowledge of the physical properties of soil is essential in defining and/or improving soil water management practices to achieve optimal productivity for each soil/climatic condition. Soil retention is a major soil water property that governs soil functioning as an ecosystem. The effects of changes in soil water retention depend on the proportions of the textural components and the amount of organic carbon present in the soil organic matter is one of the most important biophysical elements that can be managed to improve soil physical health and resilience. Incorporation of organic matter either in the form of crop residues or FYM has been shown to improve soil structure (aggregate stability) and water retention capacity, increase the initial and steady infiltration rates and decrease bulk density, resulting in reduction in crust formation and consequent increase in water productivity.

Key words : Soil physical properties, Soil water retention, organic matter

BETALAINS – ROLE IN CARDIOVASCULAR DISEASES AND THALASSEMIA**MAMTA RANI^{1*} AND PINKY BOORA²****Department of Foods and Nutrition, CCSHAU, Hisar*

Betalains are water-soluble nitrogen containing pigments, which are synthesized from the amino acid tyrosine and consist of two structural groups: red-violet betacyanins and yellow-orange betaxanthins. (Azeredo, 2009). Betalains are used for food coloration in products such as ice cream, candies, and processed meat and the quantity in these foods rarely exceeds 50mg/kg due to their strong pigment coloration (Vargas *et al.*, 2000). The majority of plants containing betalains are in the *caryophyllales* family (Moreno *et al.*, 2008). Betalains strongly reduce oxidized LDL cholesterol and protect against cardiovascular diseases. Betalains can bind to LDL and the oxidation of LDL appears to be inhibited by both betanidin and betanin (Guzman-Maldonado *et al.*, 2010). The Regular ingestion of *Opuntia robusta* (500g/day) is able to significantly reduce LDL in a group of patients suffering from hypercholesterolemia (Tessoriere *et al.*, 2004). Betalains assist the body in

a total transformation by neutralizing toxins and supporting the cell's natural detoxification process. They prevent toxins from accumulating and preserve the integrity of the cell and control chronic inflammation. They also reduce the enzymes responsible for causing inflammation, thus protect against CVDs. Betalains protect the thin lining of blood vessels and this helps to reduce the inflammation that makes your blood sticky and leads to clots. Betalains provide significant protection from toxins that directly affect liver (Stintzing *et al.*, 2004). Thalassemia is a blood disorder passed down through families (inherited) in which the body makes an abnormal form of hemoglobin. The disorder results in large numbers of red blood cells being destroyed, which leads to anemia. Betalains play indirect role in thalassemia minor by inhibiting the hemolysis of RBCs and increasing the life of cells. (Tessoriere *et al.*, 2005).

Keywords: Betalains, Cardiovascular disease, hypercholesterolemia and Thalassemia

STUDY ON PHYTOCHEMICAL CHARACTERIZATION AND ANTIBACTERIAL ACTIVITY OF FRUIT TREES OF CHAMOLI DISTRICT, UTTARAKHAND

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Rubus ellipticus, *Berberis aristata* and *Zizipus mauritina* are perennial herb from the Himalayas, found to grow on damp, old walls in chamoli. Ethanobotanically, juice of the plants are sore the fruits and applied to food, like a small size red, blue berry and golden pulp. The present study was carried out on the phytochemical characterization and antibacterial activity of the local fruit yielding plants in Chmoli Gharwal. Plant material was subjected to extraction using ethanol solvent. Phytochemical screening of the extract showed the presence of alkaloids, proteins, carbohydrates, cardiac glycosides, tannins and phenolic. The extract of the plants were assayed for antibacterial activity against the pathogenic bacterial strains. Out of the extracts assayed, the ethanol extracts was most active against the four gram positive and one gram negative bacterial stain while the ethanol extract was most active against. Maximum zone of Inhibition against (Antibacterial activity) *E. faecalis* strains and minimum inhibitory concentration also *E. faecalis* showing zone of inhibition. Therefore, minimum inhibitory concentration (MIC) of these extracts was determined against the selected bacteria showing zones of inhibition. The MIC for different strains range between 12mg/ml to 17mg/ml. So, it can be concluded that ethanol extract of possess good antibacterial activity that can be enhanced if the phytoactive components are purified and adequate dosage is determined for proper administration.

REASONS AND SATISFACTION LEVEL OF USING CASHLESS PAYMENT METHODS BY RESPONDENTS

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The present study was conducted in Hisar district of Haryana state covering 200 respondents from two localities viz., rural and urban. Results shows that majority of the respondents always utilized mobile banking as it is secure and risk-free and bankcards as they provides details of transactions and rarely utilized internet banking as they found it difficult to operate. As far as reasons for not using mobile phone as they do not trust the providers behind the app, not sure of using internet banking and did not use bankcards due to high interest rate and increased debt. Majority of respondents were satisfied with the number of transactions and quality of notes of ATM services; due installment enquiry of internet banking services; prepaid mobile recharge and clear instructions from tele phone banking services. Rao (2004) also aimed at comparing the marketing strategies of two of the commercial banks — Citi bank and Andhra bank. He also evaluated the customer satisfaction with respect to their credit cards and suggested necessary steps for promoting credit card business by considering its benefit and scope in the business.

Keywords: Mobile banking, internet banking, mobile phone, satisfaction

APICULTURE: A GROWING TREND IN INDIA

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Apiculture or bee-keeping is a technique of rearing honey bees for honey, wax, royal jelly and propolis as well as for increasing the crop yield. India is one of the largest honey producer and exporter in the world that plays an important role in world honey production and trade. In India Apiculture is a growing trend in India. Honey bee farming can be done separately as a commercial honey bee farm to get income from the honey and other by-products or integrated with crops to increase the crop yield. This is because bees play an important role in pollinating many plants. Sunflowers, Cheery, Apple, Citrus, Lily, Lotus and such other crops are highly dependent on bees for pollination. In addition, it does not require huge investments, infrastructure or even a fertile land to start bee farming in India. In agricultural, honey bees do not compete with the crops for resources. There are many by-products like honey, royal jelly, bees wax, pollen, propolis and bee venom. The most valuable by product of apiculture is honey that has a long history of human consumption. It is consumed as medicine, taken as food, or incorporated as an additive in a variety of food and beverages. India has been known as 'land of honey.' As per 2016-17 estimates, about 30 lakh bee colonies has been produced 94.5 thousand MT of honey. Yields of honey per colony with supers (20 frames) has increased to 25kg per annum in 2015-16 from 18 to 20 kg per annum in 2014-15. Asian bee (*Apis cerana indica*) and European bee (*Apis mellifera*) are important species for bee keeping as these are domesticated in nature. Honey bee farming may help in doubling farmers income by supplementing/complimenting agriculture/ horticulture. Unemployed youth can start this business with minimal funds (Rs. 1.00 to 2.00 lakhs) and can get good returns. Encouraging beekeeping encourages biodiversity.

Keywords: Apiculture, Honey, Growing trend, Pollination, India

ROLE OF POLICIES TO PRODUCE QUALITY SEED OF VEGETABLE CROPS

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Seed is a key component among all inputs for sustainable crop production. It is estimated that quality of seed accounts for 20-25% of productivity. The importance of quality seed has been realized by mankind long ago. "A good seed in a good field will win and prosper". In terms of genetic and physical purity is realized for first time during green revolution period with the establishment of National Seeds Corporation (NSC) in 1963. The principle responsibilities of NSC are establishing an adequate system of quality control inspection for scientific processing, storage and marketing of seeds. Policy making and implementations shall be free from political motivations. Few milestone events in seed policy by Govt. of India are - A. The Seeds Act, 1968, B. National Seeds Project, C. New Seeds Policy, 1988, D. PPV & FRA, 2001, E. The Seeds Bill, 2004. The global seed sector outlook 2025 for major vegetable crop species such as Brassica (Cabbage, cauliflower, broccoli), cucurbits (Muskmelon, watermelon, cucumber, squash), corn (Baby corn, sweet corn), Legumes (Pea, beans), leafy vegetable (Lettuce, spinach), Root – Bulb (Carrot, radish, onion), and Solanaceae (Pepper, eggplant, tomato) is a dynamic capture of semi-annual long range (10-15 year) forecasting data for global vegetable seed market. Vegetable seeds are the fastest growing category within the overall seed market. Vegetable play a major role in providing an affordable balanced diet. Vegetable seed business will ever have huge scope to success and will play an important role in economy in countries like India Making available quality seeds to the farmers in time and in sufficient quantity at reasonable prices.

SCOPE AND IMPORTANCE OF HONEYBEE FARMING IN INDIA

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Since ages, India is an agricultural country. People are dependent on agricultural goods. Honey is one such product. This honey has an important role in the Indian history. People often use it in the many pooja and all. They mix honey with milk and other items and offer it to the God. Such is the value that it has in India. Earlier there is not much importance for Honeybee farming in India. Earlier it was available in plenty and population is also less. But this is the exact opposite in the current scenario. Hence we are now going to explain the Honeybee Farming Disadvantages and Advantages. Here Honeybee Farming is nothing but Apiculture. Honeybee Farming can boost the income of the farmers. Hence they can rely on this apart from Agriculture. While it can produce a number jobs for the rural India. This, in turn, will decrease the unemployment. There are a number of Environmental Benefits of Beekeeping. Mainly the honey bees are responsible for cross-pollination. Health benefits of beekeeping are too many. Since honey is famous to treat a number of diseases, people can use it as medicine. It can play a big role in the preparation of medicines. With Bee Wax; a number of items can be produced. These are some of the Scope of Apiculture in India. Furthermore, check below to know more about this Apiculture in India.

Keywords: Honeybee, India, Agricultural, Disadvantages and Advantages.

ROLE OF WOMEN IN SERICULTURE AND COMMUNITY DEVELOPMENT

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In any discourse on sociology and anthropology, one fact that clearly emerges is that women can generally be trusted to perform their duties with utmost care and attention. This is more so in the case of agriculture and allied activities. No wonder women are playing a very important role in the sericulture industry. Their qualities like maternal instincts and loving care of those under their charge prove to be very helpful in the successful breeding of silk worms. The sericulture industry has opened up phenomenal employment avenues and helped women to become important players in the decision-making process—whether in the household or in the community at large. The active involvement of women is very essential for the success of the any community development initiative. This has been proved on many occasions all over the world—more so in the developing countries. For instance, the success of Self Help Groups (SHGs) in states of India is all due to the active role played by women. The thrust of this article is on the role of women in promotion of sericulture activities in the village, and how their participation has led to community development. Given the above backdrop, the present article is based on an empirical work undertaken in India. Sericulture is an important means for generating employment, income enhancement crop enterprises, and is a most appropriate household activity. In all these activities, women have shown their mettle and performed their tasks most skillfully. In the village under study, women are playing an important role in silk rearing and processing activities. This article will endeavor to show how “sericulture,” an agro-based activity, has brought about overall development of individual households, the village, and the community at large.

Keywords: women, sericulture, community development, division of labor.

ROLE OF KVKs IN AGRICULTURAL EXTENSION

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The Krishi Vigyan Kendras (KVK) in the country was established in 1974 with the first one at Pondicherry subsequent to the detailed discussions and studies followed by the recommendation of the Education Commission (1964-66), Govt. of India. Krishi Vigyan Kendras (Agricultural Science Centres) were established as innovative institutions for imparting vocational training to the practicing farmers, school dropouts and field level extension functionaries. The mandates of KVKs are: 1) Organizing frontline demonstrations (FLD) to establish production potential of various crops and enterprises on the farmers fields, (2) Conducting on-farm testing (OFT) to identify the location specificity of agricultural technologies under various farming systems, (3) Organizing need based training of farmers to update their knowledge and skills in modern agricultural technologies related to technology assessment, refinement and demonstration, and training of extension personnel to orient them in the frontier areas of technology development, (4) Creating awareness about improved technologies to larger masses through appropriate extension programmes, (5) Production and supply of good quality seeds and planting materials, livestock, poultry and fisheries breeds and products and various bio-products to the farming community and (6) work as resource and knowledge centre of agricultural technology for supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district. Therefore, KVK plays a significant role in Agricultural Extension for dissemination and change of Knowledge, Skill and attitude among farmers.

Keywords: KVK, Extension and skill.

DYE SENSITIZED SOLAR CELLS BASED ON NATURAL DYES AS SENSITIZERS: A REVIEW

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Since their development in 1991, dye sensitized solar cells (DSSCs) also known as Gratzel cells after the name of their inventor, have attracted huge attention in the field of renewable technologies due to their ease of fabrication, environment friendliness as well as lower production costs. The key components of a typical DSSC device are a nanocrystalline porous semiconductor photoanode film on surface of which a photosensitizer dye is adsorbed, a counter electrode typically made up of platinum, and a redox coupled electrolyte generally composed of iodide and tri-iodide ions. The sensitizer dye in DSSCs plays an important role of photon absorption and it is heart of DSSCs operation. Traditionally, ruthenium (Ru) metal based complexes as well as organic dyes have employed as sensitizers in highly efficient DSSCs but these are suffering from very high production prices. Recently, natural dye sensitizers extracted from natural resources such as flowers, fruits, vegetables, leaves etc. are the major research interests for researchers as these dyes can be extracted by very simple methods and have non-toxic behaviors. However, the efficiency values obtained from the natural dye based DSSCs are lower as compared to

the traditional sensitizers but optimization of the cell components that matches well with such dyes can boost the commercialization process for low-cost DSSCs. This review focuses on the recent developments in natural dye sensitizers, their extraction methods, their applications in low cost DSSCs, and work done on natural dye sensitizers on past years.

Keywords: Natural dye, sensitizers, DSSCs, low-cost, efficiency

ESTIMATION OF POPULATION VARIANCE USING NON-CONVENTIONAL LOCATION PARAMETERS IN ABSENCE AND PRESENCE OF NON-RESPONSE

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In survey sampling, the use of auxiliary information at the estimation stage has been discussed by various statisticians in order to improve the efficiency of their formulated estimators for estimating the population mean. Out of many ratio, product and regression methods of estimation are good examples in this context. The present study utilize the auxiliary information through Ratio type estimator, as these are extensively used in sampling theory in order to get precise estimates of the population parameters by taking the advantage of positive (high) correlation between study and auxiliary variable than usual sample mean estimator. In this study we have addressed the issue of estimation of population variance utilizing non-conventional location parameters and some of their functions of an auxiliary variable in absence and presence of non-response. A class of ratio type estimators have been suggested with their mean square error (MSE) in simple random sampling. The suggested estimators have been compared with the estimators given by Isaki (1983), Singh (1999), Kadilar and Cingi (2006a), Kadilar and Cingi (2006b), Solanki et al. (2015) and Singh and Kumar (2015). Further, an empirical illustration is carried out to support the theoretical findings.

Keywords: Non-response, Simple random sampling, Non-Conventional Location parameters, MSE, Efficiency

SIZING OF OFR UNDER DIFFERENT CROPPING SITUATIONS USING THE WATER BALANCE MODEL

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For natural resource management and sustainable development of rainfed farming systems, the optimum size of the rainwater storage and recycling structure is essential for mitigating the uncertainty of rainfall. The on-farm reservoir (OFR) is an auxiliary storage structure in upland rice fields to conserve excess rainwater and also to provide supplemental irrigation for increasing rice production as well as growing a second crop in winter season. But most of the structure is over-designed or under-designed because of inappropriate design procedures. Rice is grown generally in all topo-sequences including uplands during the rainy season. Rainfed upland rice in eastern India suffers from drought due to poor rainwater management practices during the monsoon season. These lands often remain barren in winter due to scanty rainfall and lack of rainwater storage facilities. The lowlands are best suited for rice production because of the adequate water availability and water holding capacity of the soil. For determining the optimum size of the OFR, daily simulation of water balance model in the cropped fields as well as in the OFR was developed to assess the availability of water in the OFR to meet supplemental irrigation demand of rice in monsoon season and pre-sowing irrigation to mustard in winter. This model requires soil, crop and meteorological data as inputs. To overcome this problem, user friendly software was developed using Visual Basic.NET. It simulates various water balance components such as evapotranspiration, seepage and percolation, surface runoff and depth of supplemental irrigation and ponding depth in the field on a daily basis. Seepage and evaporation are two major outflow component of unlined OFR. The software predicts optimal size of the OFR, so as to provide supplemental irrigation to kharif crops in critical growth stages. In rabi crops, supplemental irrigation is provided at pre-sowing and critical stages of crops. The software is able to compute size of the OFR for various cropping pattern i.e. rice, maize, rice-mustard and maize-mustard, etc. User has to specify the crop he wants to grow in the field and the type of irrigation practice he wants to follow. The developed software was validated using one year data (2014) collected from the field experiments conducted at Agricultural and Food Engineering Departmental farm of IIT Kharagpur. The software was tested for rice, maize, rice-mustard, and maize-mustard cropping sequence under different irrigation practices and different field sizes. The OFR size was found to be lower in case of single crop (maize) in comparison to rice-mustard because of higher irrigation requirement.

Keywords: Rainfed farming, on-farm Reservoir (OFR), water balance model, supplemental irrigation, cropping pattern.

INCREASING ECONOMY AND FARMER'S INCOME BY CONTROLLING THE EFFECT OF BIOTIC AND ABIOTIC FACTORS ON SHELF LIFE OF KANGRA TEA**MITTU KATOCH^{1*}, PARMOD VERMA, SATYANARAYAN MALLADI MURTHY AND RAJJU PRIYA SONI**^{1&3} Research Scholar, Lovely Professional University, Phagwara, Punjab., ²Assistant professor and ⁴Senior Research fellow, CSKHPKV, Palampur.

Tea, *Cammelia sinensis*, is one of the oldest and non-alcoholic beverages used in the world. It is available for consumption in six main variants, based on the oxidation/fermentation technique applied during processing. Black and green tea is the most common form of made tea. Basically commonly known but completely ignored problem of tea i.e. the effect of different packaging material (Flipovic. et al., 2009) on the shelf life (Debnath *et. al* 2012) of the Kangra tea and seasonal impact on tea. This study proves to be quite useful in respect of variety, durability, cost, production and economic status of the tea. As we aware, that tea is used worldwide as a beverage once or thrice a day. Shelf life is the important aspect on the storage of tea because quality and also the large quantity of stored made tea available at home get spoiled due to the non-availability or lesser knowledge about the best packaging material of tea against different seasonal variations and packaging problems (Gimenez et al., 2003). If this problem is solved then it is a better solution for society and also it strengthens the economy of India. The study is planned with objectives viz. 1.To study the impact of different packing material on the shelf life of Kangra Tea. 2. To study the seasonal impact on the shelf life of Kangra tea. and 3.Isolation and identification of different biotic factor responsible for the degradation of packed tea. Research work will be carried out through site selection, sample collection, from Palampur tea cooperative factory at three different growing seasons of tea in a different type of packaging materials. Various microbial parameters shall be tested in the laboratory of Crop Research laboratory of Agronomy department of CSKHPKV, Palampur and Natural Product Laboratory of IHBT CSIR Palampur of Kangra district (H.P.).

SOIL HEALTH CARD SCHEME**MOHAMMAD IMRAN, S.A.KERKHI, L.K. GANGWAR AND MOHAMMAD RIZWAN***Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India-250 110*

Sustaining agricultural productivity depends on quality and availability of natural resources like soil, water, etc. Intensive agriculture with growth in food grain production, use of varieties of seeds, usage of fertilizers with the existing Nitrogen, Phosphorus & Potassium consumption ratio is skewed from 8:2:3 (2012-13) as against preferred ratio of 4:2:1. Fertilizer recommendations rarely matches soil fertility need, and usage of fertilizers differs from place to place. Soil health card scheme is one of the flagship programmes of Government of India that was launched in February 2015. Schemes managed by Integrated Management (INM) Division in the Ministry of Agriculture Cooperation and Farmers' Welfare (AC&FW), Government of India (GoI). This scheme was launched to help farmers to know their soil health condition as represented by 12 important soil parameters (viz. Nitrogen, Phosphorus, Potassium, pH, EC, Organic Carbon, Sulphur, Zinc, Boron, Iron, Manganese and Copper) and follow management practices accordingly. Under this scheme, soil samples collected from different locations are analyzed in the Soil Testing Labs (STL) as per the norms provided in the scheme's operational guidelines. The results are uploaded in the national Soil Health Card portal which has been developed for registration of soil samples, recording test results of soil samples and generation of Soil Health Cards (SHCs) along with fertilizer recommendations besides an information module for monitoring progress. To issue Soil Health Cards (SHCs) to all 14 Crore holdings in the country about 2.53 Crore samples are to be analyzed. The cycle is proposed to be implemented in two years, with a target of 1 Crore samples for the year 2015-16 and 1.53 Crore samples in the year 2016-17. The soil health card will contain an advisory based on the soil nutrient status of a farmer's holding. It will show recommendations on dosage of different nutrients needed. Further, it will advise the farmer on the fertilizers and their quantities he should apply, and also the soil amendments that he should undertake, so as to realize optimal yields.

APPLICATIONS OF INFRARED RADIATION IN FOOD PROCESSING: A REVIEW**MOHD ISHFAQ BHAT¹, NAVIN CHANDRA SHAHI²***G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand -263145*

Wave concept of electromagnetics is the most important and classic concept defining the radiation patterns observed in our day to day life. With rapid technological advancements, this concept has been exploited in a wide scientific domain for the

betterment of human life. The various bands of EM spectrum have been used for different purposes in food processing sector. Infrared radiation is one of the most important bands of the electromagnetic spectrum having a wide domain application in food processing at the commercial level. The applications can be broadly divided into two group's viz. transformation of foods, quality evaluation, and disinfection. Among the transformation processes, drying is the most prominent, potential and experimented application. The other processes in the food transformation include blanching, peeling, roasting etc. most of which are being experimented on pilot or laboratory scale basis, and are giving promising results in terms of product quality, processing times and economics. Non-destructive quality evaluation of foods is one of the commercialized applications of IR radiation, which is specifically put under the name of Infrared spectroscopy, comprising of Near-infrared spectroscopy (NIR), Mid-infrared spectroscopy (MIR) and Far infrared spectroscopy (FIR). Surface disinfection of foods using infrared radiation is its recent application. Infrared radiation for drying has also been used in combined modes, in conjunction with convective drying and microwave heating, both of which have proved to be significant. All the aforementioned facts light up the more potential uses of infrared radiation in food processing.

Keywords: Infrared, Drying, Spectroscopy, Disinfection

EXPLOITATION OF UNDER-UTILIZED FIBRES FOR EARTH'S RESTORATION AND INCOME GENERATION

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The endowed creativity and innovative deeds of humans for the development of their society and their concern for the sustainable development and ecological conservation has diverted attention towards agricultural by- products. The by-product or waste from agro industries has found a potential place outside their respective field owing to their incredible properties. The region of Kumaon endowed with indigenous flora rich in natural fibres due to favorable climatic conditions. These plants are used by local masses for manufacturing household items. Considering the opportunities of natural by-product, a green manure, *dhaincha* "*Sesbania aculeata*" plant could offer an opportunity to produce textiles for technical end use. Besides its primary use, the plant can be taken up additional as a source of income generation among the local people. The researches on *dhaincha* have indicated the existence of splendid properties. Hence the study was planned with the objective to extract fibres for the development of nonwoven for agro textiles uses. The fibres were extracted from bark of 3 months old plant using 15 days stagnant water retting method. The fibres were processed with the combination of sodium carbonate and sodium hydroxide to remove noncellulosic vegetative matter and further softened with silicon softener. The processed fibres were suitable for the development of nonwoven for technical end uses. The extracted fibres exhibited properties like 5.43 g/denier tenacity, 3.41 % elongation, 35.3 denier fineness, 8.12% moisture content. The processed fibres exhibited better properties than extracted fibres and further used to develop nonwoven to use in agriculture as mulch material. The results showed effective moisture control through *dhaincha* nonwoven material in comparison to conventional mulch materials. Thus the use of plant grown for green manuring can be diversified for technical textile sectors and can lead to the economical and social development of a region and the country.

ROLE OF HOME SCIENCE IN INCREASING LIVELIHOOD AND ACCELERATING DEVELOPMENT IN RURAL AREAS

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Home science is an amalgamation of five dynamic departments, which in the very root of it have rural transformation as their basic component. All department have specific role to play and are very thoughtfully included in the course curriculum of home science. In recent trends it has gain more momentum because of the requirement to home scientists in particularly dealing with the farm women because no other stream offers that. The present paper is an attempt to pursue the changes home science has brought to the rural masses particularly farm women and added to the earning of family eventually ensuring the well-being of family. Paper provides facts and figures from secondary sources of data about its inception and the core values of the subject. It ends up with throwing lights on the avenues it can create in association with other allied agricultural sciences. Through Home Science Extension activities, rural women will have opportunities to discuss their problems and seek solutions to their problems. They will be helped to utilize, to the best of advantage, the products of their labour in agricultural production through improving their nutritional status, health and standards of living. This can provide integrated technical advice to farmers in all aspects of agriculture with emphasising that time utilization pattern of farm women, inter-gender work load, training need assessment and training course development for specific clientele groups needs to be developed.

IMPACT AND CONSTRAINTS OF TOILET SCHEME FOR RURAL WOMEN'S SECURITY IN INDIA**DIPIKA SACHAN***C S Azad University of Agriculture & Technology, Kanpur-208002*

Toilets are one important element of a sustainable system. Diseases, including cholera, which still affects some 3 million people each year, can be largely prevented when effective sanitation and water treatment prevents fecal matter from contaminating waterways, groundwater and drinking water supplies. Infected water supplies can be treated to make the water safe for consumption and use. Women's safety is a key driver behind the big push for sanitation in these villages, led by an Indian NGO called Discipleship Centre. We're here as Toilet Twinning, a partnership between development agencies Cord and Tear fund to raise money for sanitation projects. As in most poor, rural areas in India, open defecation is still the norm. But while men squat by the roadside in the early morning sun, culture dictates that women have to rise before dawn or wait until dark to relieve them. Prime Minister Narendra Modi's government has set itself a huge challenge: to end open defecation by 2019. Yet people in Shohorn feel they share of the government radar, the government offers grants to help poor families install a toilet, but the funding has to be applied for retrospectively, with no guarantee the application will succeed. Many people can't afford to take that risk. Toilets are unmanned toilets which work on a sensor-based technology. The self-cleaning and water conservation mechanism in the toilet makes it unique. The user has to insert a coin to open the door and its sensor-based light system is automatically turned on once you enter the toilet.

Keywords: Sanitation, Toilet, women, safety.

ROLE OF WOMEN IN ENVIRONMENTAL SECURITY IN INDIA**JYOTI GUPTA***C S Azad University of Agriculture & Technology, Kanpur-208002*

Health and Hygiene security in more women involve in the water supply and sanitation, however they have lack of knowledge and control to support the hygiene needed for health. Most men hygiene and control the resources and decision making and gender differences is rottenly missing on the consideration with regard to hygiene and sanitation initiatives. Women play an essential role in the management of natural resources, including soil, water, forests and energy and often have a profound traditional and contemporary knowledge of the natural world around them. Women were previously neglected or ignored. There was increasing attention paid to the impact of women on the natural environment and, results in positive effect of environment on the health and well-being of women. The gender-environment relations have valuable ramifications in regard to the understanding of nature between men and women, the management and distribution of resources including responsibilities, the day-to-day life and wellbeing of people. In terms of the environment, women around the world play distinct roles: in managing plants and animals in forests, dry lands, wetlands and agriculture; in collecting water, fuel and fodder for domestic use and income generation; and in overseeing land and water resources. By so doing, they contribute time, energy, skills and personal vision to family and community development. Women's extensive experience makes them an invaluable source of knowledge and expertise on environmental management and appropriate actions.

Keywords: health, hygiene, security, women, environmental.

SUSTAINABLE IMPACT OF SWACHH BHARAT ABHIYAN IN INDIAN SOCIETY**SNEH LATA SINGH***C S Azad University of Agriculture & Technology, Kanpur-208002*

The Honorable Prime Minister Sri Narendra Modi announced the making of "Swachh Bharat " (Clean India) into a mass movement and linking it to economic activity to ensure greater participation, Mission Swachh Bharat has been launched. This programme launched on October 2, with Mahatma Gandhi as the inspiration, to create a clean India of his dreams by 2019, his 150th birth anniversary. The Prime Minister has said that the pursuit of cleanliness can be an economic activity, contributing to Gross Domestic Product growth, reduction in health care costs, and a source of employment. Linking Cleanliness to tourism and global interest in India, the Prime Minister has said world class levels of hygiene and cleanliness are required in India's top 50 tourist destinations, to bring about a paradigm shift in the country's global perception. August must be acknowledged, appreciated and adopted by every citizen of the country as an actor in the making of the nation. However, it must be noted that the 'Clean India'. However, it must be noted that the 'Clean India' campaign should not be a rechristened version of the similar such campaigns like total Sanitation Campaign or Nirmal Bharat Abhiyan which aimed at Universalizing safe sanitation. In this context, the present article endeavors to briefly review the significant efforts and initiatives for clean India in the recent past and the lessons that could be taken for making 'Clean India' campaign a reality. This inter alia means that even in 21st century our rural masses are compelled to either open defecation practice or to the

unhygienic toilets and even the dry latrines. Swachh Bharat mission is very necessary to run continuously in India to really get the feeling of physical, mental, social and intellectual wellbeing. It is to make living status advance in India in real means which can be started by bringing all over cleanliness. Below I have mentioned some points proving the urgent need of Swachh Abhiyan in India.

Keyword: Swachh Bharat, Mission, Clean India,

MEDICINAL AND AROMATIC CROPS: POTENTIAL SOURCE FOR ENHANCING FARMER'S INCOME IN INDIA

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Medicinal plants are plants that provide people with medicines - to prevent disease, maintain health or cure ailments. India has about 2,000 species of medicinal plants and a vast geographical area with high production potential and varied agro-climatic conditions. Medicinal herbs are considered as valuable and profitable cash crops. The herbs have a good export potential also. Growing, processing and selling medicinal herbs have better opportunities for the farmers. Indian Govt. has formed Central Herbal Agro Marketing Federation of India to provide the marketing facility to the herbs growers. Any individual having sufficient land and irrigation source can start herbs business in India. From the commercial point of view, it is important to have a prior feasibility report of the particular herbs that we are planning to grow. The medicinal plants contribute to cater 80 per cent of the raw material used in the preparation of drugs. Many valuable drugs (e.g. atropine, ephedrine, tubocurarine, digoxin, reserpine) came into use through the scientific study of indigenous remedies. A number of medicinal plants (Ghrit kumara, kalmegh, Artemesia, satavah, Neem, brahmi) produce essential oils used for perfumery e.g. Ajwain, cedar wood, celery seed, citronella, eucalyptus, lemon grass, mentha, spearmints, Palmarosa, patchouli, turpentine and vetiver etc. Exploiting the benefits of global markets for Indian medicinal and aromatic plants, there is an urgent need to focus attention on Indian traditional systems of medicine and through scientific approaches makes them widely acceptable at national and international levels.

Keywords: Medicinal herbs, Aromatic crops, Cash crops, Drugs.

ACCEPTABILITY OF FIBRE RICH COOKIES DEVELOPED FROM POMEGRANATE PEEL FLOUR MUMTAZ BEGUM, ZEBISH ALI AND RITU TOIJAM

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To develop value added Cookies by incorporating pomegranate peel flour. To determine organoleptic and nutritional attributes of prepared cookies. Methods:- Sensory evaluation of pomegranate peel flour cookies was done by panel of five judges. Products were scored with help of "Nine point hedonic scale" score card especially prepared for the purpose. Results:- On basis of findings it was observed that average sensory scores of different parameters in control and treated sample of pomegranate peel cookies indicates that treatments T₂ (8.7) had highest score followed by T₁ (8.2), T₀ (7.3) and T₃ (6.3) making it obvious that an increase in amount of Pomegranate peel powder also increase Overall acceptability of Cookies gradually. At 10% of Pomegranate peel flour incorporation overall acceptability was maximum but it slightly decreased when level of incorporation was increased to 15%. Conclusion:- Fruit peel is generally discarded in majority of fruits juice corners. Even when it is safe for consumption. Peel is recognized as essential components of diet as it contains vital nutrients which play important role in well being. Pomegranate peel is rich source of flavonoids which is powerful antioxidant and protect cells from cancer-causing free radicals. Pomegranate peel can be incorporated in cookies to enhance its fiber content. These can be recommended to the people suffering from GI disorders and constipation.

Keywords:- Pomegranate peel flour, cookies

PERFORMANCE OF FARMER PRODUCER ORGANATIONS (FPOS) IN ANDHRA PRADESH

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The Indian agrarian condition becoming worsen as day by day, due to distortion of marketing ,their produced goods and avoid middle men , to get minimum cost of the product by the farmers . Small Farmers' Agribusiness Consortium (SFAC) is

providing support for promotion of FPOs. The main aim of FPO is to ensure better income for the producers through an organization of their own. Small producers do not have the volume individually (both inputs and produce) to get the benefit of economies of scale. Besides, in agricultural marketing, there is a long chain of intermediaries who very often work non-transparently leading to the situation where the producer receives only a small part of the value that the ultimate consumer pays. Through aggregation, the primary producers can avail the benefit of economies of scale. They will also have better bargaining power vis-à-vis the bulk buyers of produce and bulk suppliers of inputs. The ownership of the PO is with its members. It is an organization of the producers, by the producers and for the producers. In India total numbers of FPOs are 769. The highest number (141) of FPOs are in Madhya Pradesh and the lowest number (1) in Mizoram. In case of Andhra Pradesh having seven FPOs, out of two are performed well namely Sri Ramanjaneya Farmer Producer Company Limited and Simhadri Farmer Producer Company Limited which are located at Vijayanagaram. Maize and Paddy are the major commodities traded, with an annual turnover of Rs. 7 lakhs and Rs. 2.20 lakhs respectively. The FPOs are given pathway for boosting the economic conditions of small and marginal farmers. Therefore need to strengthen Indian agricultural marketing conditions by extension and execution of FPOs, this leads to betterment of farming community in India

Keywords: Producers, Performance, Marketing

ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF AGRI-ENTERPRISES

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Economies analysis refers to the ability of a farm to lower costs of production by increasing production. Agriculture production displays an L-shaped average cost curve where costs are lower initially but reach a point where no further gains are achieved. Spreading fixed costs, bulk purchases, and marketing power are cited as reasons for economies of size. Labour-reducing technologies may be the primary reason. Most studies do not include the external costs from prophylactic antibiotic use, impact on rural communities, and environmental damage associated with large-scale production. These can contribute to the economies of size. Agribusiness is defined as all business enterprises or sells to farmers / traders / consumers. The transaction may involve either an input or a produce or service and encompasses items such as:-Productive resources (feed, seed, fertilizer, equipment, energy, pesticides, machinery, etc.), Agricultural commodities – (raw and processed commodities of food and fiber), Facilitative services (credit, insurance, marketing, storage, processing, transportation, packing, distribution, consultancy, soil testing etc.). This study aims to identify the income level required for agricultural enterprises to achieve economic sustainability. The theory behind the equation used to calculate a sustainable income is explained. The ecological, technical, social and economic components of sustainability in agricultural enterprises have been identified and discussed and the importance of economic sustainability in terms of achieving total sustainability has been emphasised. Economic sustainability was divided into three rating the income needed to meet the cost of living and to address depreciation and interest costs for the enterprise. Those enterprises that achieved this income level were determined to be economically sustainable.

NATURAL RESOURCES AND EDUCATION FOR SUSTAINABLE DEVELOPMENT

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People depend on natural resources for their survival. The Earth's ecological cycle cleans the air we breathe, recycles and purifies the water we drink, provides us with food and fuel. The diversity of natural resource also provides enormous economic and community benefits through the use of biological resources in forestry, farming, fishing, recreation and other activities. However, the dimensions of our current resource use are to have access to their fair share of scarce resources are endangered. Thus, sustainable development that dimension of natural resource is important. Sustainable Development is "ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs". One of the most effective ways of ensuring we appreciate the importance of sustainable development is through the environmental education process. The aim of this study is to examine environment and sustainable development concept on the world and environmental education for sustainable development is to provide for sustainability. Key words: Natural Resource & Environmental Education for Sustainable Development

FARM MECHANIZATION AND POST HARVEST TECHNOLOGIES AND THEIR MANAGEMENT

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Farm mechanization is the application of engineering and technology in agricultural operations, to do a job in a better way to improve productivity. This includes development application and management of all mechanical aids for field production, water control, material handling, storing and processing. Mechanical aids include hand tools, animal drawn equipment, power tillers, tractors, engines, electric motors, processing and hauling equipment. Post harvest loss reduction technology encompasses the usage of optimum harvest factors, reduction of losses in handling, packaging, transportation and storage with modern infrastructure machinery, processing into a wide variety of products, home scale preservation with low cost technology. Use of thermal processing, low temperature, drying, chemical and biological reactions coupled with other preservation techniques are applied to enhance the storability. Containers and packaging materials confer portability as well as extend the shelf-life. Adoption of these techniques could make available a large quantity of food by avoiding losses and provide better quality food and nutrition, more raw materials for processing, thus ensuring better returns to the farmers. Importance of Post-harvest technology lies in the fact that it has the capability to meet food requirement of growing population by eliminating losses making more nutritive food items from raw commodities by proper processing and fortification. Post Harvest Management Practices there are following as - Harvesting-Produce must be harvested without any form of damage and under certain conditions in order to maintain its good quality and prevent spoilage. Harvesting Methods-The use of proper tools will prevent unnecessary injury to the produce being harvested. Field Handling. Grading-The best quality is grade one, those with defects is placed in the grade two and the poorest quality placed in grade three. Packaging-for protect the produce against rough handling during loading and unloading and transport. Storage -Make sure that the containers and the storage rooms are clean to prevent contamination and spoilage of the produce. **Transport-** During transportation, the produce must be protected against sun, rain and dust by covering it with a light colored tarpaulin or enclosing it in a refrigerators truck.

AGRICULTURAL MARKETING, ENTREPRENEURSHIPS DEVELOPMENT AND IMPORT-EXPORT OF AGRICULTURAL COMMODITIES

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Agricultural marketing is inferred to cover the services involved in moving an agricultural product from the farm to the consumer. It is also the planning, organizing, directing and handling of agricultural produce in such a way as to satisfy the farmer, producer and the consumer. Numerous interconnected activities are involved in doing this, such as planning production, growing and harvesting, grading, packing and packaging, transport, storage, agro and food processing, distribution, advertising and sale. Effectively, the term encompasses the entire range of supply chain operations. However, its key function is to help direct these services, by providing competent and able market information, thereby linking the other operations into an integrated service with targeted outcomes. A class of entrepreneurs is must for the economic and industrial development of country. To some extent entrepreneurs are born but not totally. Those who have decided to become entrepreneurs must have basic understanding, visionary power, sense of value, risk-taking capacity, innovative nature etc. as basic qualities. But now-a-days one can be developed as per his/her requirement. They can be motivated and developed to undertake the entrepreneurial activities. Someone has rightly said that, "Self-development is the best development". There are so many means, facilities, supportive institutions, tools, etc. that can be used to motivate and develop entrepreneurs. India since ages has been known to be an agrarian country as nearly 60% of its population is dependent on agriculture for living. During the mid-1960s, India suffered a shortage of agricultural products that later on led to the green revolution that revolutionized the agricultural sector. India not only was able to fulfill the demands of countrymen but it also exported many agricultural goods for profits to other countries. In the present time as well, India's agricultural export amounts to \$33.87 billion as of 2017. This amounts to 10.5% of total export that Indian does.

IMPACT OF WOMEN'S EDUCATION ON THE GROWTH OF AGRICULTURAL BASED SMALL SCALE INDUSTRIES

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The livelihoods of a larger part of India's population depend on agriculture. Agricultural based business directly influence the country's notional and international economic growth. In past few years many government policies had appreciated the development of agricultural enterprises from small to large scale. This had led to the emergence of many successful small to

large scale agri. Entrepreneurs and had also rigid the country's economic position in international market. Many previous studies had shown the role of women in the development and growth of the agriculture based enterprises. In this array to understand the impact of the women's education on the growth of agricultural based small scale industries in rural areas of district Varanasi the present study was conducted with a total of hundred women. The results from the present study revealed a significant impact of women and their level of education on the growth as well as development of rural small scale enterprises. The educated women agri-entrepreneurs were able to utilize the government schemes more efficiently than that of the uneducated one. The benefit cost ratio of those enterprises which were owned by educated women was also found significantly higher than that of the uneducated ones. This might be due to a better understanding toward the different market strategies, channels and management practices by the educated women. Furthermore, the results supported that both educated and uneducated women play a pivotal role in the growth and development of agricultural based enterprises in the rural India. However, women education directly affect the growth and development of agricultural enterprises in rural therefore we need more rigid policies for women's education.

Keywords: Rural, Agricultural Enterprises; Women's Education; Livelihoods.

STUDY ON ENVIRONMENTAL ETHICS AMONG THE HIGHER SECONDARY STUDENTS

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The definition of environmental ethics rests on the principle that there is an ethical relationship between human beings and the natural environment. Human beings are a part of the environment and so are the other living beings. Concept of environmental ethics brings out the fact that all the life forms on Earth have the right to live. Environmental ethics has given a new dimension to the conservation of natural resources concern of mankind to take part in an environmental organisation or voluntarily involve in various instrumental activities is known as participation in the environmental activities. The aim of the present investigation was to study the environmental ethics among higher secondary students. The study was conducted to purposive random sampling of 200 higher secondary students were selected from different school of Faizabad district. The investigators employed the gender, locality of institution, type of institution, medium of instruction, residence of students and type of family of higher secondary students. Descriptive study was used to analyze the data on Dr. Hseen Taj" scale and environmental ethics was used as a tool to measure the environmental ethics, this scale consists of 45 items with three categories. The maximum score is 135 and minimum possible score is 45. The data obtained was subjected to statistical analyzed using significance of difference of mean was calculated using t-test or ANOVA. The findings of study revealed that there that exists significant difference in the environmental ethics of higher secondary students belonging to locality of institution, residence of student and show do not significant difference belonging to gender, type of institution, medium of institution, and type of family towards environmental ethics of higher secondary students.

Key words; Environment, ethics, ANOVA, gender etc.

OPINION LEADERSHIP AMONG FARM WOMEN: A STRATEGY FOR WOMEN INCLUSION IN DEVELOPMENT

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Women are considered to play a critical role in the dynamic process of social change. More specifically, rural women engaged in agriculture and allied activities have been realized as the backbone of rural economy of the nation. Any development effort in this direction requires sensitivity and understanding of women's preferred style of communication, interaction and leadership. In context of Uttarakhand, most effective and leading workforce is of women, visible in every walk of life, from agriculture to small industry. But due to certain specificities like inaccessibility, fragility, marginality, diversity or heterogeneity, as described by Jodha (1992), life in general is tougher for Himalayan women. In spite of their central role in agricultural, they face numerous constraints and challenges in accessing support services, especially extension services that are offered by the state or private organizations (Karuna, 2013). However, over time the top- down approaches has been switched to target- based, group oriented, and participatory approaches. Thus, the focus of any developmental strategy has shifted to women as informal leaders. The influence of opinion leaders on their fellow farmers in the adoption of new technologies has being underestimated in many farming communities in developing countries (Williams, 2005). For effective dissemination of generated information and technology, the combined effort of extension personnel along with the opinion leaders is a vital/critical component of any effective developmental strategy. The paper identifies informal leaders among women farmers in two villages of Uttarakhand state who can be trained and suitably utilized to empower women.

Further, in order to effectively utilize the opinion leaders, their extent of opinion leadership has been stated. Thus, the paper highlights both on identification of opinion leaders as well as analyzing their extent of opinion leadership.

Keywords: Opinion leaders, Opinion leadership, Farm women, Extension strategy, Women development, informal leaders

DAIRY SECTOR GROWTH IN INDIA VIS-À-VIS HARYANA

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Dairying plays an important role in strengthening rural economy of India. It is perceived to be an effective instrument for bringing socio-economic transformation. It contributes more than one-fifth to the agricultural value of output and provides employment to about 21 million people, the majority of whom, are resource-poor. India is the largest producer of milk in the world. The milk revolution ("Operation Flood"), started by National Dairy Development Board (NDDB) in 1970, transformed India from being milk deficient to the largest milk producer surpassing USA in 1988. The program was led by Mr. Verghese Kurien, known as the Father of White Revolution in India. Dairying in India has come a long way, from being written off as a basket case to the largest milk producer in the world, with production crossing 155.5 million tonnes in 2015-16. Milk production has increased tremendously despite the fact that 70 per cent of its producers are small landholders and landless households. Since 1970, India's milk production has grown by an average of nearly 4% per year and in 2006 became the largest milk producing country in the world. At national level, 57 per cent of the milk production consists of buffalo milk and 43 per cent of cow's milk. The total milk production has increased from 17 million tonnes in 1951-52 to 155.5 million tonnes in 2015-16. The per capita availability of milk has reached a level of 337 grams per day during the year 2015-16, which is more than the world average of 299 grams per day in 2015-16. And Haryana alone contributes 8.4 million tonnes of milk in 2015-16 and second in milk availability after Punjab.

Keywords: Dairying, milk production, million tonnes, grams, economy

ECO-WASTE MANAGEMENT

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Citrus by-product represents a major problem in the field of food industry. It represent more than 1.5 million tons per year of waste. That waste consists of seeds, pulp and peels (albedo and flavedo), which are represent one half of the fruit. Orange contributes approximately 82% of the citrus by-products. Peels are the main by-product of citrus industry which may lead to environmental pollution due to its bad disposal and accumulation. Citrus fruit peel contains carbohydrates, pectin and fiber, that giving it to better functional properties. Thus, citrus fruit residues, which are generally discarded as waste in the environment, can act as potential for antimicrobial finish for fabric. Due to their low cost and easy availability such wastes are capable of offering significant low-cost antimicrobial finish. The utilization of these bioactive rich citrus residues can provide an efficient, inexpensive, and environment friendly platform for the production of novel antimicrobial finish in the fabric which resist the bacteria. This review systematically summarized the potential components present in citrus peel, which generally discarded as waste.

Keywords: - Antimicrobial, Citrus Peel, Waste.

KRISHI VIGYAN KENDRA: A POWERFUL TOOL TO TRANSFORM AGRICULTURE

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The Education Commission(1964-1966) recommended that a vigorous effort be made to establish specialized institution to provide vocational education in agriculture and allied fields at the pre and post-matriculate levels to cater the training needs of a large numbers of boys and girls coming from the rural areas the commission, further suggested that such institution be named as 'Agricultural Polytechnics'. The recommendation of the commission was thoroughly discussed during 1966-72 by the Ministry of education, Ministry of Agriculture, Planning Commission, Indian Council of Agricultural Research(ICAR) and other allied institutions. Finally, the ICAR mooted the idea of establishing Krishi Vigyan Kendras(Agricultural Science Centers) as innovative institutions for imparting vocational training to the practicing farmers, school dropouts and field level extension functionaries. The ICAR standing committee on Agricultural education in its meeting held in August 1973, observe that since the establishment of Krishi Vigyan Kendras(KVKs) was of national importance which would help in accelerating the agricultural production as also in improving the socio-economic conditions of the farming community The ICAR therefore, constituted committee in 1973 headed by Dr. Mohan Singh Mehta of Seva Mandir, Udaipur(Rajasthan) for working out a detailed plan for implementing this scheme. The committee submitted its report in 1974. The first KVK, on a

pilot basis was established in 1974 at Pondicherry under the administrative control of Tamil Nadu, Agricultural University, Coimbatore. The planning the commission approved the proposal the ICAR to establish 18 KVKs during the fifth five year plan. With the growing demands for more such Kendras, the Governing body of the Councils approved 12 more KVKs in 1979 and they were established in same years from Agricultural Produce Cess fund. Pending clearance sixth five year plans scheme on KVK planning commission, the GB of the Council again approved 14 KVKs in 1981 which were established during 1982-83 from AP Cess fund. At present, there are 669 KVKs. Out of these 458 are under State Agricultural Universities(SAUs) and Central Agricultural Universities(CAUs), 55 are under ICAR institutes, 100 under NGOs, 35 under State Government, and remaining 21 under other educational institutions. The KVK scheme is 100% financed by Govt. of India and the KVKs are sanctioned to Agricultural Universities, ICAR institutes, related Government Department and Non Government working in Agriculture. Krishi Vigyan Kendras are agricultural extension centers and its affiliated institution at district level provide various types of farm support to agricultural sector. The mandates of KVKs technology assessment and the demonstration for its application and capacity development. Frontline demonstration to establish production potential of technology on the farmers field Capacity development of farmers and extension personal to update their knowledge and skills on modern Agricultural technologies. To work as knowledge and resource central of Agricultural technologies for supporting initiatives of public, private and voluntary sectors in improving the Agricultural economy of the district. Provide farm advisories using ICT and other media means on varied subjects of interest to farmers. In addition KVK would produce qualities technological products(seed, planting material, bio-agents, livestock) and make it available to farmers, organized frontline extension activities, identify and document selected farm innovations and converge with ongoing schemes and programs within the mandate of KVK.

NUTRITION GARDEN AN INTERVENTION AGAINST MALNUTRITION: A CASE STUDY ON NICRA VILLAGE.

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India is the second largest producer of fruits and vegetables, but their consumption is meager among the rural population that leads to malnutrition. Malnutrition is a serious problem which effects the potentials of an individuals. The sustainable solution to this problem lies in the improvement and diversification of household diets by raising kitchen garden. Vegetables are rich source of nutritional bioactive compounds. They are important sources of protective nutrients like vitamins, minerals, antioxidants, folic acid and dietary fibers. The diversified and highly nutritive vegetables are affordable and cost effective solution to hidden hunger. Home gardening contributes to household security also by providing direct access to healthy diet that can be harvested, prepared and fed to family members, often on daily basis with adequate macro and micronutrient at door step. Keeping this view into consideration the present study was taken during 2014-2015, 2015-2016 and 2016-2017 as an intervention programme in NICRA Village Said-Sohal of Kathua district of J&K. In this village 40 families were provided with mini seed kits of seasonal vegetables at backyard of their houses with an objective to investigate the role of kitchen gardens in food supply and nutritional diversity. Results revealed that kitchen garden could not only help in mitigating malnutrition by providing fresh vegetables round the year but also enhanced income indirectly by saving the money, which otherwise incurred in purchasing of vegetables. Moreover these vegetables are chemicals like insecticides and pesticides free. Apart from that in general health and improvement in general health and comparatively less incidence of diseases was reported with annual reduction on family expenses on vegetables.

AN ECONOMIC ANALYSIS OF PRODUCTION & MARKETING OF MUSTARD IN MORENA DISTRICT OF MADHYA PRADESH

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Madhya Pradesh is a leading state of India in terms of area and production of oilseeds and recognized as soya state in the country. It becomes possible only due to the serious efforts made by the scientists and the government resulting into tremendous increase in oilseed production. Amongst different major oilseeds cultivated in Madhya Pradesh the mustard crop stands on second position after soybean with 10.70 per cent acreage (AERC Report 2014). An experiment was conducted

during the year 2015-16, to find out the cost and return of mustard crop in Morena block in Morena district in Madhya Pradesh. For this objective, 50 grower farmers were selected randomly out of 230 mustard grower farmer and classified in different size of farm holdings viz, small, medium, and large. Cost of cultivation & Cost of production were calculated with the help of cost concept including Cost – A1, A2, B1, B2, C1, C2, C3 and calculate B:C Ratio / Input – Output Ratio, gross income and net income etc. On the basis of study area, it was found that in regulated market Rs. 3282, 3282 and 3502.83 per quintal were received by the small, medium and large farmers, respectively when they sell their produce to local village trader and processing mills it was found to be Rs. 3343, 3317 and 3217, 3288 & 3487.67 per quintal were received by the above mentioned categories, respectively. Average distance to sale point was 15 kms. On the basis of analysis of data it can be concluded that the net income of mustard in case of small, medium and large and overall categories of the farmers was recorded as Rs. 31497.38/-, 32042.57/-, 27095.56/- and 30211.84/- per hectare, The B:C ratios obtained under mustard cultivation were 2.78, 2.72, 2.34 and 2.61 among above mentioned categories, respectively. The yield of mustard obtained under small, medium, large and overall categories was 14.86, 15.35, 13.51 and 14.57 q/ha and cost of production to obtain a quintal of mustard was recorded as Rs. 1190.76/-, 1211.69/-, 1502.01/- and 1301.49/-, respectively. The cost of cultivation per hectare of mustard was documented as Rs. 17691.32/-, 18599.50/-, 20295.66/- and 18862.16/- respectively among different the categories.

Keywords – Cost of cultivation, Cost of production, Gross return, Net income, and B: C Ratio

SYNTHETIC STUDY OF GALACTOPYRANOSYL AMINO ALCOHOLS AND THEIR BIOEVALUATION

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Everyone wants to be healthy, but many of us decline to act in healthy ways. The lifestyle of the people affects the environment. Global public health aims at improving health on a population level. Infectious disease like Tuberculosis (TB) caused by *Mycobacterium tuberculosis* affects about 8 million people worldwide and kills 2 million people annually. Multiple drug resistant (MDR) tuberculosis and its synergy with HIV and mycotic infections particularly due to *Candida albicans*, *Candida sp.* and *Cryptococcus neoformans* in immunocompromised patients have worsened the problem. Cell wall of *M. tuberculosis* is an ideal and selective target in antitubercular drug development as it protects the bacterium and to a large extent responsible for drug resistance. Galactose and arabinose are predominant in cell wall of mycobacterium. Thus synthesis of carbohydrate based drugs might be more effective in drug discovery area. Ring opening reaction of Epoxide derivative of galactopyranosyl Sugar with various amines in ethanol and in presence of tetrabutyl ammonium bromide (TBAB) as phase transfer catalyst resulted in quantitative yield of some galactopyranosyl amino alcohols compounds at ambient temperature in a shorter duration. Thus use of TBAB not only increases the yield of the product but also saves time and energy both. The secondary amines namely pyrrolidine, piperidine, 4-(6-chloro-2-pyridyl)- piperazine and morpholine on similar reaction with above epoxides would give corresponding galactopyranosylated amino alcohols in quantitative yields. All compounds synthesized would be tested for biological activity.

Keywords: Tuberculosis, sugar, epoxides, amines

ANTIMICROBIAL EFFICACY OF *THELYPTERIS DENTATA* AND *POLYSTICHUM DISCRETUM* AGAINST GRAM POSITIVE AND GRAM NEGATIVE BACTERIA CAUSING INFECTIONS IN HUMANS.

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Ferns are a group of about 12000 species commonly known as Cryptogram vascular plants. The present study was carried out to investigate the medicinal potency of selected ferns collected from different locations of Mussoorie and Jammu. Various Plant parts were used such as Rhizome and leaves for the extract preparation. The antimicrobial activity was assessed by Agar well diffusion method and MIC assay. The data obtained was very effective against *E.coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Staphylococcus aureus*. Phytochemical analysis was also done to find out the significant compounds responsible for exhibiting potent antimicrobial activity. Tests detected the presence of Flavonoids, Tannins, Saponins etc., which supported the data. On the basis of the data obtained, *Thelypteris dentata* and *Polystichum discretum* can be used to treat various afflictions caused by pathogenic bacteria in humans as herbal formulations pose negligible side effects.

Keywords: *Thelypteris dentata*, *Polystichum discretum*, MIC, Agar well diffusion method, Flavonoids, tannins, Saponins, Ferns.

EXTENSION STRATEGIES INCLUDING E-INITIATIVES TOWARDS FARMERS PROSPERITY

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Extension programmes So many Extension programs are going on for Farmers prosperity like NMSA, Rainfed Area Development (RAD), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), Adoption of micro irrigation is providing economic benefits to farmers, Micro Irrigation Fund, Agriculture Contingency Plan, Rainfed Area Development Programme (RADP), National Watershed Development Project for Rainfed Areas (NWDPA). Most of the family farmers in developing countries live rural areas and are in most cases divorced from technology and vital agricultural support services needed to carry out farming activities. Extension and advisory services are relevant to smallholder farmers, who remain the bedrock of the agricultural and food supply chains in developing countries. Providing farmers with (i) timely and relevant information; (ii) access to credit; and (iii) better market prices could go a long way in addressing global poverty and improving agricultural productivity. The aspect of timely and relevant information, especially with the role of Information Communication and Technology to connect farmers with the information they need has received much attention in the last decade. There is a growing body of experience providing lessons on factors required for successful ICT applications in agricultural extension and on how ICT can lead to beneficial behavior change amongst poor farmers. 3 important roles which ICT can play are in enhancing agricultural production, improving market access, and capacity building and empowerment. ICT initiatives are IT Ce-chaupaln-Logue, Tara-haat, Akshaya, Gyaan, doot Rural E-seva, Warana Wired Kisan Call Centers, Village Knowledge centers, agmarknet, enam, apps viz. kisan suvidha, pusa krishi, mkisan application, shetkari masik android app, farm-o-pedia, bhuvan hailstorm app, crop insurance mobile app, digital mandi india, mncfc, karnataka bhoomi, hp soil testing, intelligent advisory system for farmers, crop info.

DIETARY PATTERN OF ADOLESCENCE GIRLS OF URBAN, RURAL AND SLUM AREAS

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Adolescent may represent a window of opportunity to prepare nutritionally for a healthy adult life. Adolescence is an important stage of growth and development in the lifespan. Unique Nutritional and health needs of the adolescents are also more important because of more requirements for growth spurt and increase in physical activity. It also supports other bodily functions such as growth, maintenance and repair. The objective of the study was to determine the nutritional status of adolescent girls and to study the relationship between the socio-economic statuses of the respondents with dietary habit of adolescent girls in urban, rural and slum areas in Kanpur district. A study was carried out amongst adolescent girls in the age group of 14-18 years. Total 150 adolescent girls were included. The 72.0 per cent, 88.0 per cent and 84.0 per cent girls in urban, rural and slum areas were belonged to 14-16 age groups. Majority of urban girls were educated. The very poor eating habits and life style conditions were found in slum areas. But, its conditions were better in rural than slum. Most of girl's vegetarian in rural area. Urban girls more nutritional awareness compared were rural and slum areas. The urban girls were more physically better than rural and slum areas. The socio economic conditions of urban area correspondents were better than rural and slum areas. Nutritional status has profound effect on health and food consumption performance of adolescent girls. The health of the adolescent girls is closely related to nutritional status but there are certain other eco-social variables such as literacy, social status and environmental hygiene which have impact on health of the girls.

Keywords: Adolescent girls, dietary pattern, nutritional status

ICT AS EFFECTIVE TOOL FOR DEVELOPMENT OF RURAL INDIA

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India is a nation with 69.8% of total population lives in rural areas. With such large rural population government is required to make concrete efforts for the development of rural areas. Undoubtedly Government of India has made considerable efforts like Digital India campaign initiated in 2015 to reduce the digital divide and ICT has proved to be a tool for its successful implementation. Rural Development is a process which leads to sustainable improvement in quality of life of poor people residing in rural areas. The percentage of rural population in India is decreasing since last two decades but still it accounts for major proportion of total population. This decrease in rural population could be understood as an indication that there is a need to provide better facilities in rural areas. It indicates that more people are migrating to urban areas in past two decades in order to get access to better facilities and services available in cities. In today's era Information and Communication

Technologies (ICT) has brought remarkable change in the lives of people in every respect also enabling government to deliver better services even at remotest corners of the country. Various ICT applications have been designed specifically for the people residing in rural areas of the country. Ministry of Rural Development (India) has also taken various initiatives at different levels by way of strengthening the ICT infrastructure to provide opportunities, information and easy access of the rural development Schemes to all citizens in rural India. Such developments have facilitated access to innumerable services and information in a very economical manner. Through ICT, several e-governance initiatives have been adopted which have ultimately proved to be a major contributor in rural development.

STUDIES ON LIQUID MANURE BASED DRIP FERTIGATION ON WATER USE, QUALITY AND PRODUCTIVITY OF ONION

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An experiment was conducted to study the effect of liquid manures viz. banana pseudostem sap, liquid sheep manure, liquid sheep manure+ 1 per cent bio-fertilizer and different nitrogen levels on onion crop (*Allium cepa*) var. Palam lohit. Soil samples were collected from surface (0 - 0.15 m) and sub surface (0.15 - 0.30 m) layers at monthly intervals (NH_4^+ and NO_3^-) and after the harvest of onion (*rabi*, 2016-17). The results revealed that with the application of liquid sheep manure and 1 per cent bio-fertilizer gave significantly higher yield (30.6 t ha^{-1}) and yield attributing characters as compared to farmer's practice. Similar trend was observed for quality parameters viz TSS (10.5°Brix) and protein content (1.8%). The treatment liquid sheep manure+ 1 per cent bio-fertilizer resulted in higher nutrient uptake and availability of primary nutrients. Similarly, soil enzymatic activities viz. phosphatase and urease activities were significantly higher in treatment liquid sheep manure+ 1 per cent bio-fertilizer as compared to all other treatments. The inorganic fractions of nitrogen viz. ammonical and nitrate nitrogen increased significantly over all the sampling stages and at harvest at both the soil depths under study with the application of liquid sheep manure in conjunction with 1 per cent bio-fertilizer. Fertigation with liquid sheep manure + 1 per cent bio-fertilizer resulted in higher water use efficiency and B:C ratio was 5.7.

Keywords: bio-fertilizer, TSS, nitrogen levels, enzymatic activities, liquid manures, inorganic fractions of nitrogen and nutrient uptake.

SOIL HEALTH CARD AND ITS IMPORTANCE TO FARMERS

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Soil Health Card (SHC) is a very advantageous Government of India's scheme promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers' Welfare. A Soil health card is meant to provide each farmer soil nutrient status of his/her land and advice him/her on the dosage of fertilizers and also the needed soil amendments, which s/he must apply to sustain soil health in the long run. In India, mostly farmer having less than one hectare land and they are not much aware about cropping systems, market requirement, soil nutrient status, soil fertility and productivity status of their soil. The reason behind that is less awareness about the soil testing procedure, Lack of farming information. Soil health card provide details about the fertility status of the field and what corrective measures the farmers can take to improve their crop yield. It provides important information regarding different soil properties of the selected field and contributes towards the reducing the excess use of chemical fertilizers and reduce the harmful effect on soil and environment. Bilingual distribution help farmer to understand the status of the field report about the nutrient sufficiency/ Deficiency and use.

Key words: Soil health card, Importance, Soil fertility

IMPACT OF KISAN MOBILE ADVISORY (KMA) ON AGRICULTURAL TECHNOLOGY DISSEMINATION

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To study the Impact of Kisan Mobile Advisory (KMA) on agricultural technology dissemination, the secondary sources were explored. Information was also collected by surfing the net. Krishi Vigyan Kendra, Raipur (Bhatapara) started Kisan Mobile Advisory (KMA) service in the year 2015 (October) and selected 200 (Farmers=125, In-service Personnel=50, Input Dealers=25) Mobile holder members for sending the messages of Agricultural aspects in their Mobile by using Bulk Message Service. After sending the messages for 2 years responses from the members were taken in month of October 2015. For the

responses about KMA 20 percent members from each category were selected in this way 25 Farmers, 10 In-service Personnel and 5 Input Dealers were selected and interviewed through telephone by calling in their respective mobile numbers. Among three categories (Farmers, In service Personnel and Input Dealers) of members of Kisan Mobile Advisory (KMA) a case study was undertaken to document the impact of services provided to the members and find out their satisfaction with KMA services. It was found that technology imposes high impact on 58 percent of KMA members of farmers category, whereas 72 percent and 53.33 percent members of In-service Personnel and Input Dealers category reported technology impacted highly on them. Low impact was reported by ranging about 08-20% of KMA members among all categories. This paper presents a review study on Impact of Kisan Mobile Advisory (KMA) On Agricultural Technology Dissemination.

TRAINING NEEDS OF AN EXTENSION WORKER

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The extension teaching methods is defined as the devices used to create situations in which communication takes place between the extension workers and the farmers. The main functions of extension methods are: (1) To provide communication so that the farmer may see, hear and do the things to be learned; (2) To provide stimulation that causes the desired mental and/or physical action on the part of the farmer; and (3) To take the farmer through one or more steps of the teaching, learning process, viz., attention, interest, desire, conviction, action and satisfaction. According to use, the extension teaching methods are classified into individual contacts (farm and home visits, office calls, personnel letters etc.), group contacts (demonstrations, training, meetings, discussions, tours, etc.) and mass contacts (leaflets, radio, television, posters etc.). A vast pool of extension workers engaged in the technology dissemination needs their knowledge and skill to be periodically updated so as to keep abreast of latest technology and modes of their dissemination in the fastly changing global and national scenario. The training of agricultural extension workers is an integral part of the overall agricultural production process. It is the duty of agricultural extension agents to reach farmers scattered around the country with useful and practical information for increased agricultural production. In-service training of the extension agents is the call of the time. Through trained agricultural extension agents new agricultural technology can easily and favorably be transferred to clientele. Training should not be conducted at the time of sowing and harvesting time and lectures should be carried out during the training sessions and choose time suitable for agricultural extension workers. Thus, necessary steps should be taken to identify the unfelt needs of the agricultural extension workers and strengthen their knowledge, skills and attitudes required for performing their job efficiently.

MINOR MILLETS FOR FOOD AND NUTRITIONAL SECURITY

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Nutritional insecurity is a major threat to the world's population that is highly dependent on cereal-based diet, deficient in micronutrients. Micronutrient malnutrition has been considered as a serious challenge, which is commonly known as hidden hunger, as two-thirds of the world's population is at risk of deficiency in one or more essential micronutrients as they rely on cereal-based foods. Millets can be served as an important food in attaining both food security as well as nutritional security. In recent years, millets have been recognized as important substitutes for major cereal crops to cope up with the world foods storage. Minor millets are the storehouse of many chemical components including nutrients, phyto-chemicals and non-nutritive functional constituents. Hence, an investigation was undertaken with an objective to find the nutritional composition of minor millets in comparison with staple crops. Minor millet such as finger millet, foxtail millet, kodo millet, proso millet, little millet, barnyard millet and staple crops like rice and wheat were selected for the study. The results revealed that minor millets have high nutrient content which includes protein, dietary fibre, minerals such as calcium, iron, zinc and potassium content compared to rice and wheat. Minor millets offer nutritional security and there is a need for promoting millets as they are highly nutritious. Millets hold great potential in contributing substantially to food and nutritional security of the country and they are not only a powerhouse of nutrients but also are climate resilient crops and possess unique nutritional characteristics. Millets can provide nutritional security and act as a shield against nutritional deficiency, especially among children and women.

Keywords: Minor millets, Protein, Dietary fibre

STUDY ON PHYSICAL PROPERTIES OF KODO MILLET (*PASPALUM SCORBICULATUM*)

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Kodo millet, (*Paspalum scrobiculatum* L.) is widely distributed in damp habitats across the tropics and subtropics of the world. It is indigenous cereal crop of India and is grown today in Uttar Pradesh in the north, Kerala and Tamilnadu in the south. It forms the main stay of the dietary nutritional requirements. Kodo millet is commonly known as 'kodo' in Hindi, *varagu* in Tamil and *harka* in Kannada. It is predominately grown in India and West African countries. The physical properties of kodo millet and other grains and seeds, are essential for the design of equipment for handling, harvesting, processing and storing the grain. Physical appearance of the grain is also an important characteristic which determines the consumer acceptability. Hence the present study was undertaken with an objective to find the physical characteristics of kodo millet. The physical characteristics such as thousand seed weight, thousand seed volume, hydration capacity, hydration index, swelling capacity, swelling index, specific gravity and bulk density were studied. The result revealed that thousand seed weight in kodo millet found to be 3.58 g, thousand seed volume 4.40 ml, hydration capacity 0.76 g, hydration index 0.21, swelling capacity 1.90 g, swelling index 0.43, specific gravity 0.64 and bulk density was found to be 0.81 g/ml.

Keywords: Kodo millet, Specific gravity, Bulk density.

MUSHROOM FARMING TO ENSURE THE ECONOMIC SECURITY OF THE FARMER

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India is fortunate to have a varied agro climate, abundance of agro wastes, relatively low cost labor and a rich fungal biodiversity. These factors combined make India a potential major producer of temperate, tropical and subtropical mushroom species. The production and consumption of mushrooms is increasing very fast throughout the world, mainly due to greater awareness of their nutritive and medicinal attributes, unique flavor and texture. Mushroom farming today is being practiced in more than 100 countries and the production is increasing at an annual rate of 6-7 per cent. Present world production of mushrooms is around 3.5 million tonnes as per FAO statistics. China alone is reported to grow more than 20 different types of mushroom at commercial scale and mushroom cultivation has become China's sixth largest industry. In India, mushroom production shot-up from mere 5000 tonnes in 1990 to over 1,20,000 tonnes in 2013. The land resources in the world are limited, but mushroom is indoor crop, grow independent of sunlight and does not require fertile land. Mushroom growing is a highly labor-oriented venture and labor availability is no constraint in the country and two factors, that is, availabilities of raw materials and labor make mushroom growing economically profitable in India. Indoor cultivation of mushrooms utilizes the vertical space and is regarded as the highest protein producer per unit area and time. Almost 100 times more than the conventional agriculture and animal husbandry. Five to six crops of mushrooms can be raised in a year under suitable condition. Mushroom production enhanced the livelihood security of farmers through generating additional income. In India it may become foremost source of incomes along with other source of income, which ultimately elevates the socio-economic status of farmer.

VALUE ADDITION OF COOKIES WITH THE HELP OF BUCKWHEAT

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Cookies are considered to be a very high protein snack and the best part is that it is very tasty. It contains grain flour, which provide vitamins, minerals, and fiberall of which are nutritional in value.Low gluten and high nutritional value foods are currently in demand. With the changing time the demand of the consumers is also evolved and consumer in now a day is getting aware about the nutrition. Cookies can be easily fortified with low gluten or no gluten or even fat free to produce food products of high quality. Cookies fortified with the buckwheat are rich in nutritional values. The components present in the buckwheat as like rutin a phytonutrient found in buckwheat helps fight blood pressure. Oligomeric proanthocyanide is found in buckwheat are seen to fight with the cancer. It also contains the sugar of low glycemic index that help to maintain the

blood sugar and to control insulin spike in the blood. In this experiment, I performed trials in which C₂ has shown the best result. This trial was the combination of the 30% buckwheat with the 70% wheat flour. The cookies contain 11.50 g of protein of a good quality, with about 60 g of the carbohydrates in a 100 g sample. Cookies with 30% buckwheat were liked most by the judges in respect of texture, flavour and taste. These cookies offer a great combination of both good nutrition and taste. They are no longer only a snack but can also be used anytime. With high nutritional values, low glycemic carbohydrates, high amount of carbohydrates and low level of gluten, they are certainly a good combination on taste and nutritional quality.

Keywords: Phytonutrient, Gluten, Glycemic.

INNOVATIONS IN FOOD PROCESSING AND PRESERVATION TECHNIQUES

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Food preservation is through common preservation techniques such as salting, drying, canning, smoking and other. Where, the main problem with the thermal processing method is loss of colour, flavor, vitamins and other nutrients in food products. The food industry is currently interested to use some of novel production and processing technologies that may result in economical and improved quality products. Innovation in food technology goes in parallel with consumer demand for healthy food and safer while improving the quality and shelf life. Novel technologies like microwave heating, the new techniques such as high-pressure processing (HPP), innovations to packaging materials (Active packaging techniques extend the possibility of keeping food quality at its best during storage), and use of preservatives (chemical additives) in food has expanded a great deal in recent years, such as natural anti-microbial preservatives and antioxidants. Also, some of the future methods of food preservation are irradiation, although, these methods are currently in use, they are expected to expand and develop further. The development of novel nano-technological tools and other bioactive ingredients will also contribute to the development of value added food products.

Keyword- Food preservation, processing technologies, shelf life etc.

PERFORMANCE AND DETERMINANTS OF MANGO EXPORT FROM INDIA

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The study has examined the growth performance and identified determinants of Mango exports from India during 2006-07 to 2014-2015. The compound growth rate, instability index were applied to estimate trend and instability and the project export to different countries. The time series data were used for estimating the determinants of Indian Mango export. The study observed that the Mango contributed substantially to the total horticultural export during study period. The higher growth observed in the value of mango export (8.77%) than the quantity of export (-6.54%) due to phytosanitary barriers in European and American countries during 2006-07 to 2014-15. The growth of unit value of mango export is higher (16.39 %). The instability index has been found higher for unit value (21.38%) than the quantity export (15.94 %) and value of export (10.16 %). The estimated regression model has shown that export price, lagged production, exchange rate and domestic consumption are major determinants for mango export from India. In order to sustain in the international market improvement in the quality and sanitary standards is essential.

Keywords: Mango, export, performance, instability index and export determinants

NUTRIENT STATUS AND THEIR RELATIONSHIP WITH SOIL PROPERTIES AT NARAYANPUR BLOCK, MIRZAPUR DISTRICT OF UTTAR-PRADESH, INDIA.

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Soil quality is one of the important factors controlling yields of the crops. Soil characterization in relation to evaluation of soil fertility status of the soils of an area or region is an important aspect in the context of sustainable agricultural production. Soil physico-chemical parameters are more important that control its quality. The macro nutrients govern the fertility of soils and control the growth and yields of crops. In the present investigation Narayanpur block was selected in the district Mirzapur of Uttar Pradesh and studied the available macronutrient status and their relationship with physico-chemical properties. Mirzapur district have different cropping systems and irrigated by Ganga canal and Tube well tributaries. Seven representative villages were chosen and 10 surface soil (0-15 cm) samples collected from each village and analyzed for physico-chemical properties and available N, P, K, and S status using standard laboratory procedures. Results of the study

indicated that soils of Narayanpur block were medium to high in organic carbon. Out of 75 collected soil samples, 96% were Low in available nitrogen and medium to high in available phosphorus, potassium and Sulphur Medium to high in soil. The soil of studied area found Iron Out of 75 soil samples 18.66% soil samples found deficient, 40% soil samples were marginal and 41.34% high in iron content. The Mn out of 75 soil samples 1.33% soil samples were found deficient, 0% found in marginal and 98.67% soil samples found High in Manganese content. While Zn out of 75 soil samples 1.34% soil samples were found deficient, 16% soil samples were found marginal and 82.66% found high in Zn content. Out of total 75 soil samples collected from villages' 0% soil samples were found sufficient, 0% soil samples were found marginal and 100% found high in Cu content.

Key words: Macro and micro nutrient, Physico-chemical properties, Correlation, Soil.

COMPARATIVE ECONOMICS OF REJUVENATED AND NON-REJUVENATED MANGO ORCHARDS IN SOUTH KONKAN REGION (M.S.)

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An attempt has been made to study the comparative economics of rejuvenated and non-rejuvenated mango orchards in South Konkan region (M.S.), was undertaken with a sample of 80 mango growers selected randomly out of which 40 farmers were among the rejuvenated group and 40 were among non-rejuvenated mango growers. The rejuvenated mango growers were divided in to 2 groups i.e. Group-I (age of rejuvenated orchards 1-4 years) and Group-II (age of rejuvenated orchards more than 4 years). At overall level, input cost incurred for rejuvenated orchards was Rs 36243, while it was Rs 33952 for non-rejuvenated orchards. The average per quintal cost of cultivation was Rs 3051 at overall level in rejuvenated group while it was Rs 4166 in non-rejuvenated group. At overall level in rejuvenated orchards it was observed that 'Cost-A', 'Cost-B' and 'Cost-C' was Rs. 71773, Rs.132214 and Rs. 147854 respectively. In the case of non-rejuvenated group it was Rs. 64663, Rs.113431 and Rs. 135896 respectively. The Benefit Cost Ratio of rejuvenated orchards at overall level was 1.49 while in non-rejuvenated orchards it was 1.16 respectively. The Benefit Cost Ratio of matured rejuvenated orchards (age of orchards 4-8 years) was 1.60.

Key words: Mango, economics, rejuvenated and non-rejuvenated orchard etc.

KITCHEN WASTE COMPOSTING MODULE FOR PLANT GROWTH

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Kitchen waste is a nutrient rich organic material containing high level of carbohydrates, lipids, proteins and other organic molecules which can support abundant population of microorganisms (Wang, et.al.2001). Kitchen waste is usually acidic due to the action of acid fermentation bacteria such as lactic acid bacteria. This needs a buffer to be added to make the environment less acidic. In the present study biodecompose buffer (BDB) is prepared to make an attempt for faster decomposition of kitchen waste. This was prepared by mixing 45 kg of cow dung compost, 8 kg of dry leaves mulch and 1 Kg of sand. Daily household plant based kitchen waste like vegetable and fruit peels, used tea leaves, and foods not of use were used for composting. 1 empty wheat flour bag measuring 15" x 12" was taken. 12 small holes were carved, scattering on whole of the bag. Bag was kept under the sun at rooftop and on soil based platform. 1 Kg of household plant based kitchen waste was thrown in the wrapper followed by top dressing of 2 handful of Biodecompose Buffer (BDB). Next day, on the top dressing of the first day, again daily kitchen waste was thrown followed by BDB. This was done daily till the wrapper filled up. Decomposing material was analyzed for moisture, temperature, efficacy of mass loss, pH value and C:N ratio for eight regular days starting after the wrapper filled up. After 8 days, decomposing material was transferred to a vegetable garden rows and brinjal plant was planted. Plant growth was measured in terms of weekly plant's length, width, no of leaves and weight of the plant before and after. Moisture and temperature were major factors impacting bacterial community. Moisture content was ranged from 60.4 to 55.2%. Moisture under control was helpful to give warmth and oxygen diffusion within the decomposing material. Composting organisms need a continuously supply of oxygen for their metabolic activities. So maximum mass loss was obtained by 4th day which was 6.5 inches. Temperature range of 30 to 35°C within the compost pile was obtained. Cellulase production by cow dung compost was maximum at 30°C (Saraswati Bai, et. al.2012) which resulted the speedy mass loss. pH stabilizes after 4th day between 6.80 to 6.52 which favored for plant growth. C:N ratio of decomposing material was calculated as 30:1 which favored for maximum fertility. Plant obtained maximum growth during 6th week. It had added 100 new leaves. It was increased 8 inches in length and 11.5 inches in width. Total weight of the plant by the end of the 8th week was 1011 gm.

FARMERS' PERCEPTIONS TOWARDS APPLICATIONS OF MODERN FARMING TOOLS USED IN VEGETABLE PRODUCTION AT SOLAN DISTRICT, HIMACHAL PRADESH-INDIA**PANKAJ THAKUR*, PIYUSH MEHTA, KRISHAN KUMAR AND GAURAV***Department of Business Management, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni-Solan, Himachal Pradesh (173230), India*

Increase in vegetable productivity has been achieved in several parts of the country mainly by modernizing agriculture. In this context application of modern farming tools play significant role. The concerned study has analyzed the awareness levels of farmers' towards application of modern farming tools used in vegetable production and study the effect of modern farming tools on farmers' income. The scientific orientation inclined by farming community that new methods of farming give better results to a farmer than old tools. The key economic motivation that enforced the farming community were that farmer should work towards higher yield and economic profits. The key constraints and problems emerged during the study mainly circumvented around the lack of sufficient incentives provided by the government and the imparting of adequate training for the use of farm tools.

Keywords: Perception, Modern farming tools, Vegetable Production.**DRY FLOWERS: A BOON TO FLORICULTURE INDUSTRY AND ITS FUTURE POTENTIAL****PARVATHI BENNURMATH¹, SAJANA S², PRASHANT KALAL², ANAMIKA GURUNG¹**¹*Division of Floriculture and Medicinal Crops, ²Division of Fruit Crops**ICAR- Indian Institute of Horticultural Research, Hesaraghatta lake post, Bengaluru-560089*

Floriculture has emerged as a major diversification option in the agri-business in recent years. In the present era of eco-consciousness, use of natural products like dry flowers and their parts has become the premier choice of the masses in their lifestyles for interior decoration. They can be utilized in the best manner for making decorative floral craft items, greeting cards and covers, wall hangings, floral designs, calendars, floral balls, festive decoration and other creative displays. The industry comprising of dry flowers are basically localized in Tamil Nadu while the other material for drying is collected from West Bengal, Orissa, Madhya Pradesh, Andhra Pradesh, North Eastern States and Bihar. Although demand for dry flowers is increasing at an impressive rate of 8-10%, and therefore there is a great scope for the Indian entrepreneurs. India, with its vast resources, varied products and experience in the field of dried flowers and plants enjoy a distinct advantage even for dry flower industry as a wide range of plant material can be exploited for dry flowers. Flowers and plant parts for dry flower making are usually collected from wild sources and some flower crops Dahlias, marigold, jute flowers, wood roses, wild lilies, helichrysum, lotus pods, poppy seed heads, statice, globe amaranth etc. But it is sure that promotion of dry flower industry will not only going to help for creation of huge self-employment for unemployed educated youth but it will also increase the national economy by sale of high quality, ever-lasting produce in domestic as well as international markets. Under the new era of start-up India, make in India and FDI (Foreign Direct Investment) in retails, these kinds of models possess high potential for enhancing the income farmers, self-help groups; NGO's opting for quality and new diverse floral products through dry flower industry.

STATUS OF MARKETING OF VEGETABLE IN INDIA**PAVAN KUMAR SINGH, BHARTENDU YADAV, BRIJESH KUMAR PATEL, AJEET KUMAR***Department of Agricultural Economics, NDUAT- Kumarganj, Faizabad*

India is the second largest producer of fruits and vegetables in the world next only to China. Most of the marketing of vegetables is done in the unorganized sectors and very little quantity is marketed through organized sectors. India produces about 14% of total world's vegetables from 15% world's area. From this production of the vegetables nearly 30- 40% were wastage during the supply chain that is reaching of product from producer to consumer. As we know that the vegetable is highly perishable in nature that is, the negative point for the growers of vegetables in the lack of better transportation facilities at right time. In any kind of marketing the most common problem is the presence of middlemen in the marketing channel. Cause of this as the number of middlemen in marketing channel increases, the marketing efficiency of the channel decreases due to increase in the marketing cost and margin. Out of total vegetables production in India, Potato(28.9%), tomato (11.3), onion (10.3%), and brinjal (8.1%) are the four major vegetables grown in the country which contribute about 58.6% of total vegetable production. Total value of vegetable exports from India were accounted for 2706.97 crores, which account for about 2.25% of total agricultural exports and 0.23% of India's total export. Major importers of Indian vegetables are UAE, Nepal, Sri Lanka, U.K. and Saudi Arabia accounting for about 55% of the total Indian vegetable exports.

ANALYSIS OF SHEET RESISTANCE VARIATION WITH STOICOMETRY OF CADMIUM SULPHIDE THIN FILMS

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Cadmium sulphide thin films are prepared by spray pyrolysis technique. The electrical properties are studied using hall measurement system. The variation of resistance with stoichiometry of cadmium sulphide thin films is studied. It is obtained that CdS films with $X = 0.50$ has the least resistance and the subsequent variation in values of X either way, increases the resistance.

Keywords: CdS, Stoichiometry, Sheet resistance.

ADOPTION OF GOOD AGRICULTURAL PRACTICES BY MUSHROOM CULTIVATORS IN SOLAN DISTRICT OF HIMACHAL PRADESH, INDIA

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Solan being the mushroom city of India is having many farmers and entrepreneurs opting for mushroom cultivation and now, through transfer of technologies from lab to land new technological interventions and practices like Good Agricultural Practices (GAP) has established its roots in the mushroom cultivation industry of the country. This research study analysed the key objectives including awareness level, factors affecting the adoption and problems and challenges faced by mushroom cultivators while adopting GAP. For this research work, sample size of 60 mushroom cultivators from Solan district of Himachal Pradesh was taken. Research revealed that awareness regarding GAP particularly for mushroom cultivation and associated certification drawn benefits among growers was observed to be very least. Though, the cultivators considered hygienic practices as the significant component of GAP implementation in Mushroom cultivation. Moreover, unregulated market conditions were the focal problem highlighted by the cultivators to be significantly considered under GAP oriented mushroom cultivation. It was suggested that mushroom Cultivators should explore the possibilities of mushroom cultivation as a potential agribusiness on larger scale with advanced practices like GAP and should also apply for the good agricultural practices certificate with the audit authorities of concern.

Keywords: Mushroom cultivation, Good Agricultural Practices, hygienic practices, Agribusiness, agricultural practices.

MUSHROOM CULTIVATION: MONEY SPINNER FOR FARMERS

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Food and Agricultural Organization (FAO) of United Nations has recognized mushroom as food item contributing to the protein nutrition of developing countries like India, where there is a heavy dependence on cereal diet. It contains about 90% moisture and is basically a low caloric food. The significant feature of mushroom is that this nutritious and tasteful food is cultivated entirely from waste products and converts a wide spectrum of agricultural and industrial wastes into a substrate on which the growth of mushroom is supported. There are various types of edible mushroom available world widely but in India generally four types of mushroom are cultivated-White Button Mushroom, Portobello Mushroom, Dhingri (Oyster) Mushroom and Paddy Straw Mushroom, among all above white button mushroom are grown all over the world and account for 35-45 % of the total mushroom production. India has tremendous potential for the growth of mushroom production with production capacity between 2000-3000 tonnes/annum. In India, 50% of mushroom production comes from marginal farmer and small manufacturing units and the remaining mushroom produced by industrial institutions. Farmers are generating additional income by cultivating mushroom, the raw material are locally available and mushrooms houses are built of kaccha bricks, preparing shelves out of sarkandas. Assistance to mushroom farmers is provided by Department of Agriculture under National Horticulture Mission for spawn units, compost preparation and training. Due to lack of information regarding mushroom cultivation more farm advisory service should be provided to the mushroom growers for dissemination of technical know-how at their door step. The economies of scale in mushroom cultivation should be followed.

Keywords: Compost, Mushroom production, Spawn production, Straw, White button

SUSTAINABLE DEVELOPMENT OF PRODUCTS FROM THE AGROTEXTILES USED IN AGRICULTURAL FARMS

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The agrotextile is the major technological development which has found an irreplaceable use in the agriculture sector. The textile technology has widened its purpose of safeguarding agricultural products by offering various agrotextile products. The use of textile structures has reduced the traditional practices like pesticide and herbicide application on crops for enhancing the quality and the yield of crops. Agrotextiles have thus found wide application in agricultural practices and its demand is continuously increasing. Govind Ballabh Pant University of Agriculture and Technology, the leading agricultural university of Uttarakhand, have different crops grown for research, instructional and commercial purpose. The farms utilize the agrotextile materials and produce lumpsum amount of used textile materials. The study was, therefore, planned to develop value added products from the used textile materials and to assess the consumer acceptability of these products. The product development from these materials gave an advantage of sustainable utilization of agrotextile materials even after their intended use in the agricultural farms. The used materials were recycled through innovative product development which helped to reduce the textile waste generation in the farms. The products developed using the principles of sustainability were lampshade, hanging basket, coasters, doormat and wind chime and gained acceptability from the customers. Further, the sustainable use of the agrotextiles would carve a path for revenue generation and provide social and economic benefits. The reuse or recycling of the materials would ultimately help to reduce the solid waste issues in the farms.

Keywords: Agrotextiles, sustainable products, value addition, recycle, reuse.

BIO- FORTIFICATION TO ADDRESS MALNUTRITION IN INDIA

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Bio-fortification is an emerging new approach to address micronutrient malnutrition based on the fact that is essentially a food problem. Bio-fortification is breeding crops with increased levels of vitamins, minerals or higher protein with healthier crops. It can be performed through genetic engineering or conventional selective breeding. It differs from ordinary fortification as the main emphasis on making plant foods more nutritious when plants are growing rather than having nutrients added to food while they are being processed. Bio-fortification helps directly in improving the micronutrients found on a crop during production and eliminates the need for a public distribution system and no additional nutritional intervention is required for better nutrition for poverty stricken population. Billions of people suffer from micronutrient malnutrition also known as hidden hunger leading to chronic deficiencies and health problems of blindness, anaemia, stunting growth and mental problems, low working capacity learning disabilities and even premature death. Most of Indian diets are based on cereals and other starchy foods lacking sufficient quantities of essential minerals and vitamins like iodine, zinc iron and vitamin A and often suffer from micronutrient malnutrition. In India the focus is on six crops viz. pearl millet(iron), wheat(zinc), sorghum(iron), rice(zinc), cowpea(iron) and lentils(iron and zinc). As a part of the agriculture ministry Food Security Mission, ICAR(Indian Council of Agricultural Research) has been developing strains including infusing varieties of rice, cauliflower and vegetables with carotene, pro-vitamin A rich Golden Rice and protein rich potato, pro-vitamin and iron rich banana and pro-vitamin A rich orange cauliflower. Bio-fortified strains of crops like rice, maize, wheat and pearl millet and vegetables developed will be used to study the health parameters over a period of time to curb the problem of malnutrition. Value added food products to be developed so as to improve the status of food and nutritional security for malnourished. Various nutrition education programs needs to be planned to educate the masses on nutritional benefits of these new varieties and encourage farmers to grow and eat these bio-fortified food from traditional staples.

MICRO-ENTREPRENEURSHIP DEVELOPMENT THROUGH FOOD PROCESSING TECHNOLOGIES IN KASHMIR

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Micro-enterprise creation through food processing training aims at developing entrepreneurial competence and confidence of potential entrepreneurs dairy cooperatives, vermi-composting, nursery of fruits and vegetables, processing and value addition to horticulture crops, mushroom cultivation, apiculture's sericulture, fish farming, poultry management have greater potential to empower farm women. Agriculture being an important occupation for the rural people in Jammu & Kashmir region has potential for micro entrepreneurship development through food processing units. The state grows a variety of food crops like rice, maize, wheat pulses, oilseeds and has a monopoly of growing temperate fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond and quince. The Horticulture industry serves as a major economic boost for the development of the

state. Postharvest losses of horticultural crops are enormous and it is a serious threat for horticulture industry. However, these losses can be avoided to some extent, if the produce is handled with great care after harvest. The properly harvested, graded and packed fruits and vegetables have good market potential, because now-a-days consumers are becoming quality conscious and believe in hygiene and food safety. Food processing technologies provide opportunity to the individuals or group of skilled persons to become successful entrepreneur. Value added agriculture has attracted attention in recent years as a means to increase and stabilize to help them start new ventures. The ICAR and SAUs form a close network for agricultural research and extension education through All India Coordinated Research Projects, National Agriculture Research Project, KVKs, National Agriculture Extension Projects and deeper intervention of the ICAR have provided an umbrella to develop and demonstrate front line technologies to empower farmers in the country. Micro and small industries need to be nurtured and Government support in form of financial assistance for term loan, working capital, machinery and technology upgradation and food testing laboratories is required for safe quality products..

ORGANIC FOOD AND HEALTH

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Organic food is in nowadays. With a lot more people choosing to live the healthy life it's quite normal to have people making healthier food choices. Most people buy organically grown food products because they are concerned about pesticides, additives, antibiotics or other chemical residues. Organic foods are items that are produced, processed and packaged without using chemicals including items such as vegetables, fruits, milk and meat products etc. As organic food is the result of sustainable agricultural practices the produce is the healthiest in terms of nutrition, taste and fresher, free of unwanted drugs and avoids genetically modified food. Organic is not good just for the people consuming it, it is also good for environment. Though it may be more labour-intensive and use more resources, it uses fewer pesticides, antibiotics and other harmful substances which will give way to a greener earth. Consumer demand has risen at even faster rate for organic foods and it can be attributed to the massive cultural shift towards healthy eating. In last few years more stores have been offering a greater selection and the availability of organic foods.

WOMEN EMPOWERMENT STATUS AND MEASURES FOR MAINSTREAMING SUSTAINABLE QUALITY OF LIFE IN FARM WOMEN OF UTTARAKHAND STATE

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Empowerment is a multidimensional social process which helps people to gain control over the quality of their own lives. Women empowerment enhance women's power to take control over decisions that shape their lives, and access to resources, participation in decision making and control over distribution of benefits. Women deprived from the right of decision-making in important household affairs, adequate food, proper education and recognition in household and social affairs. Women play a pivotal role in all types of household, farm and allied activities that are deprived from most of the privileges of life. Women work for 14 -18 long hours performing manual works daily on farming operations, livestock raising, fetching fodder, fuel and water from distant places and expending more total energy a day. Their work is not recognized in any statistical terms. In agricultural sector women participate in several activities such as weeding, sowing, transplanting, harvesting, and storage. For this a systematic procedure is needed to address their problems. This includes selection of descriptive and experimental detailed research design, conceptual framework and schematic representation of interaction of variables. Tools and techniques will be developed for collecting information related to work, health and their safety and improving their skills, enhancing the income and upgrading technical knowledge. Empowering farm women for better quality of life is an important and burning issue today. Knowledge coupled with efficient resource management is considered one of the most important factors for development. Extension approaches and strategies followed for transfer of technologies to farm women are required to satisfy their specific needs and problems. Thus there is a need to be given on cultivation technologies, improved agricultural tools and implements, institutional approach for empowerment and inculcating entrepreneurship skill in them. Coordination is to be made among technology generation, technology dissemination and technology receiving system. In farm women provides valuable information to development authorities to formulate appropriate strategies in framing the policy, organizing suitable extension activities and training programmes for the women. It also helps to formulate proper policies to overcome the difficulties and improved management practices. The study will be designed to focus on the contribution of socio-economic characteristics of farm women towards extent of empowerment. This helps in identifying programmes and methods that enhance the extent of empowerment of farm women.

ROLE OF CROP DIVERSIFICATION IN SUSTAINABLE INTENSIFICATION OF AGRICULTURE

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Crop diversification sustains the agricultural production system of any area through protection of environment and maintaining soil health. The desirable change in the existing cropping patterns towards a more balanced cropping system to meet the ever increasing demand for food is bases for crop diversification which is technologically feasible and economically viable. Lack of crop diversification in our cropping system has cause never ending problems that mainly include pollution of the ecosystem, excessive use of water resources (as in case of rice crop) causing poor water use efficiency (WUE), deterioration in soil health, multiplication of diseases, pests and weeds, unplanned consumption of energy, reduction in the availability of other protective food and high value crops.. The main goal of crop diversification is to stabilize farm income and promote better farm linkages among primary, secondary and tertiary sectors of economic activity. The major reasons which highlight to need for adopting diversification are conservation of natural resources, more income to marginal farmers, combat ill-effects of aberrant weather provide employment opportunities, reduce dependence on outside supply, diversify food basket, withstand price fluctuations, promote export possibilities. Crop diversification can be a useful means to increase crop output under different situations. Crop diversification takes into account the economic returns from different crops. This is very different to the concept of multiple cropping in which the cropping in a given piece of land in a given period is taken into account. Therefore, conservation of agriculture and its sustainability can enhance through diversifying crops and cropping system.

CLIMATE CHANGE IN HIMALAYA, YARSHA GUMBA AND ITS IMPACT ON RURAL ECONOMY OF NEPAL.**PRABIN KARKI, SAKET KUSHWAHA, SARTHAK GHIMIRE, V. KAMALVANSI***Department of Agricultural Economics, I.Ag.Sc., BHU, Varanasi-221005, India.*

Nepal ranks 4th under Climate vulnerability index and the high Himalayas is much more vulnerable than lower lying region in Nepal. Several studies report that the Himalayas is warming at the rate of 0.6 °C per decade in the last three decades, which is much higher than the global average of 0.74°C over a hundred year. Impact of climate change has been seen in the livelihood of communities over the Himalayas, of which impact on Yarsha Gumba (*Ophiocordyceps sinensis*) collecting communities in western Himalayas of Nepal is not an exception. Yarsha Gumba, popularly known as 'Himalayan Viagra', is claimed to be the world's most expensive medicinal fungus, which is used in the treatment of asthma, cancer, and impotence. It is also being used as a supplement to tea, coffees, milk product and energy drinks. Due to the price fetch from a single fungus can be much higher than a day of manual labor, people go for its collection in high altitude leaving the villages deserted and the school closed. In 2011, the value was estimated at about \$ 25,416 or NPR 20, 33, 280 (1 US\$ = NPR 80) per kilogram. Yarsha gumba has contributed up to 65% of the annual income to the collector. During, the year 2010-14, there was a mean annual decline of 25 pieces in the per capita harvest. Due to the climate change, their availability will be shifting to higher altitude and 36-39% of habitat will be lost in Tibet. This scenario demands a study of the climate change with respect to its population in major Yarsha collection centers in Nepal, and its subsequent socioeconomic impacts on collector, to regulate the collection, market, and trade of it.

Keywords: Yarsha Gumba, *Ophiocordyceps sinensis*, climate change, Himalaya, socioeconomic impact, livelihood

INTELLECTUAL PROPERTY RIGHTS FOR USE OF GENETIC RESOURCES AND THEIR EFFECT ON LOCAL COMMUNITIES**PRABLEEN KAUR¹ AND AMAN DEEP RANGA²**¹*Amity Institute of Biotechnology, Amity University, Uttar Pradesh-201313*²*Department of Genetics and Plant Breeding, School of Agriculture, Lovely Professional University, Phagwara, Punjab*

Intellectual property right is the right given to the creators to have secured limited use for specified period of time for making, using, or selling a new, useful, non-obvious invention. Convention on Biological Diversity (CBD), 1992, defines genetic resources (GRs) as genetic material of plant, animal, microbial or other origin comprising functional units of hereditary that have actual or potential value. Although, GRs are not intellectual property (IP) however inventions based on or developed using GRs are protected through the IP system. In developing countries, the local and indigenous communities have preserved these GRs as traditional knowledge (TK) for generations and now being exploited immensely for modern

scientific research. Concerns about the misappropriation of the GRs and TK have been addressed by establishment of laws and treaties on an international level which include CBD(1992), Bonn guidelines on access and benefit sharing(2002), International Treaty on Plant Genetic Resources for Food and Agriculture ITPGRFA (2004) and Nagoya protocol (2010) provide legal framework for access and benefit sharing (ABS). However the issue arises in the effective implementation of these policies in sharing the benefits arising out of commercialization of these resources. The issue of biopiracy arises where developed countries have been reproached with exploiting developing countries' GRs and their communities' TK without authorisation or compensation by granting patents on inventions derived from the same. It jeopardizes the communities' way of living, livelihood and violates the sacred customs which are of immense value to them. These agreements do not define novelty standards and thus do not recognize the oral transfer of TK and the role of these communities in the development of these GRs. However the companies that take GRs from indigenous communities and develop products (e.g. drugs) based on those resources could own patents enabling the company to sell the invention back to its "true inventors".

Keywords: Genetic Material, Jeopardise, Nagoya Protocol, Patents

IMPORTANT PRODUCTS OBTAINED FROM BEEKEEPING

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The seven important products obtained from beekeeping, viz., honey, beeswax, honey dew, bee bread, propolis, royal Jelly, bee venom and apiotoxin. Honey is produced by worker honey bees. It contains 17% water, 38% fructose, 31% glucose, 1.3% sucrose and 7% enzymes and other mineral matter. To produce honey, honey bees suck the nectars from the flowers with the help of proboscis and glossa. It is used as a food, medicine, antibiotics and cosmetics etc. Beeswax is secreted by the wax glands located on the underside of the last four abdominal segments (4th to 7th) of the worker bee. This wax is used in constructing bee combs in which the colony of the bee develops. It is also used for making of candles, making pharmaceutical preparation, preparation of varnishes and paints, water proofing and waxing threads, formation of comb foundation and pathological and scientific laboratories for preparation for tissue during micro-anatomical survey of soft tissues. Honey bees collected resinous substance known as propolis from tree bud, sap-flows, tree bark and other botanical sources. It is used as sealant material for unwanted open space in hives. It is also used for filling the cracks, holes and some small gaps. It has some medicinal importance for human, medicines for tonsillitis, bronchitis and dental infections. Royal jelly is secreted by hypopharyngeal and mandibular glands of nurse bees of the age of 6 to 12 days when the glands are fully active. It is the richest nutritious food and is fed to the young queen larva. It contains a high concentration of vitamins B5, B6 and natural glycerides and amino acids and is believed to be a potent antioxidant, a special rejuvenating substance that promotes tissue growth, muscle and cell regeneration. Bee bread is mixture of nectar, pollen grain and honey. It is simple food material and is fed to worker, drone or male bee and its larva so also known as bee bread.

THE LIVESTOCK ROLES IN THE WELLBEING AND UPLIFTMENT OF SOCIO-ECONOMIC STATUS OF FARMER'S

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The livestock species play very important economic and socio-cultural roles for the wellbeing of rural households, such as food supply, source of income, asset saving, source of employment, soil fertility, livelihoods, transport, agricultural traction, agricultural diversification and sustainable agricultural production. The livestock development in India has assumed a much broader role in the overall economy than so far envisaged. Demand for animal food products in India is also rising owing to population increase, urbanization and sustained rise in per capita income. Animal husbandry has been an integral part of Indian agriculture. It assumes greater significance in India's socio-economic development. Livestock system is known to enhance sustainable livelihoods for farmers. Livestock farming represents the only way by which the large parts of natural vegetation can be converted into economic products. Livestock products play an important role in export earnings. Livestock sector helps in augmenting farm family income, narrowing down the protein gap, providing draught power and manure for crop cultivation and in earning foreign exchange. Livestock generated more employment for men and women. The households used livestock for mitigating uncertainties of farming. The overall viewer of livestock farming is a symbol of higher social status. The livestock system contributes economically and socially to enhance sustainable livelihoods. The first purpose to keep the livestock is to obtain milk to sell that provides additional source of income to their livelihood.

Keywords: Livestock, Food, Socio-economic, Sustainable, Livelihood

A STUDY ON REPAYMENT BEHAVIOUR OF AGRICULTURAL LOAN BORROWERS THROUGH COMMERCIAL BANKS**PRASHANT MARATHA^{1*} AND S.K. BADODIYA^{2**}****Career point University Kota, Raj. **K.V.K. Badwani, R.V.S.K.V.V., Gwalior (MP)*

Agriculture is one of the predominant pillars of the Indian economy. To meet the requirements of the growing population and rapidly developing economy, agriculture has to grow fast and get modernized. This requires the use of high pay off inputs. Adoption of high yielding varieties requires large quantities of fertilizers, plant-protection chemicals, modernized equipments, and machineries, which in turn needs huge investment. Though agriculture provides employment to about three-fourths of the working population and contributes the major share of the national income, yet, in India, it is more a way of life than a pure business. As Cultivation becomes uneconomic, the cultivator is forced into a hand-to-mouth existence, which, in turn, presses him to borrow either for consumption or for investment in agriculture. Individual tend to use different credit utilization pattern for obtaining the technology. For accepting any innovation by the farmers in varying socio-personal and farm situation, different types of credit utilization pattern are required. Thus by keeping this view the study was conducted in purposively selected Bundi district of Rajasthan. Total of 500 agricultural loan borrowers were formed the sample for the study. The primary data were collected through personal interview method with the help of pre-tested interview schedule, which was prepared on the basis of objectives of investigation and variables. The statistical tests and procedures were used for analyzing the data with the help of statistical tools like- mean, S.D., percentage, and Karl Pearson's coefficient of correlation, multiple correlation and regression analysis. We found that 67.60 per cent borrowers paid their dues on time and to be called as "Regular" or standard borrowers. It was observed that correlation coefficients in respect of sources of information, Cosmo-politeness, scientific orientation and risk preference were found positive and highly significant with repayment behaviour of farmers. Co-efficient of determination value of 0.5514 with highly significant 'F' value revealed the significance of regression equation in the prediction of repayment behaviour of farmers. Out of sixteen traits viz., caste, annual income, cosmopoliteness, scientific orientation and Risk preference were found positive and highly significant relationship with repayment behaviour of farmers. Crop raze due to natural hazards as major constraints for effective repayment behaviour by borrowers and Curb less financing, effective crop insurance and procedure of loaning should be more sophisticated were the main suggestion offered by borrowers for effective repayment behaviour of the borrowers.

CONSUMERS' PREFERENCE TOWARDS DIFFERENT FRUITS OF WEST BENGAL**PRATICK MONDAL****Faculty of Agriculture, Bidhan Chandra Krishi Viswa Vidyalaya Mohanpur, Nadia, West Bengal, 741252**Bidhan Chandra Krishi Viswa Vidyalaya Mohanpur, Nadia, West Bengal, 741252*

Understanding the preference pattern of consumers is important to set the farmers and researchers to produce and sale fruits according to consumers' and retailers' need. In this study four important fruits of West Bengal were selected i.e. Mango, Banana, Guava and Ber. The objectives of this study were to find out the background information of consumers, to study the purchase behaviour of consumers, to find out the attribute importance of consumers towards the selected fruits, to study varietal difference of fruits by the consumers and to identify problems faced by consumers. The study was conducted in the small town of Kanchrapara in North 24 Parganas district of West Bengal, India. Data was collected with the help of questionnaire the study from 30 consumers who were selected from Ward no 14. It was observed that majorly of the consumers were men within the age group of 41-60, while 50% of all the consumers purchased fruits irregularly. The consumers belonging to annual income more than 5 lakhs used to purchase fruits regularly while those of the low income group purchased fruits irregularly. Consumer gave more importance to odour of the fruit in mango and spotlessness in banana whereas in case of guava and ber the 1st preference went to tightness and colour respectively. The preference pattern of different varieties of fruits was assessed through semantic differential scale. The decreasing orders of preference were Himsagar, Langra, Fazli and Amrapali for mango, Singapuri and Martaman for banana and Apple ber and Narkeli for ber. Consumers identified presence of spots in the skin of mango and banana, high price for guava and ber as potential problems. It can be concluded that the study on preference pattern opened up newer information which could be utilised for production and promotion of fruit crops in particular and horticulture in general.

SMART VILLAGE –AN APPROACH FOR SUSTAINABLE VILLAGES**PRATIMA TIWARI*, PRATIMA SACHAN*, ROHIT MAURYA **, ANAMIKA SINGH*, ALKA NIGAM***** Department of Home Science, CSAUAT Kanpur 208002 **, Department Vegetable Science, NDUAT Kumarganj*

In India majority of the population still lives in villages. The UN's State of the World Population Report of 2007 estimates that by 2030, nearly 41% of India's population will reside in some kind of urban area. Mostly people migrate to cities, due to poor living conditions and lack of job opportunities. Rural development has always been an important issue in all discussions

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pertaining to economic development, especially of developing countries, throughout the world. The socio-economic disparities between rural and urban areas are widening and creating tremendous pressure on the social and economic fabric of many developing Asian economies. These factors, among many others, tend to highlight the importance of rural development. With a vision to create smart villages and promote rural development "Sansad Adarsh Gram Yojana" was announced recently by our Honorable Prime Minister of India. In this era of digitalization the model village will leverage the technologies of ICT to enable a Sustainable Smart Village. These include optimizing agricultural growth, putting up of economic and social infrastructure, fair wages, employment, village planning, public health, education and functional literacy, communication, smart governance, safety, clean and green environment etc. A lot of work needs to be done in making the villages clean. There are different aspects of clean village such as: water supply, sanitation, indoor air quality, solid waste management and renewable energy etc.

HORTICULTURE AS A THERAPEUTIC MODALITY IN URBAN CENTERS

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Horticulture in India is commonly perceived as just growing fruits, flowers, vegetables, feed the population and earn livelihood. However, horticulture has much broader concept rather than just feed the world. Plant people relation is not only just of food, clothing, shelter and medicine but also has been a step further by the domain of horticulture therapy. Horticultural therapy is a professionally conducted client-centered treatment modality that utilizes horticulture activities to meet specific therapeutic or rehabilitative goals of its participants. The focus is to maximize social, cognitive, physical and/or psychological functioning and/or to enhance general health and wellness. Although this concept is not new but with the expanding advancement in medical technology, pharmaceuticals and efficiency, however, the concept of horticulture as a therapy lays fallow for some time. As our lifestyle is changing continuously and becoming more technology dependent, which drag us away from the nature, horticulture therapy is again regaining its importance in last 25 year. Today, country's urban centres are continuously growing and becoming more polluted, populated, overcrowded and stressful due wrong architectural urban planning. In such urban centers horticulture may emerge as therapeutic medium for addressing innate psychological needs and connection with the natural world and offers restoration and respite from mental stress, providing meaningful, purposeful activity along with encouraging human growth that is 76 fundamental and central to each, individual served through disability services, rehabilitation, occupational therapy, divisional & recreation therapy, landscape architecture.

ROLE OF MUSHROOM IN HUMAN HEALTH

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Although the button mushroom (*Agaricus bisporus*) accounts for slightly over half of total world mushroom production, specialty mushrooms, e.g., shiitake (*Lentinula edodes*), straw (*Volvariella volvacea*), oyster (*Pleurotus spp.*), and enokitake (*Flammulina velutipes*), are increasing in popularity. These species contain moderate quantities of good quality protein and are good sources of dietary fiber, vitamin C, B vitamins, and minerals. Lipid levels are low, but unsaturated to saturated fatty acid ratios are high (about 2.0 - 4.5:1). Some species (e.g., shiitake) accumulate cadmium and selenium and other heavy metals, and some may contain toxic substances such as the heat labile cardiotoxic proteins volvatotoxin in the straw mushroom and flammutoxin in enokitake. One cup of chopped or sliced raw white mushrooms contains: 15 calories, 0 grams of fat, 2.2 grams of protein, 2.3 grams of carbohydrate, including 0.7 grams of fiber and 1.4 grams of sugar. And role of mushroom on human health is Anemia Prevention (source of dietary iron and contain 8.1mg of iron per cup.), Stronger Bones (adequate calcium help prevent joint complications and osteoporosis) Healthy Immune System (The presence of Ergothioneine and selenium as powerful antioxidants in mushrooms protects the body from experiencing oxidative damage.)_Healthy Skin and Hair (The Selenium in the mushroom helps improves skin elasticity, which is a major part of anti-aging. Polysaccharide present in mushrooms helps maintain a hydrated and supple skin.)_Weight Loss (Mushrooms provide lean protein, which is effective for weight loss purposes; they are rich in fiber and contain no cholesterol or fat), Manage Blood Pressure (contains potassium, which relaxes and calms the nerves and maintains a healthy level of blood flow.), Manage Diabetes (studies that show the enzymes in mushrooms help break down the sugars and starch in food.), Prevent Breast Cancer (Apart from being high in anti-oxidants, mushrooms also contain linoleic acid, which targets the estrogen levels in the body and reduces the risk of breast cancer.).

INNOVATIVE APPROACHES IN APPLIED SCIENCES AND SOCIO-ECONOMIC DEVELOPMENT EXTENSION STRATEGIES INCLUDING E-INITIATIVES TOWARDS FARMERS PROSPERITY

PREMLATA

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Despite a wide range of reform initiatives in agricultural extension in India in the past decades, the coverage of, access to, and quality of information provided to marginalized and poor farmers is uneven. This paper aims to ascertain why farmers are not accessing information by e-initiatives and where information gaps exist, despite the variety of extension approaches in India. Using information provision and access as the basis for analysis, the paper reviews some of the major agricultural extension strategies and programmes in India by considering their ability to provide information and facilitate information sharing and use in farming communities. The review gives a broad overview of the current strategies in India. The paper examines the challenges and constraints of each agricultural extension approach as it attempts to provide farmers with access to information that is relevant to their farm enterprises. The review concludes that there is an increasing need to work in partnership and to share knowledge and skills in order to provide locally relevant services that meet the information needs of marginal and smallholder farmers in India.

Keywords: extension, knowledge, information, initiative, approach

LONG-TERM TEMPORAL TREND ANALYSIS OF RAINFALL USING NON-PARAMETRIC TEST: A CASE STUDY IN MAHARASHTRA, INDIA

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This study investigates long-term temporal trend on three different time series including monthly, seasonal and annual rainfall data of 44-years (1974-2014) of Parbhani district, Maharashtra, India. The temporal trend was analyzed using Mann-Kendall (MK) test at 10%, 5% and 1% of significance levels. The true slope of rainfall trend line was obtained using Theil-Sen's slope (TSS) test. The results of Mann-Kendall test revealed that there is no trend in the monthly, seasonal and annual series except the March, April and July months. In March, April and July months significant positive trend was detected at 10% and 1% significance levels. The slope of trend line in monthly, seasonal and annual rainfall series was found rising (April, July, September, October, pre-monsoon, post-monsoon and annual), falling (June, August and monsoon), zero (January, February, March, May, November, December and winter). The results of this study can be employed in sustainable development and management of water resources for study location.

Keywords: Trend analysis, Mann-Kendall (MK) test, Theil-Sen's slope (TSS), Prabhani,

MARKET-LED EXTENSION: ROLE OF EXTENSION AGENTS

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India is an agrarian country with 60% of its population depending on agriculture. It remains the principal source of livelihood for more than 58 % of the population and contributes 17.9% in national GDP. Agricultural sustainability can only be achieved when the ends are target from the means. This does not include only safe production in terms of consciousness of future generation needs but building up the capacity of the Agricultural system towards increase in productivity cum profit maximization through the new trend of extension services. Under WTO, the globalization/ liberalization of market demands farmers at all levels to transform themselves from production and selling in the domestic market to producer cum seller in the wider market scene to realize the optimum returns on their investments. The need for market led is of necessity by the paradigm shift of present agriculture scenarios which calls for conversion of the sector into profit oriented business. The transition from Legitimiser-led extension to Market-Led extension is quiet eventful in the country. Market-led-extension is the market ward orientation of agriculture through extension which includes agriculture & economics. Market-led-extension works with various aspects on quality, consumer's preference, market intelligence, processing, value addition and other marketing information on regular basis. Many initiatives like Rythu bazaar, AGMARKNET, iKisan, Digital Mandi have been started for the farmers to get market information and recently e-NAM was launched by the government to enhance market access by the farmers. But still there are some challenges which need to be faced related to production, market and extension. The role of extension agents is mainly to overcome these problems. However this loss can be minimized by the Market Led extension approach through adequate supply of information by SWOT analysis of the market, establishing market and agro processing linkages, direct marketing, and capacity building in terms of improved production and post-harvest operation such as proper handling, grading, standardizing, value addition, packaging as well as storage and transport system. The extension personnel must have some competency like technical, communication, facilitation and management in the present scenario to

fulfill the need of the farmers as there are many changes in today's marketing pattern which can help them in making it a profit oriented business.

SOCIO- ECONOMIC ASPECTS OF MENTHOL MINT CULTIVATION IN THE DISTRICTS OF UTTAR PRADESH

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This study was conducted in the Lucknow and other four main Menthol mint grower districts (Barabanki, Sitapur, Hardoi and Unnao) of Uttar Pradesh on socio-economic analysis of Menthol mint cultivation in the year 2016. The purpose of study was to know about socio economic characteristics of menthol mint growers in this area. In the study, major characters like age group of farmers, level of education, type of family, source of irrigations, annual income and problems associated in mint cultivation were observed. The small farmers of middle age groups were very keen to adopt mint cultivation. This cultivar was also worked out by input costs and output cost at different stages by the conventional/scientific methods. The study has exposed that the major portion of operational cost is shared by hired labour, distillation charges, irrigation and machine/tractor charges. The data shown variables like man labour, machinery, manures and fertilizer and irrigation charges have shown a positive and significant impact on the returns of mentha crop in the study area. The major problems faced by the farmers was high input cost (not easily availability of suckers and its high cost, fluctuated supply of electricity, infrastructural facilities, lack of sufficient cultivation information, low markets cost of the product and costly distillation tank. Majority of menthol mint growers are belonging in joint family systems having more than 6 members in a family. In the districts, bore-well was the main source of irrigation used by the mint growers. The farmers' net income was recorded of Rs. 30,000-40,000 per annum.

Keywords: Medicinal and aromatic plants, Menthol mint, *Mentha arvensis*, Cash crop.

CONSTRAINTS OF APICULTURE IN BAGHPAT DISTRICT UTTAR PRADESH

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Beekeeping plays an important role in the sustainable agriculture as it contributes significantly for diversification of agriculture. Beekeeping is an interesting hobby, an ideal agro-based subsidiary enterprise, providing supplementary and sometimes major source of income to the farmers, especially to the small farmers. It is an ideal, eco-friendly and non-land based rural enterprise, which does not tax the farm resources and provide sustainable livelihood to the rural people, including landless and women. Beekeeping production is affected by indiscriminate use of pesticides, bee diseases and enemies, adverse effects of weather, low price of products, etc. The susceptibility of honey bees to different diseases, pesticide hazards and marketing of bee products were found to be major limiting factors in the prospects of beekeeping. Majority of the beekeepers wanted to increase their level of business. Therefore, the specialized training courses should be organized to overcome these problems and promote their business.

Keyword: Apiculture, Allied business, Beekeeping, and Honey production.

AGRI-PRENUERSHIP AS A TOOL TO UPLIFTMENT OF AGRICULTURE

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A shift from agriculture to agribusiness is an essential pathway to revitalize Indian agriculture and to make more attractive and profitable venture. An agripreneur is someone who undertakes a variety of activities in agriculture and its allied sectors to be agripreneur. An agripreneur may start an agro business, change a business direction, acquire a business or may be involved in innovatory activity of value addition. India 2/3rd population is employed in the agriculture sector, providing viable and sustainable business opportunities in Indian agribusiness is essential for generating employment in the country. Innovation, production, financial and marketing was the four step to be an agripreneur. Various challenges/ barriers faced by

the agripreneurs like lack of funds, lack of infrastructure, risk, marketing problems and competition, management problems. To solve these problems measures should be adopted i.e. establishment of finance cells, Concessional rates of interest, suitable supply of raw materials, offering training facilities and setting up marketing co-operatives.

IMPORTANCE OF BLACK GRAM IN HUMAN LIFE

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Black gram has been in cultivation from ancient times and is one of the most highly prized pulses of India and Pakistan. It is originated by India. It is very widely used in Punjabi cuisine and is often referred to as maah di daal in the native language by Punjabis. The Coastal Andhra region in Andhra Pradesh is famous for black gram. The Guntur District ranks first in Andhra Pradesh for the production of black gram. Black gram has also been introduced to other tropical areas such as the Caribbean, Fiji, Mauritius, and Africa, mainly by Indian immigrants. Black gram (VIGNA MUNGO L.) belongs to leguminaceae family known as also urd. The Black gram make a importance role in our health like Black gram originated in India, where it has been in cultivation from ancient times and is one of the most highly prized pulses of India and Pakistan. It is very widely used in Punjabi cuisine. Black gram is rich In protein 25.26%, Carbohydrate 59.9%, Fat 1.64%, Cholesterol 0% and Vitamin A -23 IU and many micro nutrients like Zinc ,phosphorus ,Mg ,Fe, etc also found . Black gram is one of the important crops among the pulses crop. In India the area under black gram cultivation is 3.19 Million ha producing 1.95 million tones and contributes 11% of the total production in the our country.

PRECISION FARMING: THE FUTURE OF INDIAN AGRICULTURE

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Human kind invented agriculture 10,000 years ago. After a long mile, no where in the world has agriculture made such an impact as it has made in India. The economy of the second most populous country in the world is inextricably linked to the pulse of its agricultural success or failure. The green revolution in the late 60's saw the country through a period of what could otherwise have been the worst famine in the world. Yet after nearly three and half decades into the post green revolution period, the country still faces crisis each year in trying to meet the burgeoning demand for food by its people. As the result of information technology application in agriculture, precision farming is a feasible approach for sustainable agriculture. Precision Farming or Precision Agriculture is generally defined as information and technology based farm management system to identify, analyse and manage spatial and temporal variability within fields for optimum productivity and profitability, sustainability and protection of the land resource by minimizing the production costs. The use of inputs (i.e. chemical fertilizers and pesticides) based on the right quantity, at the right time, and in the right place. This type of management is commonly known as "Site-Specific Management". Precision farming makes use of remote sensing to macro-control of GPS to locate precisely ground position and of GIS to store ground information. It precisely establishes various operations, such as the best tillage, application of fertilizer, sowing, irrigation, harvesting etc., and turns traditional extensive production to intensive production according to space variable data. PA is facilitating the prospects and scope for switching over to modern agriculture leaving the traditional one by utilizing right resources in right time and management, which results an environment friendly sustainable agriculture.

Keywords : Indian agriculture, Precision farming, sustainable agriculture, remote sensing

IMPACT OF PROTECTED HORTICULTURE SKILFUL TRAINING ON TRIPLING THE INCOME OF UNEMPLOYED RURAL YOUTHS

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Skill Development is specially designed to enhance trainees' capabilities, to enable them to efficiently deal with various skilled jobs. By way of effectiveness of Skill development an individual can achieve the goals of the corporate world. In recent times, investment in training and skill development has come to be considered as an asset for organizational development and it's in fact safe to say that, training is indispensable for effective organization development also. Therefore, the credibility of any training programme for employees lies in its usefulness and significance to the needs of both the employees and their organizations at large. In this concern, the Hi-tech horticulture is becoming popular with the help of

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NHM and NHB. The farmers are diversifying from traditional crops to Horticultural crops for higher income. Poly house and Shade net house are being established continuously under various Government schemes. After sometime poly house and shade net house become old, damaged and haphazard. In this situation, the farmers depend on big companies for repair and maintenance of poly house and shade net house. But, companies show their interest in establishing new ones as compare to repair and maintenance. So, due to lack of technically skilled person at grass root level, Poly house and Shade net house could not be repaired which were major constraints in adoption of poly house and shade net house, but the poly house and shade net house plays important role in enhancing of farmer income. In this context it essential to trained youth for repair of poly house and shade net house which helpful in self employment generation and to provide services for poly house and shade net house repair at grass root level. A training of 20 youth was conducted on repair and maintenance of poly house and shade net house. Apart from the revenue generation, the participants formed a group and they earned 6.25 lakh in 1^{1/2} year through the repair and maintenance of dozens of Shade net and poly house in Rajasthan and Madhya Pradesh. Total 25 youths were engaged for 636 days and earned Rs. 624997 as service component. The monitoring impact of training was that their income increased from Rs. 250 per day to Rs. 982.70 per day.

Key words:- Poly house, shade net, repair, maintenance, skill.

ROLE OF AGRICULTURE AND ALLIED SECTORS (ANIMAL HUSBANDRY, FISHERIES, SERICULTURE, FORESTRY) IN INDIAN ECONOMY

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Indian economy is classified in three sectors - Agriculture and allied, Industry and Services. Agriculture plays a vital role in India's economy. Indian agriculture sector accounts for 18 per cent of India's gross domestic product (GDP) and provides employment to 50% of the country's workforce. Livestock provides livelihood to two-third of rural community. It also provides employment to about 8.8 % of the population in India. India has vast livestock resources. Livestock sector contributes 4.11% GDP and 25.6% of total Agriculture GDP. Fish and fish products have presently emerged as the largest group in agricultural exports of India, with 10.51 lakh tonnes in terms of quantity and Rs.33,442 crores in value. Sericulture is an important cottage industry in India contributing roughly to 5% of GDP. Forests provide several goods which serve as raw materials for many industries. Wood grown in forests serves as a source of energy for rural households. Survey of India states its forest cover increased to 69.8 million hectares by 2012, per satellite measurements; this represents an increase of 5,871 square kilometres of forest cover in 2 years. Forestry industry contributed 1.7% to India's GDP.

PUBLIC-PRIVATE PARTNERSHIP (PPP) MODEL - PRESENT NEED

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Public-private partnership (PPP) is a funding model for a public infrastructure project such as a new telecommunications system, airport or power plant. The public partner is represented by the government at a local, state and/or national level. The private partner can be a privately-owned business, public corporation or consortium of businesses with a specific area of expertise. PPP is a broad term that can be applied to anything from a simple, short term management contract (with or without investment requirements) to a long-term contract that includes funding, planning, building, operation, maintenance and divestiture. PPP arrangements are useful for large projects that require highly-skilled workers and a significant cash outlay to get started. They are also useful in countries that require the state to legally own any infrastructure that serves the public. Examples of PPP models: Design-Build (DB), Operation & Maintenance Contract (O & M), Design-Build-Finance-Operate (DBFO), Build-Own-Operate (BOO), Build-Own-Operate-Transfer (BOOT), Buy-Build-Operate (BBO), Build-lease-operate-transfer (BLOT), Operation License, Finance Only etc .

CRYOPRESERVATION: A BETTER TECHNIQUE TO CONSERVE GERMPLASM OVER THE CONVENTIONAL METHODS

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Conservation in field gene banks is not a safer strategy anymore because of pest, disease and adverse weather conditions. Their maintenance is labour-intensive and requires vast areas of land. Conservation of germplasm in the form of in vitro cultures has been adapted as a safer method for conservation for safety duplication of the field collections, rapid

multiplication and distribution of disease-free plant material. However, in recent times, cryopreservation i.e. storage of germplasm at ultra-low temperature (196°C) in liquid nitrogen has been advocated for long term storage of germplasm than invitro conservation which provides only short term conservation. Cryopreservation is a cost-effective long term method of conservation of germplasm and successfully used for conservation of diverse plant materials like apices, zygotic embryos, cell suspensions and calli. It is highly effective for vegetatively propagated and recalcitrant seeds where the normal conservation methods are not successful. It has also found its use in cryoselection, cryotherapy and in biotechnology in recent times. Cryopreservation protocol needs to be standardized so that this technique can be applied for a wide range plant species. There is a need to develop easy protocols and understand the complex cytochemical and biochemical changes involved in cryopreservation. Till date, no standard cryopreservation protocol is available which can be used widely and can be applicable to a variety of plant species. Each time, the protocol has to be standardized. So there is a need to co-ordinate between the private and the public sectors and between various countries to implement cryopreservation for conserving the germplasm for large scale application.

Keywords: Cryopreservation, Germplasm, Recalcitrant seeds, Long term conservation.

SYNTHESIS OF STEROID-BASED MOLECULAR IMPRINTED POLYMER AND THEIR MOLECULAR RECOGNITION STUDY FOR DRUG COUNTERFEITING STUDY

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Introduction: Molecular imprinting technology is a new and revolutionary way of producing recognition sites for specific analyte in synthetic polymers. This imprinting technology can be used to generate polymeric materials with recognition sites providing high selectivity and affinity for template molecules. **Objective:** Recognition of two steroid compounds, β -estradiol and testosterone were studied using a synthesized molecular imprinted polymer and distinguished counterfeit drug. A molecular imprinted polymer (MIP) was prepared by non-covalent molecular imprinting approach. The number and nature of functional groups present in a β -estradiol and testosterone molecule seemed to be suitable to design specific recognition cavities with the non-covalent approach. Surface characteristics were investigated by Scanning Electron Microscope (SEM) measurements. **Methodology:** For MIP synthesis, β -estradiol and testosterone were used as template molecule; the polymer was synthesized via non covalent interaction using methacrylic acid as functional monomer, ethylene glycol dimethacrylate as cross-linker and azobisisobutyronitrile as initiator. The MIP prepared have a strong and specific affinity for both steroids, using non-covalent approach. Release of template was performed by continuous extraction with methyl alcohol containing 10% acetic acid in a soxhlet extractor. After completion of the extraction rebinding experiment was carried out to separate analyte of interest from the sample matrix. The analyte eluted from MIPs by methanol was analysed by U.V and study of surface morphology is carried by scanning electron microscope. **Result:** The SEM clearly shows that pores were embedded in the network of the MIPs, and that there were substantial differences in morphology between the MIPs and Non Imprinted Polymers (NIPs). The NIPs had a smoother structure with small cavities and surface area than those of the MIPs, which indicates that the increase of surface area of MIPs was because of imprinting. **Conclusion:** This research presents MIP as interesting biomaterial for analyte identification and separation of drugs from complex biological matrices and may serve as useful references for identification of other steroidal drugs.

DYNAMICS OF GRAZING LAND RESOURCE AVAILABILITY AND UTILIZATION IN CENTRAL REGION OF UTTAR PRADESH

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Based on primary and secondary data pertaining to the availability, utilization and conservation of grazing land resources at a village level in Indo-Gangetic plains of India, the paper highlights that there has been a significant decline in the grazing land resources over the last 15 years. Only 53.1% of grazing lands and forest land resources are actually available for grazing purposes. Out of available grazing land resource, the main source of grazing is forest land (72.46%) followed by culturable waste lands (16.56%). The scenario at the district level is also the same, as the area of grazing lands has decreased from 71

thousand ha in 1991-92 to 48.2 thousands ha during last 25 years. The intensity of grazing is 16 animals per ha. The village is acutely deficit in green fodder availability against its requirement, and the farmers resort to grazing of animals (except costly milch animals) to optimize the nutritional constraints. The worst sufferers are the livestock owners having very less or no availability of cultivated land. Neglect, poor maintenance and overgrazing have resulted in most of the grazing resources declining to a poor and degraded condition. Farmers lack guidance, extension service and the requisite sensitization to efficiently manage these resources. The role of village-panchayat institution in efficient management of grazing land resources is almost negligible. Much detailed work at ground level for green fodder production, grazing land maintenance and conservation is desired with the active involvement of multi-stakeholders and under the ambit of a national policy in this regard.

Keywords: Land-use, grazing land resources, livestock production, fodder demand, grazing practices, grazing land maintenance and conservation

MOLECULARLY IMPRINTED POLYMERS FOR SELECTIVE DETERMINATION OF ENVIRONMENTAL POLLUTANTS – A REVIEW

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Molecular imprinting technology is a new and revolutionary way of producing recognition sites for specific analyte in synthetic polymers. This imprinting technology can be used to generate polymeric materials with recognition sites providing high selectivity and affinity for template molecules. The molecularly imprinted polymers (MIPs) are synthetic polymers possessing specific cavities designed for a target molecule. By a mechanism of molecular recognition, the MIPs are used as selective tools for the development of various analytical techniques such as liquid chromatography, capillary electro chromatography, solid-phase extraction (SPE), binding assays and biosensors. This review describes the application of MIPs to the determination of environmental pollutants in these different analytical approaches with a special emphasis on their potential as selective SPE sorbent for the selective extraction of target analytes from complex matrices. Present review reports the principle of synthesis of MIPs and the different approaches to evaluate their selectivity. Their use in different analytical techniques for the determination of pollutants in complex environmental matrices is discussed with a special emphasis on their potential as SPE sorbent.

AGRICULTURAL MARKET INFRASTRUCTURE

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Efficient marketing infrastructure such as wholesale, retail and assembly markets and storage facilities is essential for cost-effective marketing, to minimize post-harvest losses and to reduce health risks. Markets play an important role in rural development, income generation, food security, and developing rural-market linkages. Experience shows that planners need to be aware of how to design markets that meet a community's social and economic needs and how to choose a suitable site for a new market. In many cases sites are chosen that are inappropriate and result in under-use or even no use of the infrastructure constructed. It is also not sufficient just to build a market: attention needs to be paid to how that market will be managed, operated and maintained. Most market improvements that have been only aimed at infrastructure upgrading and have not guaranteed maintenance and management have failed within a few years. Rural assembly markets are located in production areas and primarily serve as places where farmers can meet with traders to sell their products. These may be occasional (perhaps weekly) markets, such as haat bazaars in India and Nepal, or permanent. Terminal wholesale markets are located in major metropolitan areas, where produce is finally channelled to consumers through trade between wholesalers and retailers, caterers, etc. The characteristics of wholesale markets have changed considerably as retailing changes in response to urban growth, the increasing role of supermarkets and increased consumer spending capacity. These changes may require responses in the way in which traditional wholesale markets are organized and managed. Retail marketing systems in western countries have broadly evolved from traditional street markets through to the modern hypermarket or out-of-town shopping center. In developing countries, there remains scope to improve agricultural marketing by constructing new retail markets, despite the growth of supermarkets, although municipalities often view markets primarily as sources of revenue rather than infrastructure requiring development. Effective regulation of markets is essential. Inside a market, both hygiene rules and revenue collection activities have to be enforced. Of equal importance, however, is the maintenance of order outside the market. Licensed traders in a market will not be willing to cooperate in raising standards if they face competition from unlicensed operators outside who do not pay any of the costs involved in providing a proper service.

ECONOMICS OF POTATO CULTIVATION IN AZAMGARH DISTRICT**RAM SINGH YADAV, R. R. KUSHWAHA, AJEET KUMAR***Department of Agril. Economics, NDUA&T- Kumarganj, Faizabad (224229) U.P.*

The study showed that average holding size on overall farm was 1.553ha and cropping intensity was 217.92 percent. Cropping intensity was inversely related with the size of farms. The per farm average investment on overall farm in came to Rs. 242208.79 and maximum share was under the head of building i.e. 57.00 percent followed by farm machinery and livestock share. The overall average cost of cultivation (C_3) per hectare was Rs. 78154.62 and Gross income came to Rs. 123527.20, which offers a net income of Rs. 4537250. Among the various resources considered under study the cost of seed showed significant relationship at 1 per cent level of probability in marginal category of farms and it was significantly associated at 5 per cent probability level in small and medium size group of farms. Another factor of production i.e. manure and fertilizer was found significantly associated with dependent variable at 1 per cent level probability in all farm situation. The some of elasticity shows that potato cultivation was characterized as decreasing return to scale and positive value of marginal product indicate towards the further scope of expenditure on input to earn more than the cost. Problem related with hired human labor and technical knowledge were noticed at 1st and 2nd rank by the sample farmers.

STUDY ON TEMPERATURE DEPENDENT DIELECTRIC PROPERTIES OF HONEY FOR QUALITY ASSESSMENT**RAMAN DEVI***Department of Physics, CCS Haryana Agricultural University, Hissar, Haryana- 125004*

Honey is a natural food produced by honey bees, mainly composed of sugars. Monosaccharides represent about 75% of the honey sugars, 10–15% are disaccharides and the rest are small amounts of other sugars. Strong biological effects of honey and its positive influence on human health caused by prebiotic, antioxidant, antibacterial functionalities of certain constituents are very well proven. It is defined as a pure and natural product that does not include other substances. Honey is very often adulterated or improperly treated causing quality decrease and reduction of therapeutic value. The high price of honey and its limited availability results in adulteration by adding water or inexpensive sweeteners as well as overheating. Temperature and water content have been proved to be the most important factors influencing dielectric properties of food materials. Due to adulteration dielectric properties of honey changes and hence the quality which affects human health. In this study we measure dielectric constant of different brands of honey and dielectric properties at different temperature conditions. Results tend to determine the quality of honey by comparing with standard value of dielectric properties.

Key words: Honey, Honey quality, Dielectric constant, Temperature

FOOD PROCESSING AND VALUE ADDITION TO ENTREPRENEURSHIP FOR RURAL DEVELOPMENT**RAMESHWAR JANGU*, M. L. MEENA*****Department of Horticulture Babasaheb Bhimrao Ambedkar University, Lucknow*

Food processing is the process of value adding of fruit and vegetables by using various techniques like grading, sorting and packaging etc., which enhances the shelf life of food products. Unprocessed foods are susceptible to spoilage by biochemical processes, microbial attack and infestation. India is the second largest fruits and vegetables producer in the world. Although around 30% of total production gets waste due to lack of improper knowledge about post harvest handling, storage, packaging and lack of cold chain infrastructure. In India only 2-3% of total production of fruits and vegetables are processed which is extremely low as compared to the international averages. The market for processed foods in India is growing significantly with its increased consumption by the present-day consumers. The past decade has witnessed a radical development on India's food processing sector but still the processing level in India is low when compared to its vast production. Hence, it should be realised that its increase would in turn drive up the Indian economy. As a regulatory mechanism, the ministry of food processing industry acts as a catalyst to bring greater investment for entrepreneurs guiding and helping the industry to create a conducive environment for its healthy growth. Entrepreneurship needs more focus and emphasize for tapping all such cashing opportunities. It plays a vital role in diversification and commercialization of agriculture, enhances shelf life, ensures value addition to agro products, generates employment, enhances income of the farmers and creates market for export of agro foods. However, there are a lot of barriers in the entrepreneurship of food processing pertaining to technology, finance, marketing and export. There is an urgent need to provide facilities for entrepreneurs to run up an economically viable unit.

Keywords: Food Processing, Infrastructure, Entrepreneurship, Barriers.

SOCIO-ECONOMIC ASSESSMENT OF RURAL LIVELIHOOD THEIR PATTERN AND PROBLEMS IN KANGRA DISTRICT OF HIMACHAL PRADESH

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Agriculture is considered as main stay of livelihood for two-third of rural population in Himachal Pradesh. Vegetable plays an important role in the state agriculture by providing food, nutrition and economic security to the people. About 88 percent land holding are marginal and small and growing of foodgrain crops are not profitable. Farmers are diversifying their cropping pattern towards vegetable crops. This will increase income and employment in the area. The area and production of vegetable crops in the state has increased over the period but, the returns from vegetable production is depended on the optimum use of inputs and their efficient use. Therefore, the present study was undertaken in Nagrota Bagwan block of Kangra district to study the socio-economic pattern and problems faced by vegetable growers. Three stage random sampling technique was used to select a representative sample of 60 vegetable growers from Nagrota Bagwan block of Kangra district. On an average literacy-rate of 96 per cent was recorded on the sample farms. The average size of land holdings was 0.68 hectares per farm. The results emanated showed that there was a cropping intensity of 200.59 per cent on the sample farms. The total household income was calculated as Rs 291619 per farm and the vegetables contributed around 46 per cent to the total household income. The major problems reported by the vegetable growers were scarce & costly labour, non-remunerative prices for produce, inadequate training facilities, lack of extension facilities and non-availability of seeds of desired quality. The policy implications suggested the need of awareness creation among the vegetable growers to make better use of improved technologies and enhance farm mechanization. There is also a need to diversify their cropping pattern towards vegetable cultivation to increase their farm income.

PYROLYSIS: AN EMERGING FUEL TECHNOLOGY FOR SUSTAINABLE FUTURE

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The available fossil fuel is the main source to fulfil the increasing fuel demand since long time but taking in to consideration the increasing prices, demand and pollution issue there is an urgent need to create sustainable and pollution free fuel. Pyrolysis oil now days seem to be alternative fuel. It is the oil obtained by the pyrolysis processes of plastic, tyre, biomass Etc. Pyrolysis is the thermochemical decomposition processes in which large molecules are broke down in to smaller molecular. The output of the pyrolysis is obtained in to three different forms i.e. solid, liquid and gases. The liquid obtained is called as pyrolysis oil which can be used as alternative fuel in blend with diesel after the necessary purification process. The present study was carried out at G. B. Pant University to check the suitability of tyre pyrolysis oil after purification in blend with diesel for engine use. It was observed that after the desulphurization and distillation processes the fuel properties of the oil comes nearly equal to diesel fuel and after blending with diesel up to 40% the oil was suitable for engine use.

Keywords: Pyrolysis, prices, Blend

NEED OF CANNING OF FRUIT AND VEGETABLE IN FOOD INDUSTRY

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Fruits and vegetables contribute important nutrients for the human body. Eating fruit and vegetable lowers the risk of developing many chronic diseases and can also help with weight management. Canning a method of preservation in which a cooked or uncooked food is sealed in tin plated and lacquered steel cans. The sealed cans are sterilized by heat treatment under high pressure in retort. The temperature required for effective sterilization varies with the pH of the product and is generally higher than boiling point of water (100°C or 212°F). The vegetable canning is similar to fruit canning except that the filling materials in case of vegetables is brine solution. The vegetables require thorough cleaning and slicing before passing through canning line. Since vegetables are low in acid it does not require lacquered cans. Canning is the process of sterilizing and sealing foods in airtight containers to preserve them. To retain nutrients and optimum quality, preserve fruits and vegetables when at their peak of freshness. Clean the food thoroughly before processing. Salt and/or sugar may be added to canned fruits and vegetables but these ingredients are not essential for a safe product. Microorganisms live and multiply quickly on the surfaces of fresh food and on the inside of bruised, insect-damaged, and diseased food. Oxygen and enzymes are present throughout fresh food tissues. These practices remove oxygen; destroy enzymes; prevent the growth of undesirable bacteria, yeasts, and molds; and help form a high vacuum in jars. Good vacuums form tight seals which keep liquid in and air and microorganisms out.

Keyword: Fruit and Vegetable, Blanching, Canned, Nutrient

ASSESSMENT OF ENERGY CONSERVATION THROUGH AUDIT: REVIEW

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India is 7th largest energy producer, 4th largest energy consumer and at 5th position as CO₂ emitter in the world. India is with 17.5% of the world population, having only 1% of available energy source. The fundamental goal of energy management is to produce goods and provide services with the least cost and environmental effect. In any industry, the three top expenses are often found to be energy (both electrical and thermal), labour and materials. Energy audit will help to understand more about the ways, energy and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exists. The world is moving in the direction of environment protection. There is all-round serious discussions/conferences to save the planet from Green House Gases, as the effect of these gases are alarming, i.e. it is killing wild life, creating health problems, rise in sea level, non-uniformity in seasons, ecology is totally disturbed and increase in flood situations. The increase of the so called greenhouse gases which also include methane, ozone, nitrous oxide etc. causes a rise of the earth's temperature. The use of renewable energy reduces the CO₂ emission through a reduction of the demand for fossil fuels. At the same time, by capturing uncontrolled methane emissions, the second most important greenhouse gas is reduced. Energy auditing in different field will assist to minimization of energy losses, proper energy conservation/management, reduce the harmful impact of global warming and shows the field where we can use renewable energy sources instead of non renewable energy. India is located in the equatorial sun belt of the earth and receives abundant solar radiation. Most parts of India experience 250 to 300 clear sunny days in a year. The average daily global solar radiation received in India varies between 4 to 7 kWh/m²/day that too for 5 to 5:30 hours per day.

ADVANCE ESTIMATION OF CROP YIELD THROUGH APPLICATION OF REGRESSION MODEL

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Estimation of crop production before harvest are required for marketing, price, import, export storage etc. Due to lack of proper storage facilities approximately 35 percent of the total is destroyed. To overcome from this situation, the storage need can be easily managed by advance estimation of crop yield. After using the available technology and proper demonstration, it is possible to increase the productivity. Regression analysis is a statistical forecasting model that is concerned with describing and evaluating the relationship between a given variable (usually called the dependent variables) and one or more other variables (usually known as the independent variable). The first stage of the process is to identify the variable to predict the dependent variable, then carry out regression analysis focusing on the variable. Then, regression analysis identifies the relationship between the dependent variable and the explanatory variables. Stepwise regression uses to screen out the important variables and by the help of different regression approach are subsequently employed to estimate model parameters. All possible regression analysis was carried out to select the best combination of variables on the basis of some important statistics such as C.V, R² Adjusted R², RMSE, Residuals & cook's D statistic. Finally, on basis of statistics viz. C.V, R² Adjusted R², RMSE, Residuals & cook's D statistic, the best fitted model is selected for forecasting.

Keyword: Yield estimation, Regression analysis, Statistical tools, Statistical model

ENHANCING NUTRITIONAL SECURITY AND ECONOMIC EMPOWERMENT OF WOMEN FARMERS OF INDIA

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The world population has increased to about 7.4 billion, out of which India's population is 17.86 percent, the second most populated country after China. Such a drastic growth brings forward challenges like shrinking resources, demands for quality food, achieving nutritional security, poverty and socio-economic development. Amongst these the availability of adequate amount of quality food i.e. achieving food security along with the nutritional security to the growing population is utmost crucial and important factor. Women farmers play an active and important role in agriculture. In developing countries like India, women's are the building blocks managing the food security of their family, unfortunately, they are also suffering from

malnutrition as they always tend to neglect their own health as priority on taking care of others. In lieu with this, Division of Agricultural Extension, ICAR-IARI has initiated steps ahead by leading a project funded by UNDP towards enhancing nutritional security and empowering farm women's of India. The current study is based on the results and outcomes of the above stated project, in which we surveyed and trained the total of 2000 women's. The study was conducted in the selected villages of districts Mewat, Jhajjar and Sonapat of Haryana state. Results revealed that there was about 40 percent increment in the level of knowledge of the women in terms of nutrition, value addition and post-harvest management of the nutri products such as *Bajra ladoos*, *Bajra pops*, *Soy tofu*, *Soy milk* etc. Additionally, based on the pre and post-tests, women's were found to have high entrepreneurial motivation to start their own ventures for their improved nutritional as well as socio-economic development. A pool of 725 nutripreneurs have emerged till now at micro levels who have started their ventures by selling the nutritionally rich food products at village and district level. The data pertaining to the same including the demographic profiling of the women is also discussed in the paper. This approach can be replicated in other locations which will yield positive impact in terms of economic empowerment and nutritional security.

RURAL WOMEN KEY TO SUSTAINABLE FOOD SECURITY

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The Food and Agriculture Organization has defined food security not only in terms of access to, and availability of food, but also in terms of resource distribution to produce food and purchasing power to buy food, where it is produced. This implies that food security is a broad concept dealing with production, distribution and consumption vis-à-vis food entitlement for all household members. According to UN, 'Human Development Report,' there is no country in the world in which women's quality of life is equal to that of men. It is estimated that 20 per cent of the world's population suffers from hunger and, at the extreme; 850 million of them endure chronic malnutrition. The problem of food insecurity is evidently seen as 88 countries, nearly half of which are situated in Sub Saharan Africa, where over 100 million people suffer from hunger. More than half of the continent's food insecure population lives in Ethiopia and other six African countries, namely Chad, Democratic Republic Congo, Uganda, Zambia and Somalia. They account for over 40 per cent of the population in Africa. Worldwide about 850 million people are hungry people. In India 212 million i.e. 25 per cent of people suffer from hunger and they are mainly marginal farmers, landless rural poor, urban poor and fishermen. Women are both producers and providers of food in developing countries. Apart from participating in a wide range of productive activities, they are also carrying out full responsibility not only in bearing and caring children but also in nurturing and breast-feeding them after birth. How can their contributions be measured relative to other members of the family? Food Security, at the individual, household, national, regional, and global levels [is achieved] when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for a healthy and active life FAO (2001). This study focuses on five pillars of food security viz., availability, accessibility, adequacy, utilization and stability. Women's contribution to food security is important for household food security, nutritional food security and national food security. The right to food is a fundamental human right. Yet; millions of people suffer the "ravages of hunger and malnutrition or the consequences of food insecurity". Though rural women lack control over land, finance, decision making, and restriction on movability, lower wages rate harsh working condition. Still the contribution to food security cannot be overlooked. They tend to be responsible for food production, processing, distribution and marketing of food and child care etc. In agriculture rural women account for as much as 84 per cent of the labour force in India. India has largest food schemes and programmes in the world which are ICDS, MDMS, and Annapurna. Still there are many issues which require attention of the Government for women which are SITRA, DWCRA, and SGSY. A shift is needed from development to empowerment of women in economic stand and social choice.

Keywords: Food security, Sustainable, Accessibility, Utilization, Stability.

ORGANIC FOODS

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Organic food, food raised without chemicals and processed without additives. Organic food refers to crops or livestock that are grown on the farm without the application of synthetic fertilizers or pesticides, and without using genetically modified organisms. In contrast, the type of agriculture followed by most farmers, which does include the use of synthetic pesticides and fertilizers, is termed conventional agriculture. Organic foods are made according to certain production standards. IN 1939, Lord Northbourne coined the term organic farming. Food whose ingredients are at least 95% organic by weight may carry the USDA Organic Label products containing only organic ingredients are labeled 100% organic. Organic gardening uses organic seeds, organic, organic fertilizers, compost, organic root, stimulators and organic pest control.

MALNUTRITION GROWS IN THE SOIL: A REVIEW**RICHA SRIVASTAVA^{1*}, NEERU BALA², LUXMI GAUTUM¹***Department of Food, Nutrition & Public Health, ECHS, SHUATS, Allahabad,**Department of Food, Nutrition & Public Health, ECHS, SHUATS, Allahabad*

Globally, India is considered as the fastest growing nation as far as it's economy is concerned however malnutrition still grows as an epidemic after so many decades have passed on after Independence. According to Global Hunger Index, India ranks 100 among 119 nations as reported by International Food Policy Research Institute in 2017. Although, India topped in production of major food staples globally. According to Global Nutrition Report 2017, India carries a serious burden of Anaemia, Obesity and Malnutrition. Malnutrition are often believed to be associated with starvation and underweight. However, malnutrition is defined by National Institutes of Health as the condition that occurs when your body does not get enough nutrients. India also faces dual burden of obesity along with malnutrition. In India, child and maternal malnutrition are often believed to be a bigger concern than child and maternal obesity which is rising as an epidemic for the future generations and may lead them to various comorbidities associated with obesity. Therefore, it is a very necessary to explore more about the multiple factors that may be responsible behind Malnutrition. Soil Health deterioration is rising as one of the biggest concern behind nutritionally poor outcome of crops. I want to draw the attention of researchers towards the need of more research on Nutritional Insufficiency of the staple foods and to find out the associated factors that may be responsible behind nutritionally inadequate crops. Along with proper strategies, farmers and consumers both should be given nutritional awareness to overcome with Malnutrition.

Keywords: *Malnutrition, Starvation, Obesity, Comorbidities, Soil Health***IMPORTANCE OF CONSERVATION TILLAGE ON PHYSICAL PROPERTIES OF SOIL****RICHA^{1*}, MAMTA² AND RAMAN DEVI³**^{1, 2, 3} *Department of Physics, CCS Haryana Agricultural University, Hisar-125004*

Today world is facing population explosion and there is urgent need to increase the farm productivity for ensuring food security. Due to high yielding varieties, imbalanced use of fertilizers and intensive/conventional agriculture for increasing farm productivity, there is degradation of soil health, quality and environment. Conservation agriculture is the best option to increase the farm productivity to ensure food security on sustainable basis. Conservation agriculture aims to conserve, improve and make more efficient use of natural resources through integrated management of available soil, water and biological resources combined with external inputs. It contributes to environmental conservation as well as to enhance and sustained agricultural production. Conservation tillage is one of the importance components of the conservation agriculture which involves reducing the tillage operations and retention of plant residues at the soil surface in the ratio of at least 30%. Conservation tillage affects soil compaction and enhances soil aggregation, improves hydraulic conductivity, increases soil porosity, water storage and soil organic carbon of soil. The increase in soil organic carbon influences soil structure and water transmission properties. Thus, conservation tillage leads to favourable changes in the physical and chemical properties of a soil and provides the best opportunity for restoring and improving soil productivity; however, the magnitude of changes varies with the texture of the soil, tillage operations, soil moisture and climate.

Keywords: *Conservation tillage, food security, sustainability, soil health and quality***APPLICATION OF GREEN CHEMISTRY IN DIFFERENT FIELDS****RISHABH BHARDWAJ AND SARIKA GOEL***Dept. of Basic science, Shri Ram College, Muzaffarnagar*

Green chemistry, also called sustainable chemistry, is an area of chemistry and chemical engineering focused on the designing of products and processes that minimize the use and generation of hazardous substances. Applications of green chemistry include the use in pharmaceutical industry, along with new methodologies that decrease or eliminate the use of solvents, or render them safer and more effective. Green chemistry has also motivated numerous ways to synthesize petroleum-based chemicals from biological materials instead, regularly plant matter or waste. Green chemistry has different industrial applications in designing safer chemicals production, food & flavor Industry, and green technologies in the pharmaceutical Industry, paper & pulp industry, polymer industry, sugar & distillery industries, textile and tannery industry and green chemistry in agrochemicals. Green chemistry also plays an important role in alternate energy science, and

the production of novel methods to make solar cells, fuel cells, and batteries for energy storage. Self-assembling molecules uses bio-based plant materials which also involves green chemistry principles. Chemically synthesized agrochemicals are harmful to the environment as they are non-biodegradable and are produced by environmentally unfriendly processes.

The main goal of green chemistry is to reduce or eliminate waste in the manufacture of chemicals and its allied products, which has inspired the design of green next generation catalysts. Other developments in green chemistry are the trend toward redesigning chemical products to reduce their risk.

Keywords: Pharmecutical industry, polymer industry, reduce waste

SOIL CONDITIONER - A CONTRIVANCE FOR IMPROVING SOIL QUALITY

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A soil conditioner is a product which is added to soil to improve the soil's physical qualities, usually its fertility (ability to provide nutrition for plants) and sometimes its mechanics. In general usage, the term "soil conditioner" is often thought of as a subset of the category soil amendments, which more often is understood to include a wide range of fertilizers and non-organic materials. Soil conditioners can be used to improve poor soils, or to rebuild soils which have been damaged by improper soil management. They can make poor soils more usable, and can be used to maintain soils in peak condition. Soil quality is the capacity of a specific kind of soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality, and sustain plant, animal and human health. Soil conditioner improves the physical, chemical and biological quality of soil. It includes Minerals (e.g. gypsum, lime, etc.), Modified rocks and minerals (e.g. sand, clay, rockwool, pumice, etc.), Industrial by-products (e.g. steel mill slag, press mud), Organics (e.g. compost, sea weeds, humates, etc.), Microbes (e.g. Blue green algae- *Anabaena*, *Spirulina*, etc.) and Synthetic Polymers (e.g. polyacrylamide, poly vinyl alcohol, Hydrogels, etc). Soil conditioners optimize one or more soil physical properties, such as bulk density, porosity, aggregate stability, dispersivity parameter, erodibility, rain splash detachment, soil crusting, hydraulic conductivity, water retention characteristics, plant-available water capacity, air capacity, infiltration rate and cumulative evaporation. Many of the soil conditioners increase total microbial counts of sandy and calcareous soils. Application of Cyanobacteria as soil conditioner in salt affected soil resulted in significant improvement in the aggregation status of soil by producing exo-polysaccharides and brought down appreciably the pH, electric conductivity and exchangeable sodium, furthermore they increased considerably the hydraulic conductivity of soil. In this era of intensive agriculture where our soil and environment are under threat of degradation, soil conditioners are helpful to improve its quality.

Keywords- Soil conditioner, Soil Quality, Soil properties

IMPORTENCE OF PRADHAN MANTRI FASAL BIMA YOJANA IN AGRICULTURE SECTOR

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Pradhan Mantri Fasal Bima Yojana is an effective initiative taken by the Ministry of Agriculture and Farmers Welfare, Government of India. The PMFBY launched in April 2016 by merging two schemes i.e.; NAIS & mNAIS with some improvement. This project paves way for a farmer to get his crop insured. The new crop insurance scheme is in line with One Nation – One Scheme theme. The PMFBY will replace the existing two schemes National Agricultural Insurance Scheme as well as the Modified NAIS. Pradhan Mantri Fasal Bima Yojana (PMFBY) aims at supporting sustainable production in agriculture sector by way of, encouraging farmers to adopt innovative and modern agricultural practices, ensuring flow of credit to the agriculture sector; which will contribute to food security, crop diversification and enhancing growth and competitiveness of agriculture sector besides protecting farmers from production risks. Coverage of crops are food crops (cereal, millets, pulses), oilseeds, and annual commercial/horticultural crops. Premium Rates for *rabi*, *kharif* and annual commercial crop is 1.5%, 2.0% and 5.0% of SI(sum insured) or actuarial rate (whichever is less) respectively.

Keywords: Premium Rates, innovative, NAIS & mNAIS, etc

REVIEW OF RURAL DEVELOPMENT PROGRAMMES IN INDIA

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The current population of India is 135 crores as on September, 2018, based on the latest United Nations estimates. Thus, nearly 70 per cent of the India's population lives in rural areas. The Rural development generally refers to the process of improving the quality of life and economic well-being of people living in rural areas. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is considered as a "Silver Bullet" for eradicating rural poverty and unemployment, by way of generating demand for productive labour force in villages. It provides an alternative source of livelihood which will have an impact on reducing migration, restricting child labour, alleviating poverty, and making villages self-sustaining through productive assets creation such as road construction, cleaning up of water tanks, soil and water conservation work etc. For which it has been considered as the largest anti-poverty Programme in the world. In this topic, We discuss to improve the conditions of rural people, Government of India launched some schemes through the planning commission of India such as Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Pradhan Mantri Ujjwala Yojana (PMUY), Indira Awas Yojana (IAY), Sampoorna Grameen Rojgar Yojana (SGRY), Integrated Tribal Development Project (ITDP), Integrated Rural Development Programmes (IRDP), Pradhan Mantri Gram Sadak Yojana (PMGSY), Integrated Child Development Services (ICDS), Development of Women and Children in Rural Areas (DWCRA), Rastriya Krishi Vikash Yojana (RKVY) and Bharat Nirman etc. Bharat Nirman is an Indian business plan for creating and augmenting basic rural infrastructure. These rural populations can be characterized by mass poverty, low levels of literacy and income, high level of unemployment, poor nutrition and health status. In order to tackle these specific problems, a number of rural development programs are being implemented to create opportunities for improvement of the quality of life of these rural peoples. All these schemes are aimed to reduce the gap between rural and urban people which would help reduce imbalances and improve the standard of living of rural areas peoples.

Keywords: MGNREGA, DWCRA, SGRY, IRDP, PMGSY, ICDC, IAY

ROLE OF MASS MEDIA IN PROVIDING EDUCATION

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John Dewey stated that education could not be limited within teacher and taught without social environment. So mass media is one such potent force in the social environment of education. Through modern electronic techniques and technologies, mass media prove that education is, really comprehensive not confined within four walls of the classroom. Really, mass media are the educational medium for the mass and mass education. Irrespective of caste, colour, geographical, sociological, economical diversities mass media prove as an important means for the education to all. Mankind gets a great deal of information from the widespread mass media i.e. newspaper, TV, radio, magazines, journals, films, etc. It is estimated that mass media may substitute the real classroom teaching in future. Television programs, internet websites, feature-length films, newspapers, music tapes and CDs, magazines, billboards, radio programs: essentially, a tool/technology which is used by someone to transmit a message to a large external audience as mass media. Therefore, mass media are the main means of educating the society. These are the cheapest and quickest means of the education for the people. The impact and motivation is very quick through mass media. The teacher must use the educational media and methods effectively in the classroom.

GOVERNMENT POLICIES AND PLANNING FOR SUSTAINABLE DEVELOPMENT IN INDIA

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Development implies overall positive change in the quality of life of the people. It is a process and method of developing something. Sustainable development is the development that is likely to achieve durable satisfaction of human wants and improvement in the quality of life of the people. It helps the poor societies who are left with no option rather than demolish their environment to survive. In India, the goal of sustainable development needs to bring the development and environment together into one set of target. The improper balance between the environment and development is the fault line every time in global conferences. Governance is an ongoing process that has to continually adapt to new situations, challenges and the opportunities provided by new technologies for the planning and development in India.

Keywords; Development, Planning, Environment, Governance...

INFLUENCE OF KNOWLEDGE ON STUDENTS IN SCHOOL VEGETABLE GARDEN AND GARDEN ACTIVITIES

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Agricultural activities have produced a variety of educational benefits in primary school students. It has deepened the recognition of the importance of feeling nature, enhanced the ability of self-control and widened the understanding toward work. At disabled children's schools and in classes of disabled children, agricultural activities have immensely contributed to the development of these children, academically and socio psychologically. Kerala Agricultural University also supports agricultural school outreach programmes through its extension system and student social bodies like National Service Scheme with an aim to improve the knowledge, skill, attitude and understanding of the school children on agriculture with special reference to vegetable gardens. The focus of school gardens has shifted in purpose from production, loyalty, and safety to health and nutrition. Health and school officials see the school classroom and the lunchroom as associations for garden nutrition programs. Hands-on nutrition programs based on the use of gardens increased the number of fruits and vegetables children eat on a daily basis, particularly as healthy snack choices (Lineberger and Zajicek, 2000).

Key words: Agriculture, School Vegetable garden.

JOB OPPORTUNITIES IN AGRICULTURE SECTOR THROUGH ASCI

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As we all know that, present time nobody wants to do work as agriculturist, neither farmers nor non-farmers. Everyone wants a white collar job. Hence, thousands of rural youths and school dropouts are continue migrating from villages to metropolitan cities to earn their livelihood. Considering above facts, Agriculture Skill Council of India (ASCI) was established on 4th January, 2013 as Section 8 Company under the Companies Act, Ministry of Corporate Affairs. It is working under the aegis of Ministry of Skill Development & Entrepreneurship (MSDE), GOI. The endeavor of ASCI is to bridge the gap between laboratories and farms. ASCI works towards capacity building by upgrading skills of farmers, wage workers, self-employed and extension workers engaged in organized / unorganized segments of Agriculture & Allied Sectors. ASCI have eminent experts, representatives from Government Bodies, Academicians, Boards, Industry Association, Industry, Growers Associations, etc. in the Board of Governing Council. ASCI envisions to touch/upgrade skills of cultivators, agricultural labourers and direct & indirect labour engaged in organized and unorganized agriculture and allied industry. ASCI is contributing to nation building through Skill Development in Agriculture especially at the times when country's agriculture is experiencing stagnant growth, exodus of quality manpower to other sectors, changing climate with increased variability in production parameters and transformations in international agriculture markets that are especially too much subsidized challenging the competitiveness of Indian Agriculture. ASCI has taken upon itself the responsibility of transforming Indian Agriculture through developing the skills of country's manpower in emerging areas of agriculture.

Keywords: Job opportunities, agriculture sector, skill development, rural youth

UTILIZATION OF HONEY AS SWEETENER FOR THE PREPARATION OF COW MILK LASSI

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The present investigation entitled "Utilization of honey as sweetener for the preparation of cow milk lassi" was undertaken during the year 2014-2015 at Animal Husbandry and Dairy science section, college of agriculture, Nagpur. Milk was standardized to 3.5 per cent fat and used for preparing dahi. Then lassi prepared with addition of sugar at 15% (T₁) and honey@ 10% (T₂), 12% (T₃) and 14% (T₄) per cent by weight of dahi. The product was analyzed for chemical composition like fat, protein, total solids, titratable acidity, ash and moisture as well as for sensory attribute like colour and appearance, body and texture, flavour and overall acceptability. The cost of production was also calculated by considering the retail market prices of different ingredients used. The data revealed that total solid (%) of lassi were increased with increase in level of honey. While fat (%), protein (%), titratable acidity (%), ash (%) and moisture (%) were decreased with increase in level of honey. The fat content was decreased from 3.42 to 3.27 per cent, total solids content decreased from 17.30 to 21.34 per cent, protein content decreased from 3.10 to 2.62 per cent, titratable acidity decreased from 0.85 to 0.76, ash content decreased from 0.70 to 0.53 and moisture content decreased from 82.70 to 78.66 per cent respectively. The significantly highest score for colour and appearance (8.16 out of 9), body and texture (7.79 out of 9), flavour (7.89 out of 9) and overall acceptability (8.38 out of 9) were obtained in lassi containing 12 per cent of honey. The cost of production of lassi was increased with increase in the level of honey. The cost of production was higher with 14 per cent honey level (Rs. 93.78 per kg) while cost of the lassi prepared by blending with 12 parts of honey level was Rs. 86.86 kg⁻¹.

Keywords: Plain lassi, lassi blended with honey as sweetener, physicochemical parameters, sensory attributes, cost structure

AN ECONOMIC ANALYSIS OF RICE BASED CROPPING SYSTEMS IN RATNAGIRI DISTRICT OF MAHARASHTRA**S. A. DIWATE, S. C. PHUGE *, S. J. MHATARE, J. M. YADAV, V. N. ANAP AND J. M. TALATHI***Department of Agricultural Economics, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli – 415712, Dist. Ratnagiri, Maharashtra,*

The study was conducted at Department of Agricultural Economics, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli Dist. Ratnagiri with objectives to estimate cost, return and profitability of rice based cropping systems in Ratnagiri district of Maharashtra. In this study, primary data were collected from 120 farmers by personal interview method with the help of pre-tested schedule. Simple tabular analysis was applied for the comparison of yields and inputs used by the farmers. Economics of individual crop and crop combination was worked out. The standard cost concepts used in farm management studies. Results showed that in study area six farming systems followed by farmers. From the finding of present study, total cost higher found in FS-I (Rs.109617) and least total cost in FS-IV (Rs. 68436). The per farm gross returns were maximum in FS-III (Rs. 148377) followed by FS-II (Rs.128837), FS-I (Rs. 126304), FS-VI (Rs. 115794), FS-IV (Rs. 87787) and FS-V (Rs.76876), which indicated higher returns in farming systems in which irrigated plantations were undertake. Among all the farming systems FS-III, FS-II and FS-VI were found highly profitable than other farming systems. The FS-II (Paddy+Pulses+Irrigated plantation) and FS- III (Paddy + Irrigated plantations) plays a major role in profitability of the farming systems. Which underline its importance and need to concentrate on these enterprises for making farming systems more profitable. Therefore, the proper balance between livestock enterprises and crop enterprises need to be encouraged to bring remaining farming systems more profitable.

Keywords: Rice, farming systems, cost and profitably.

EFFECT OF VARIOUS SPACING GEOMETRIES ON TREE GROWTH AND SOIL PARAMETERS IN POPLAR BASED AGROFORESTRY SYSTEM IN NORTH-WESTERN INDIA**S. B. CHAVAN AND R. S. DHILLON***Department of Forestry, CCS Haryana Agricultural University, Hisar-125 004, India*

There is wide spread expansion in market of poplar in northern India, used extensively in pulp and paper, match splints, pencil and plywood industries. The practice of closer spacing with compact block in poplar does not permit intercropping of kharif crops from the third year onwards, which discourages small landholders. Therefore, poplar were planted at Chaudhary Charan Singh Haryana Agricultural University, Hisar (India) in three spacing geometry of 5×4m, 10×2m and paired-row (18×2×2m) at a constant density of 500 trees ha⁻¹ during 2008. Tree growth parameters revealed that with the advancement of age, a gradual increase in DBH and height was observed with maximum DBH (28.7 cm) and height (22.2 m) was attained at 8 year. The overall growth pattern of poplar followed a rising trend with age in all three spacings. The height of poplar after 8-years of plantation was affected significantly in different spacings under agroforestry. The height and DBH growth of poplar in 5×4m spacing was at par with 10×2m spacing, whereas, the lowest tree height (20.8 m) and DBH (27.4 cm) were recorded in paired-row spacing of poplar at the time of harvesting may be due to more intra-line competition of poplar plants for different growth resources. The 10×2m and 5×4m spacings produced 20 per cent and 6 per cent more growth in terms of DBH over paired-row spacing, respectively. In case of soil, after eight years, the soil pH and Electrical Conductivity was found non-significant among all the spacings of poplar and control. However, there was a decrease in soil pH and EC as compared to its initial value in 2008. Among different spacings, the highest pH (7.8) and EC (0.13 dSm⁻¹) recorded in 18×2×2m spacing. The soil organic carbon was significantly influenced by tree spacing and increased from its initial status (0.58 %) under different spacing of poplar-based agroforestry system. The average contents of organic carbon in 5×4m, 10×2m, 18×2×2m spacings were higher by 64, 50, and 41% over sole crop, respectively. The various spacing geometries of poplar had considerable effect of growth parameters of trees as well as soil properties.

Keywords: Poplar, agroforestry, soil properties, growth parameters.

GERMICIDAL EFFECT OF ULTRA VIOLET (UV-C) ON SAFETY AND QUALITY OF FRESH AND MINIMALLY PROCESSED FOODS COMMODITIES**SAIYAD AKHTAR, HARSH P. SHARMA***College of Food Processing Technology & Bio-Energy, Anand Agricultural University, Anand, Gujarat*

UV light is a range of electromagnetic radiation found in nature. UV is situated between visible light and X-rays having wavelengths between 10 nm to 400 nm and this spectrum has invisible to humans eyes. UV-C (254 nm) found in sunlight and it is completely absorbed in the upper layer of atmosphere by ozone. UV-C waves have germicidal effect so it very effective to inactivates microorganisms at ambient condition. The exposure to UV-C light is a powerful non-thermal technology to inactivate microorganisms and enzymes in food commodities. Major microbes involving fruits and vegetables have been

associated with common foodborne pathogens such as Salmonella, Shigella spp., *Escherichia coli* O157:H7 etc. This risk can be reduced by minimal processing non thermal treatment like UV-C without affecting physico-chemical properties of food commodities. It will preventing diseased and enhancing shelf life and quality of food commodities. It is also having effect on pesticide degradation. When it combine with catalyst like TiO_2 will enhance the degradation efficiency of pesticides residues content in food commodities. UV-C have been widely used to degrade pesticides, fungicides and insecticides that cannot be removed by conventional methods. So UV-C technology is very effective for decontamination of microorganisms as well as degradation of pesticides residues in food commodities. UV-C technology is easy to use as well as low equipment, energy and maintenance cost. It's having promising effect on food processing.

DEVELOPMENT OF CHICKEN MEAT KABABS BY USING SHATAVARI ROOT POWDER

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The study was conducted with an objective to evaluate the effect of Shatavari (*Asparagus racemosus*) root powder on quality characteristics of chicken meat kabab. The chicken meat kabab were prepared with incorporation of 1% shatavari root powder and the nutritional and physio-chemical characteristics of product is studied. Shatavari root powder addition showed significantly higher moisture and lower fat content as compared to control chicken meat kabab. The incorporation of Shatavari root powder also decreased the cholesterol and free fatty acid content as compared to control sample. However, the emulsion stability and cooking yield were higher in Shatavari (*Asparagus racemosus*) root powder chicken kababs. The addition of Shatavari root powder in the products resulted lower thiobarbituric acid content as compared to control product. The pH values are less affected in treated products compare to control. The shear press value was lower for Shatavari (*Asparagus racemosus*) root powder chicken meat kabab as compared to control. It is concluded that addition of Shatavari root powder at 1% levels improved the nutritional and physio-chemical properties of chicken meat kababs.

Keywords: Shatavari root powder, chicken meat kabab, quality

SYNTHETIC AND SPECTRAL STUDIES OF COMPLEXING BEHAVIOR OF PERCHLORATO COMPLEXES OF 4 [(N-BENZOPHENONE) AMINO] ANTIPYRINE ($C_{23}H_{21}N_3O$)

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Trivalent Lanthanide behaves as hard acids and therefore expected to form stronger stable complexes with ligands having N-donor atoms. Complexes of Lanthanides with coordination number less than six are uncommon. Pyrazolones have been reported to be potential extractants as well as powerful drugs and form complexes with Lanthanides. Complexes were prepared by adding a methanolic solution of Lanthanide (III) perchlorato in a hot methanolic solution of ligands in 1:3 molar ratio. The characterization of newly synthesized complexes was done by using infrared spectroscopy, electronic spectroscopy, magnetic susceptibility, molar conductance and molecular weight.

Keywords – Lanthanide perchlorato complexes, Pyrazolones, Magnetic susceptibility, Infrared Spectroscopy, Electronic Spectroscopy

USE OF MOBILE PHONE AMONG FARMERS FOR AGRICULTURAL DEVELOPMENT

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In India, access to information can possibly enable better incomes and productivity to the farmers. Mobile phone usage at present world is playing a vital role for the enhancement of farmers business towards agriculture. Estimates states that 60% of farmers do not access any source of information for advanced agricultural technology resulting in huge adoption and communication gap. Telecommunication, especially mobile phones have the potential to provide solutions to the existing information symmetry in various lagging sectors like agriculture. This topic has tried to find the answers to the use and impact of mobile phones and mobile enabled services. The answer to these questions is relevance to develop farmer. Government and other related departments appreciate mobile phones as easy, fast and convenient way to communicate and

get prompt answers of respective problems. Through this important technology, they directly keep in touch with market personnel and offer their produce with reasonable price. Furthermore, videos on 3G and 4G phones were found to have a high information utility to illiterate farmers as well as e-governance, ICT's, e-marketing, e-banking were easier way rather than offline mode. Mobile phones has an potential to transform the typically top-bottom nature of information flow from extension agents to farmers and given new directions and approach to farmers to communicate directly and share about recent advances with each other. However the impact mobile phones, can act as catalyst to improving farm and rural incomes, have saved energy and time of farmers, the quality of information and trustworthiness of information are the three important aspects that have to be delivered to the farmers to meet an opportunity of farmers and rural development workers to communicate, facilitate, adapt, retrieve, localize and discriminate a broad range of information.

Keywords: Mobile, Farmers, Communication, Information, ICT's, etc.

ECONOMICS OF FARMING SYSTEMS IN NAGOUR DISTRICT OF RAJASTHAN

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Farming is a dynamic biological and open system with human or social involvement being primarily biological with a high degree of dependence on weather variables and changing socio-political environments. The main objectives of the farming system is to develop efficiency in farm production, increasing non-farm employment has also become essential for improving income and living standard of rural population. Different farming systems are prevailing in India primarily due to varied agricultural base, available resources, and location specific needs of humans, animals etc. This study has been done to analyze the economics of the farming systems in Nagaur district of Rajasthan. For the selection of sample farmers, a multistage sampling procedure was adopted for the selection of districts, blocks, villages and farmers in the study area. The purposive sampling technique was employed to select 50-60 respondents comprising equal number of small, semi-medium, medium and large farmers across the study area. The primary data required for the study was obtained through personal interview method using pretested schedule prepared for the purpose. The highest household income has been observed in case of the system containing rain-fed and irrigated crops with livestock rearing. The farming systems can be minimizing the need for external inputs. Such as expanded analysis of farming systems will be useful in planning for technology generation and transfer in the Indian agriculture.

ENHANCING CROP AND IRRIGATION WATER PRODUCTIVITY OF DIRECT SEEDED BASMATI RICE (ORYZA SATIVA L.) THROUGH DRIP FERTIGATION

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Rice (*Oryza sativa* L.) ,a high water requiring crop is one of the, most pivotal food crops in the world and a staple grain for more than half of the world population. Irrigation and nutrient management is important for obtaining higher rice grain yield. Giving right amount of water and nutrients at the right time is important for obtaining higher efficiency which is a crucial property of drip irrigation system. Drip fertigation enables accurate adjustment of water and nutrient supplies to meet the crop requirement. Information on use of drip fertigation for improving the basmati rice productivity is lacking. The present study envisages finding out precise package of fertigation management for direct seeded basmati rice during rainy season. Irrigation at 150% CPE recorded 16 % and 5.5 % more grain yield than 100% CPE and 125 % CPE, respectively. It remained at par with 125% CPE level but was significantly superior to 100% CPE level. All the drip irrigation levels were found superior to conventional DSR practice. Nutrient level of 100% NPK recorded significantly higher grain yield than 50% NPK level. It was at par with 75% NPK level. Drip irrigation at 150 mm CPE recorded 6.9 and 22.3 % higher straw yield than 125 and 100% CPE, respectively. Among the NPK levels, crop fertilized with 100% NPK recorded the maximum and significantly higher straw yield than lower doses of NPK. In the rice cropping season, the irrigation water applied was lowest (19.8cm) in 100% CPE leading to irrigation water saving of 58.6 % in comparison with DSR conventional. All the drip irrigation levels recorded higher irrigation water productivity than conventional DSR practice. Among the drip irrigation levels, the irrigation water productivity was found highest at 100 % CPE. Crop fertilized with 100 % NPK recorded highest irrigation water productivity of 274 kg/ha-cm.

NEED FOR NATIONAL AGROFORESTRY POLICY IN INDIA

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Agroforestry is a dynamic ecologically based, natural resource management system, diversifies and sustain production through the integration of trees on farms and in agriculture landscape, for increasing social, economic and environmental benefits to the users at all level. (ICRAF, 1998). The rapid increase in human population has put tremendous pressure on natural forest resources, creating an environmental crisis which probably may increase in magnitude in the foreseeable future. The adoption of improved agroforestry systems is one of the alternative mean to counter this ongoing process of resource exploitation and environmental degradation. (DAC, 2014). Economic studies of agroforestry systems have shown that financial benefits are a consequence of increasing the diversity and productivity of the systems which are influenced by market and price fluctuations of timber, livestock and crops. In addition to higher yield potentials of agroforestry, product diversification increases the potential for economic profits by providing annual and periodic revenues from multiple outputs throughout the rotation and reducing the risks associated with farming single commodities. Small as well as large farmers' can increase return over variable cost on their farms by reallocating the existing household resources. Introduction of floriculture and apiculture as additional activities in small as well as large farms increase return over variable cost. (Rana *et al*). The multivarious benefits and services generated are recognized as a tool to improve the livelihood status of farmers. Commercial agroforestry gained momentum in the regions where it got support from industry and assured market facilities. However, lack of policy initiatives and strict trade regulations has not supported wide adoption of agroforestry. Though prominent agroforestry models are being developed in different parts of the country, there is no clear-cut mechanism from seed procurement to marketing of the products. In this context, the National Agroforestry Policy, 2014 came in limelight to address the issues of quality planting material, tree insurance, restrictions on transit and harvesting, marketing of agroforestry produce, research and extension.(Dhyani *et al*, 2015).

ENHANCING NUTRITION OF RURAL FAMILIES THROUGH KITCHEN GARDEN

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Kitchen gardening is one of the world's most ancient food production practices and is practiced throughout the world. Homestead production of fruits and vegetables provides the households with direct access to important nutrients that may not be readily available or within their economic reach. Establishment of Kitchen Garden in rural areas is easy due to availability of space and farm families are already engaged in agriculture practices. Kitchen gardening contributes to household food security by providing direct access to food that can be harvested, prepared and fed to family members, often on a daily basis. Kitchen gardens can be grown in the empty space available at the backyard of the house or a group of women can come together, identify a common place or land and grow desired vegetables, fruits, cereals etc that can benefit the women and community as a whole. There is also support for expanding economic base through production, processing, packaging and marketing, this also enhances their entrepreneurial activities and creates small jobs. So, kitchen gardening would be a good mean to improve household food security. If technical support and proper training were provided especially on new gardening techniques and variety selection then Kitchen gardening helps in improving the nutritional security of households in rural areas.

Keywords: Kitchen gardening, nutrition and rural.

UP-CYCLING: THE MANAGEMENT AND CONSERVATION OF DISCARDED DENIM

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Excessive spending and the ever-changing fashion trends lead to an increase in material production to meet consumers' needs, which also in turn, increase the amount of industrial waste and many harmful pollutants. To address this problem, have to follow the up-cycling process. Up-cycling is a process in which used materials are converted into something of higher value and/or quality in their second life. It has been increasingly recognized as one promising means to reduce material and energy use, and to engender sustainable production. By fully understanding the role and benefits of up cycling, further recommendations on techniques of up-cycling can be taken into consideration. Thus, it can be applied to ensure better and effective usage of those materials and products particularly in interior space, in order to conserve and preserve natural resources. Denim is a durable cotton twill textile, typically used to make jeans, overalls, and other clothing. This process makes diagonal ribbing of denim that distinguishes it from cotton duck, another twill fabric. Denim one of the most widely used material in the world, has significant impact on environment in manufacturing and waste management stage. Denim up-cycling has opened vast opportunities for savings in the use of natural resources as raw materials, energy and water consumption, chemicals and auxiliaries and waste water treatment. By up-cycling the waste denim, used-denim and discarded denim material, reconstructing them into edgy and functional designs for everyday products. These proposed up-cycling

ideas serve as a great alternative for consumers to actively participate in reducing carbon emission, water usage, and waste to landfill by utilizing used clothing.

Keywords: Up-cycling, natural-resources, conserve, denim, waste management.

COMPARISON OF DEM'S USED FOR WATERSHED DELINEATION THROUGH ARCSWAT AN EXTENSION TOOL OF ARCGIS

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Watershed delineation is the prior most step for any study regarding watershed management. Earlier the delineation was done with the help of topographic sheets available from the Survey of India, but nowadays, with the advancement of technology it can be accomplished by processing the freely available digital elevation models of higher spatial resolution. Three digital elevation models i.e. ASTER (ASTGDEM V2_0N29E080), SRTM (SRTM1N29E080V3) and CartoDEM (C1_DEM_16b_2005-2014_V3R1_80E29N_H44O) each with spatial resolution of 1-Arc-Second (30 m) and map projection geographic (WGS84), were used to delineate watershed. ASTER and SRTM DEM's were downloaded from USGS Earth Explorer website and Cartosat- Digital Elevation Model (CartoDEM) was downloaded from Indian Space Research Organization's Geoportal Bhuvan. ArcSWAT, an extension tool of ArcGIS uses input (DEM) defined in projected coordinate system, the UTM zone was identified through Google Earth options as 44N. Therefore, all DEM's were projected to WGS_1984_UTM_Zone_44N using ArcGIS Data Management Tools. Using all three projected DEM's watershed delineation was performed using ArcSWAT, an extension tool of ArcGIS and the shapefiles were converted to kml files (keyhole markup language) using ArcGIS Conversion Tools so as to export and compare them, as demarcated by the ridgeline on Google Earth. The best result was achieved using the CartoDEM as the watershed boundary almost coincided with the ridgeline. *ASTER GDEM is a product of METI and NASA.*

Keywords: Resolutions, Projection Systems, kml

SOME PHYSICAL AND FRICTIONAL PROPERTIES OF APPLE FRUITS AVAILABLE IN MARKET OF MEERUT

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Several physical and frictional properties as physical characteristics, mechanical, hydrodynamic and nutritional properties of two apple varieties (Red Delicious and Golden Delicious) procured from market, were determined and compared using Duncan's multiple ranges test. Physical characteristics such as: average fruit length, width, thickness, the geometric, arithmetic and equivalent mean diameter, projected area, surface area, sphericity index, aspect ratio, fruit mass, volume, true density and moisture content, were determined for both varieties. The coefficient of static friction on plastic, plywood and galvanized iron, flesh firmness, failure stress, modulus of elasticity were found. The terminal velocity, coming up time, bouncy and drag forces, as hydrodynamic properties and total dry matter, total soluble solid, pH and titratable acidity, as nutritional properties, were determined. It was concluded that most of properties of two apple varieties was statistically different at the one percent probability level. The static and dynamic coefficients of friction were determined for two apple cultivars against four different surfaces (masonite, rubber, paper, plastic) at surface moving velocities of 0.43 to 15.60 mm/s. Over this range of velocities, friction coefficients increased by 28 to 98%. Sliding velocity affected dynamic coefficient more than preloading velocity affected the static coefficient. Differences between the tested surfaces were most pronounced at the intermediate velocity of 5.11 mm/s. The effect of velocity and surface varied inconsistently between the two cultivars.

NEED OF ZERO BUDGET NATURAL FARMING FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT

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Healthy soil is the foundation upon which sustainable agriculture is built. Farming practices differ mainly based on soil inputs and crop protection measures. In conventional chemical farming practice, indiscriminate use of chemical fertilizers and pesticides destroy the beneficial soil micro flora, change the soil nature and also contribute to the high crop production cost. Heavy metals from the polluted soil may enter the food chain in significant amounts and show adverse health effects. The essence of natural farming is to minimize the external inputs to the farm land and nurture the soil fertility. Zero Budget Natural Farming is a unique method of farming which requires absolutely no monetary investment for purchase of key inputs

like seeds, fertilizers and plant protection chemicals from the market. The farmer can grow hardy local varieties of crops without application of chemical fertilizers and pesticides. Dependence on hired labours is also reduced to the bare minimum as the system discourages intercultural operations. All the system requires is native breed of cattle which in any case forms an integral part of farming families in rural areas. It is claimed that one cow is sufficient to take up this method of farming on thirty acre of land (Devarinti, 2016). In ZBNF, soil is supplemented with the microbial inoculums like Beejamrutha and Jeevamrutha to accelerate the propagation of soil microflora, beneficial to soil enrichment. 200 liters of jeevamrutha is sufficient for one acre of land. Apply the jeevamrutha to the crops twice a month along with the irrigation water or as a 10% foliar spray. The treatment of seeds of any crop Beejamrutha is done by mixing by hand; dry them well and use them for sowing. For leguminous seeds, just dip them quickly and let them dry. Other philosophy of the ZBNF is to nurture the growth of these beneficial microorganisms without using external manure and chemical pesticides. Indigenous pesticides of leaves with cow urine, Agniastram, Neemastram and Bramhastram are used. According to Palekar the need of water requirement of plant is fullfill by the waaphasa because the plant roots need the water vapour (Waaphasa). Whaphasa is the condition where there are both air molecules and water molecules present in the soil, and it encourages reducing irrigation, irrigating only at noon, in alternate furrows etc. The farmers report a significant decline in need for irrigation in ZBNF. Hence, there is about 90% of water saving. Mulching is the covering of the field that will prevent the growth of weeds and evaporation from the crop field, hence, reducing the water loss upto 30 %. Straw mulch and live mulch increases the soil organic matter, nitrogen content by biological nitrogen fixation and microbial population after decomposition (Prasada, 2016). It can be calculated that Zero Budget Natural Farming is more beneficial as compared to conventional agriculture because it has less economic requirement for crop production. ZBNF is having no adverse impact on soil and environment as compared to modern agriculture because no chemical fertilizers and pesticides are used in it. Use of natural inputs in crop production increased the quality of the product and it fetched more profitability.

STUDY THE SHELF LIFE OF PANEER AND ITS QUALITY ANALYSIS

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Paneer, a popular indigenous dairy product of India, is similar to an unripened variety of soft cheese which is used in the preparation of a variety of culinary dishes and snacks. It is obtained by heat and acid coagulation of milk, entrapping almost all the fat, casein complexed with denatured whey proteins and a portion of salts and lactose. Paneer is marble white in appearance, having firm, cohesive and spongy body with a close-knit texture and a sweetish-acidic-nutty flavour. Preparation of paneer using different types of milk and varied techniques results in wide variation in physico-chemical, microbiological and sensory quality of the product. Paneer blocks of required size are packaged in laminated plastic pouches, preferably vacuum packaged, heat sealed and stored under refrigeration. Paneer keeps well for about a day at ambient temperature and for about a week under refrigeration (7 °C). The spoilage of paneer is mainly due to bacterial action. Successful attempts have been made to enhance the shelf life of paneer. Milk is utilized by three main groups-household sector, un-organized sector and organized sector, converting it into various products such as paneer, curd, butter, ghee, sweets, powder, cheese, liquid milk, etc. Paneer is one of traditional dairy products of India which is preparations like, patties, sandwiches, shahi paneer, etc. It is estimated that about 5% of the total milk produced in India is converted into paneer. Paneer provide an easy means of conserving and preserving valuable milk solids during the flush season or in high milk producing area and transporting it to the region where either milk production is scanty or the terrain is hard for easy transportation of milk. Paneer has a fairly high level of fat and protein, low level of sugar and contains some important minerals (eg. calcium) and vitamins. Paneer is recommended for diabetic patients, dental carries, growing children and pregnant women due to high calcium and protein .

Keyword: paneer composition, quality analysis, production, study shelf life of paneer.

DEVELOPMENT OF VITAMIN FORTIFIED LOW FAT PANEER

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Vitamin fortified low fated paneer is prepared by using low fat milk i.e. skim milk with addition of vitamin premix and then sensory is to be carried out for checking the quality of the product. The study was to compare the qualitative and quantitative properties of skim milk paneer, toned milk paneer, standardized milk paneer and whole milk paneer and to compare a quality of low fat paneer and normal fat paneer for diet. Skim milk had more total solids than standardized milk and toned milk.

Milk of 5.0-6.0% fat can be found to make quality paneer. Since paneer is mostly used for cooking purposes, the relatively high level of fat may not be an absolute requirement for an acceptable product. With this view in mind, an attempt was made developing paneer of low fat content. Generally paneer is made from 5.0 to 6.0% fat milk which final product fat content is near about 26% is very high for the diet persons. But in this study four different fat level milk i.e. 0.6%, 4.5%, 3.0% and 0.5% are used for paneer preparation and according to hedonic scale and proximate analysis paneer prepared from the milk with 3.0% fat is having good acceptability. Paneer prepared from this milk is having 15% fat in final product. It indicates that the difference of fat in normal paneer and low fat paneer is near about 10%. From this comparative study of different fat level in paneer was concluded that the paneer made from low fat milk is acceptable with good hedonic points. Due to its carrier properties, Milk can be fortified with vitamins like A or D improving its nutritional properties. So the objective of this study is to prepare a vitamin fortified low fat paneer as commercial scale by adding vitamin premix in milk during preparation of paneer and to compare the qualitative and quantitative properties of vitamin fortified paneer and normal paneer.

Keywords: Low Fat Paneer, Milk Fortification, Proximate Analysis, Comparison With Normal Paneer, Sensory Analysis

DIGITAL EMBROIDERY: AN IMAGINATION

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Embroidery is decoration worked on the surface of the fabric using thread. Selection of design, embroidery stitches and colours and a very striking effect can be created. Old clothes can get a new lease of life by adding just a dash of embroidery. All basic embroidery stitches are easy. Several basic stitches can be combined to produce rich embroidered pieces. It can be beautifully described as a painting with needle and thread. Now, embroidery is largely produced on computer controlled embroidery machines. They are specially engineered machines that have a multi-needle fixed 'embroidery head' and a frame holder that moves the framed product in either of two directions so that the embroidery design can be sewn. The design is created within a grid (known as a 'field') with x being the horizontal axis and y the vertical axis. The embroidery machine reads these co-ordinates from the design data file and moves its pantograph into position to receive each new stitch from the machines' stationary needle head. The embroidery design is created on a computer using specialized 'digitizing' software. The computerized embroidery process can be broken down into six functional activities: Interpret artwork and digitize the design using specialized software, Save the design as a stitch file that can be understood by the embroidery machine, Read the stitch data file into the embroidery machine, Teach the machine how to embroider the design, Frame or hoop the fabric you wish to embroider on and slot into the machine arms. Start the machine stitching and run until embroidery design is complete and finished. This paper showed how designs can be created with embroidery software. With the help of software which benefited the experimenting with a number of colours, textures, patterns and sketch backgrounds for producing a playful, distinct and animated design, without physically making articles.

Keywords: embroidery, stitches, computerized, process, creation, designs.

ROLE OF ON-LINE COMMUNICATION TECHNOLOGY IN AGRICULTURE DEVELOPMENT

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On-line Communication technology has been considered as a tool that can be used to achieve development goals in developing countries. These technologies may help to fight against disease, unemployment, poverty, agriculture and other development problems. Agriculture plays a huge role in the society and the economy of the country. Nowadays, new advanced technologies are used for agricultural development, such as satellites, the Internet, mobile phone and social media. On-line Communication Technology can be used to improve agricultural information and farming methods with transformational development. In India around 70% of population earns its livelihood from agriculture. Agriculture needs continuous diffusion of new technology to meet global food security, poverty reduction and environment sustainability. On-line Communication Technologies in agriculture have the potential to facilitate greater access to information that support knowledge sharing. They facilitate the creation, storage, retrieval, and dissemination of any relevant data, and information

that may have been already been processed and adapted. On-line Communication Technology in agriculture is an emerging field focusing on the enhancement of agriculture development in India. They can provide accurate information for the farmers which facilitates better agriculture output. But in Indian still in growing stage and evolving as an emerging trend the benefit of On-line Communication Technology is yet to reach all the farmers. Perhaps technological innovation many farmers, especially who are share croppers are not getting proper information and service due to poor economic condition and social constraints. Other factors are illiteracy, language barriers and unwillingness to adopt the new technology. The way in which On-line Communication Technology projects access, assess, apply, and deliver content may increase the likelihood of On-line Communication Technology used by farmers and thus may become an important factor in a project success. To address the information needs of farmers, relevant content is a key component of On-line Communication Technology projects.

ADOPTION AND IMPACT OF BT COTTON IN INDIA

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Genetically modified (GM) crops are seen as the milestone of the food and fiber security in the world. 189.8 mh of land across the world was under GM crops in the year 2017 and India is the fifth largest country in term of acreage. Bt cotton is the most commercial GM crop in India, which was introduced in the year 2002. India remains as the top producer of cotton with 96% of total cultivated cotton being GM. Although the production has increased, but yield has dropped in the later years. It has led to discontent in farmers, textile industry and other related stakeholders. A report prepared by Cotton Advisory Board of India shows that there is threefold increase in the cost of production of cotton due to the increase in the cost of pesticide, seeds and other inputs. In 2016, 80% of cotton crops failed in Raichur district incurring the loss of over 2.72 crores. This led for review of adoption and socioeconomic impact of Bt cotton on Indian agriculture. This paper examines the documents from 2002, year of introduction of Bt cotton in India and reviews the adoption and socioeconomic impact of it making the necessary recommendation for the present and future.

Keywords: Bt Cotton, Genetically modified crops, Adoption, Socioeconomic Impact

ROLE OF KISAN CREDIT CARD SCHEME IN INDIA

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Kisan Credit Card Scheme was introduced in 1998-99 by Indian banks has since become an excellence program providing access to short-term credit in the agricultural sector. This model scheme was prepared by the National Bank for Agriculture and Rural Development (NABARD) on the recommendations of RV Gupta Committee. Its objective is to provide timely and adequate credit support to the farmers from the formal banking system in a flexible, hassle-free and cost-effective manner. Participating institutions include all commercial banks, Regional Rural Banks, and state co-operative banks. In order to ensure that all eligible farmers are provided with hassle-free and timely credit for their agricultural operation. Marginal farmers, sharecroppers, oral lessee and tenant farmers are eligible to be covered under the Scheme. The main objectives of the Scheme are to meet the short-term credit requirements for cultivation of crops, post-harvest expenses, produce marketing loan, consumption requirements of farmer household, working capital for maintenance of farm assets and activities allied to agriculture, like dairy animals, inland fishery etc. investment credit requirement for agriculture and allied activities like pumping sets, sprayers, dairy animals etc. KCCs have now been converted into Smart Card cum Debit Cards to facilitate its operation through ATMs. The scheme has short-term credit limits for crops and term loans. KCC credit holders are covered by personal accident insurance up to Rs. 50,000 for death and permanent disability and up to Rs. 25,000 for another risk. The validity period is five years, with an option to extend for up to three more years.

Keywords: KCC, Agricultural Information.

PRODUCTION PERFORMANCE OF POULTRY GENOTYPES UNDER TRADITIONAL SYSTEM OF REARING IN KONKAN REGION OF MAHARASHTRA

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The present experiment was conducted at Poultry Unit, Department of Animal Husbandry and Dairy Science, Dr. B. S. Konkan Krishi Vidyapeeth Dapoli, Maharashtra to assess the comparative growth performance and feed efficiency of

poultry genotypes. The experiment was carried out on four different types of poultry genotypes viz., - Kadaknath (T₁), Vanaraja (T₂), Giriraja (T₃) and Rhode Island Red (T₄). For this experiment, 200 one day old chicks were divided in five replications and each replicate have 10 birds. Results showed that Giriraja birds gain significantly higher daily body weight gain, weekly body weight gain and total body weight gain with superior feed conversion efficiency compared to Vanaraja, Kadaknath and Rhode Island Red. The benefit cost ratio (B: C ratio) higher achieved by Kadaknath birds. From the results of present investigation, it can be suggested that the rearing of Kadaknath as well as Giriraja poultry birds are more beneficial and efficient than Vanaraja and RIR in Konkan Agro-climatic condition of Maharashtra.

Keywords: Feed efficiency, growth rate, poultry breeds, weight gain, net profit.

ZERO BUDGET NATURAL FARMING (ZBNF)

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Zero Budget Natural Farming (ZBNF), which is a set of farming methods, and also a grassroots peasant movement, has spread to various states in India. It has attained wide success in southern India, especially the southern Indian state of Karnataka where it first evolved. It is also called Spiritual Farming. Indian farmers increasingly find themselves in a vicious cycle of debt, because of the high production costs, high interest rates for credit, the rising costs of fossil fuel based inputs, and private seeds. More than a quarter of a million farmers have committed suicide in India in the last two decades. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming with Nature and without chemicals, so the production cost will be zero. In the ZBNF nothing has to be purchased from the outside. All things required for the growth of the plant are available around the root zone of the plants. There is no need to add anything from outside. Our soil is prosperous-full of nutrients but only 1.5 to 2.0 % is taken up from the soil and remaining 98 to 98.5% nutrients are taken from air, water & solar energy. Science also says that 98% crop body is constituted by air and water. It is said that there is nothing in the soil and we have to add fertilizers from outside but in the forest or on the bunds of our farm, there are huge trees of Mango, Tamarind or Plum with uncountable export quality fruits in famine also without any application of chemical or organic fertilizers, insecticides, without any cultivation by tractor, without irrigation. There is no existence of any technology of the Agriculture, no fertilizers, insecticides, cultivation and irrigation. Even though these trees are giving enormous export quality fruits every year in famine also. That means, for the plants to grow and to give the production there is no necessity of adding from outside. The method involves mulching, intercropping, and the use of several preparations which include cow dung. These preparations, generated on-site, are central to the practice, and said to promote microbe and earthworm activity in the soil. There are four pillars of ZBNF, that are:- Jivamrita/Jeevamrutha, Bijamrita Acchadana, Whapasa. Jivamrita/jeevamrutha, is a fermented microbial culture. During the 48 hour fermentation process, the aerobic and anaerobic bacteria present in the cow dung and urine multiply as they eat up organic ingredients (like pulse flour). Bijamrita/beejamrutha is effective in protecting young roots from fungus as well as from soil-borne and seed borne diseases that commonly affect plants after the monsoon period. Acchadana – Mulching protects topsoil during cultivation and does not destroy it by tilling. It promotes aeration and water retention in the soil. Whapasa – moisture is the condition where there are both air and water molecules are present in the soil, and it encourages reducing irrigation, irrigating only at noon. A majority of respondents reported that by adopting ZBNF, over time they saw improvements in yield, soil conservation, seed diversity, quality of produce, household food autonomy, income, and health. Thus, ZBNF may be the new generation for agriculture.

USE OF MOBILE APPLICATIONS IN MODERN AGRICULTURE

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Dynamic growth of mobile communications technology creates opportunities for economic development, social empowerment and ground level grassroots innovation in developing countries. It does farm and rural development by providing access to information, markets and services to millions of rural residents. Earlier, mobile technology was not being used as well. We used to use mobile only for interaction, but nowadays mobile phones are being used everywhere in every field. Nowadays many mobile applications are being proven to be very useful in the field of agriculture. Many applications related to agriculture are present on the Google Play Store, which farmers can use in their own benefits. In order to work towards development, Prime Minister Narendra Modi started the 'Kisan Suvidha' app in 2016, which provides information about the weather and the forecast of the next 5 days provides knowledge on the market value of items and crops in the nearest city, fertilizer, seeds, machinery etc. This app is available in many languages. There are some similar apps which are

also helpful for farmers like IFFCO-Kisan, RML Farmer-Krishi Mitra, Crop Insurance, AgroMarketDay, Kheti- Badi Organic (Original), WhatsApp Messenger, Krishi Gyan, Pusa Krishi, Agri-Market, Agri Data, MyAgriGuru, Farm Bureau insurance, Kisan Space- Agriculture Marketing Apps, Marg Mandi Software, National Agriculture Market (e-NAM), Agribuzz, Krishitrade, Way 2 market, Mera Kisan, Digital Mandi, Big haat, Krushikendra, Raj Mandi, Live Bazar, Krishi Bazar etc. With the help of these apps farmers can see agricultural based information such as crops, crop insurance, crop disease, all crop based information, agricultural based inputs, what is the value of the product and where to sell the product.

Keywords- Mobile Communication, Modern Agriculture, Automation, Login, Android.

ICT IN AGRICULTURE: A ROAD TO DOUBLING THE FARMERS' INCOME

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Information and communication technology in agriculture (ICT in agriculture), also known as e-agriculture, is developing and applying innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. ICT in agriculture offers a wide range of solutions to some agricultural challenges. It is seen as an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. E-agriculture continues to evolve in scope as new ICT applications continue to be harnessed in the agriculture sector. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture.

Keywords: e-agriculture, ICT, rural development, innovative and institutional capacity.

BAMBOO SHOOTS: MYRIAD OF BENEFITS

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Bamboo is a plant of the family Gramineae, is the longest grass in the world. Being a very versatile plant, bamboo grows in a lot of different climates. Bamboo is intricately associated with humans from times immemorial. Popularly known for their industrial uses, a lesser known fact of bamboos is the usage of its young shoots as a food that can be consumed fresh, fermented or canned. The juvenile shoots are not only delicious but are rich in nutrient components, mainly proteins, carbohydrates, minerals and fiber and are low in fat and sugars. The shoots have antioxidant capacity due to the presence of phenolic compounds. The shoots are free from residual toxicity and grow without the application of fertilizers. The increasing trends of health consciousness among consumers have stimulated the field of functional foods and bamboo shoots can be one of them. Bamboo shoots have a number of health benefits: improving appetite and digestion, weight loss, curing cardiovascular diseases and cancer by keeping these benefits in mind bamboo fiber is now a common ingredient in breakfast cereals, fruit juices, bakery, meat products, sauces, shredded cheeses, cookies, pastas, snacks, frozen desserts and many other food products.

EFFECTIVENESS OF AGRICULTURAL PROGRAMMES ON TELEVISION AS PERCEIVED BY THE TELEVIEWING FARMERS

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The present field study was conducted mainly with the specific objective to “study the effectiveness of agricultural programmes of ABP Majha and Sahyadri channel as perceived by the televiewing farmers”. The study was conducted in two tahsils namely, Mandangad and Chiplun of Ratnagiri district which were selected randomly. Twenty villages from these two tahsils were selected for the study. The data were collected by taking personally interview of 100 televiewers, 50 each of ‘ABP Majha’ and ‘Sahyadri’ channel. The televiewers of ABP Majha and Sahyadri channels differed remarkably with regard to size of land holding, annual income and mass media exposure. However, majority of the televiewing farmers of the two channels perceived ‘medium’ effectiveness of farm telecasts. There was a significant difference in the perception of televiewing farmers of ABP Majha and Sahyadri channel with respect to components of effectiveness, namely understandability, usefulness, demonstration mode of presentation, entertainment and relevancy of pictures. More than two

third of the viewers had 'fair' perceived effectiveness category, 64.00 per cent of the viewers perceived the agricultural programmes as understand to a great extent and modes of presentation of agricultural programmes namely demonstration (70.00 %), drama (59.00 %), Discussion (60.00 %) and use of visual aids (55.00 %) were 'effective'. About 67.00 per cent of the viewers perceived that the information telecast through agricultural programmes was 'accurate' and maximum numbers (70.00 %) of the viewers were motivated to adopt few improved practices after viewing the farm telecasts.

A SURVEY OF INVASIVE ALIEN ANGIOSPERM SPECIES OF J. P. NAGAR OF ROHILKHAND REGION, INDIA

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Alien Invasive species have become an environmental concern in India. A survey of alien invasive plant species of J.P. Nagar was made. The data revealed that both aquatic and terrestrial invasive plant species are becoming threat to the native flora as they reproduce rapidly and crowding out native species. In the present study 23 invasive species belonging to 17 families are reported. Habit wise analysis shows maximum 19 herbaceous species (*Acanthospermum hispidum* DC., *Ageratum conyzoides* (L.) L., *Alternanthera pungens* Kunth., *Argemone mexicana* L., *Senna obtusifolia* (L.) H.S.Irwin & Barneby, *Senna tora* (L.) Roxb., *Cleome gynandra* L., *Cleome viscosa* L., *Croton bonplandianus* Baill., *Eclipta prostrata* (L.) L., *Eichhornia crassipes* (Mart.) Solms, *Mimosa pudica* L., *Mirabilis jalapa* L., *Oxalis corniculata* L., *Parthenium hysterophorus* L., *Dicliptera paniculata* (Forssk.) I.Darbysh., *Sida acuta* Burm.f., *Tridax procumbens* (L.) L. and *Xanthium strumarium* L.) followed by 3 shrubs (*Calotropis procera* (Aiton) Dryand., *Ipomoea carnea* Jacq., *Lantana camara* L.), 1 climber *Antigonon leptopus* Hook & Arn.). Family Asteraceae is the most dominant with 6 plant species. A better planning is needed for early detection and reporting of infestations of spread of new and naturalized weeds to monitoring and control.

Keywords- Angiosperms, Invasive alien species, Asteraceae, J.P. Nagar.

USE OF MEDIA PACKAGE FOR ASSESSING THE ACCEPTANCE OF BIOGAS TECHNOLOGY BY RURAL WOMEN

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KVK, Jehanabad, BAU, Sabour, Bhagalpur KVK, Vaishali, DRPCA, Pusa

Biogas has emerged as a very promising alternate to our conventional sources of energy in rural and semi-urban areas. It is fulfilling manifold needs of the rural population. It provides cheap, smokeless and pollution free fuel. It is used for manure production by utilising slurry. The other utilisations of biogas are for household lighting and for power production in the form of fuel engine. Biogas fuel engines help in running motor pump, in chaff cutting and in ploughing on farms. Thus, on the whole there are four sub technologies of biogas namely biogas stove, manure production, biogas fuel engine and biogas lighting which can be adopted by farming community for raising their socio-economic status and standard of living. Therefore, a study was conducted in four villages of Samastipur district of Bihar to educate the rural women with the help of a media package on the biogas technology and assess their knowledge, attitude and acceptance of the same. The media package consisted of five posters, three charts, one video cassette and one booklet which covered the most relevant messages relating to the four sub technologies of Biogas. A proportionate random sample of 120 women was drawn from the selected four village. Respondents were given intensive exposure through media package containing information related to biogas stove, manure production, biogas lighting and fuel engine. Pre-exposure and post exposure data regarding knowledge level as well as attitude level were assessed for each respondent. The study led to conclude that the pre-exposure knowledge scores obtained by majority of respondents was more than mean value. With regard to attitude level, after exposure, majority of the respondents had 'favourable' attitude and none of them was found to have 'unfavourable' attitude. With regard to acceptance of biogas technology, most of the respondents had low level of acceptance and only one-fourth of them had high level of acceptance. To conclude, frequent exposure with the help of media mix and continued sustained efforts in this direction will certainly result into better acceptance level by the farming community.

INNOVATIVE APPROACHES IN APPLIED SCIENCES AND SOCIO-ECONOMIC DEVELOPMENT

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To truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy which is the profitable kind of energy. Agriculture including agricultural marketing is the backbone of Indian economy. Methods that prevailed in earlier decades for selling the produce have changed. Earlier Rural Primary Markets (RPMs) were set up whereas in contrast to this now- a-days, prices are set by the buyers and the

commission agents. The perishable products get damage in the journey of transportation, which can be resolved by the provision of refrigerated trucks. An efficient marketing system can manage timely delivery of produce, reduce marketing costs and increased production and productivity thereby, making a healthy market. With the expansion in agricultural production and agro-industries, there has been an increase in the agricultural waste which gives birth to "Agricultural Pollution". Farmers aka Farmpreneurs don't realize that what they burn away, causing pollution, can be used to earn as much as Rs 1000 per ton. Experts believe that the agricultural sector is now all set for revolution where farmers need to shift their attention from primary to secondary agriculture, wherein they enhance the value of the produce and utilize all products and by-products of farms, poultry houses, slaughter houses, agro-industries etc. Biomass pellets and biogas generated from the agro-waste can be a big money spinner. To minimize the waste and enhance the income of the agriculturists, the best found solution is the use of 3R's viz Reuse, Recycle and Reduce. That is why, sustainable energy resources appear to be one of the most effective and efficient solutions. So just depending on the conventional energy sources will not solve the problem of energy crisis. In this paper efforts have been made to summarize the gradual shift towards exploring secondary agriculture and its future potential in India. This paper also assesses few policies for concentrating on the enhancement of renewable for the future. This paper is a piece of armed chair research and constitutes the knowledge from the secondary sources. The paper mainly focuses on what are the means of making money from agricultural waste and contribute to the entrepreneurship development.

Keywords:-Renewable Energy, Secondary Agriculture, Waste-to-wealth, Agricultural marketing, Making money from agro-waste, Sustainable Energy, Energy Policies

KITCHEN WASTE COMPOSTING: A GREEN APPROACH IN WASTE MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

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India stands second in the production of fruits and vegetables in the world. It contributes about 10% as well as 14% of fruits and vegetables in the world production. Material waste is a by-product of almost all human activities and results in stress and pollution in the environment. Waste prevention is the primary goal of the waste management. Composting is a sustainable waste management technique in developing countries; an eco-friendly approach for bioconversion into value added product which may be utilized as plant nutrients. Compost acts as a fertilizer which substitutes chemical fertilizer, reduce the load of N:P:K use and associated environmental pollution. Manure and compost not only supply many nutrients for crop production, including micronutrients, but they are also valuable sources of organic matter. Increasing soil organic matter improves soil structure or tilth, increases the water-holding capacity of coarse-textured sandy soils, improves drainage in fine-textured clay soils, provides a source of slow release nutrients, reduces wind and water erosion, and promotes growth of earthworms and other beneficial soil organisms. Microbial inoculation in kitchen waste composting may yield attributes, yield and nutritional quality of crops under field conditions. This paper aims to delineate that composting is a natural way to promote green revolution in a healthy direction thereby achieving the target of waste management and sustainable development.

Key words:- Waste management, sustainable development, Microbial Inoculation, green revolution.

GEOINFORMATICS FOR THE PHYSIOGRAPHIC AND LAND USE/LAND COVER MAPPING OF SIWANI AREA, BHIWANI DISTRICT (HARYANA)

SIMMI RAJPUT

Geoinformatics is a modern technology playing very important role in the study and monitoring of the natural resources in any part of the world. This technology can be used for generating valuable information about the land use/ land cover (LULC) changes, physiography, forest cover, vegetation type and landforms of any particular area. The study area falls in the toposheet no. H43V9 and three maps were formed such as base map, LULC map and physiographic map. Information collected from these maps will help in land use planning at micro level. The main aim of this paper is to determine and quantify the effect of different aspects responsible for deteriorating the agri-economic importance of land. The paper also establishes the relationship between landforms and land-use. The relation is not one-to-one but rather one landform may be under several land use types and vice versa. The results revealed that the area under landforms of Siwani block was found 676.36 km², dominated by plain area (582.13 km²) followed by sandy dunal area (42.35km²) and 475.91km² under land use/land cover with maximum of its area under fallow land (304.06km²) and (82.37km²) area under cropland. The maps

prepared will furnish first-hand information to authorities and devisers about the land use land cover and landforms of the study area.

FACILITATING SUSTAINABLE AGRICULTURE BY STRENGTHENING INDIGENOUS TECHNICAL KNOWLEDGE

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Farmers in India have been using traditional practices in farming since time immemorial. Indigenous Knowledge refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men appropriate to a particular geographic area. It lays emphasis on minimizing the risks rather than maximizing the profits. Indigenous knowledge can play a key role in the design of sustainable agricultural systems, increasing the likelihood that rural populations will accept, develop, and maintain innovations and interventions. Indigenous knowledge from different parts of the world, its proper documentation, validation and sharing and exchange of knowledge on global basis to provide good quality food on sustainable basis with reduced adverse impact on the environment. Government schemes and Research and Development activities should reach the indigenous users and scientific rationale behind these indigenous technologies should be studied and strengthened for patenting the same. Indigenous knowledge may contribute in several ways such as by helping identification of cost-effective and sustainable mechanisms for poverty alleviation, which are locally manageable and meaningful. There is a lack of proper integration between the practice of indigenous and modern knowledge. An appropriate association between the traditional and modern scientific knowledge and technology systems has immense potential to benefit the society.

Keywords: community, indigenous, scientific rationale, sustainable

GROUNDWATER RESOURCE ESTIMATION USING GEC 2015 METHODOLOGY IN BEMETARA BLOCK, DISTRICT BEMETARA, CHHATTISGARH

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The present methodology used in India for groundwater assessment is known as Ground Water Resource Estimation Methodology – 1997 (GEC 1997). Recently, the Ground water resources Estimation Committee formulated a new methodology (GEC 2015) which has higher frequency of computation and includes the additional components in the ground water balance equation which were either ignored or considered negligible in the GEC 1997 methodology. Hence, Bemetara block of Chhattisgarh has been chosen as the study area to compute the resources using GEC 2015. The area is divided in command and non-command area with respect to surface water irrigation and ground water irrigation. Gross groundwater draft for all uses, Rainfall recharge (using Rainfall Infiltration Factor Method and Water Table Fluctuation Method), recharge due to other sources like tanks, ponds, irrigation etc are calculated using the specified norms to obtain Net Annual Groundwater Availability and Stage of Groundwater Development. Water table trend during both pre-monsoon and post-monsoon interval is plotted and categorization of sub-units is done viz. 'Safe', 'Semi-critical', 'Critical' or 'Over Exploited' for purposes of future ground water development. The annual recharge from rainfall is 156.5 ha-m for command and 4243.98 ha-m for non-command. The stage of ground water development for command and non-command is 41.38%(Safe) and 91.15% (Critical) respectively. Total ground water resource of the study area came out to be 42988 ha-m. Therefore, GEC 2015 gives more realistic values as all the possible components such as lateral flow, interconnection between aquifers, stream flows has been considered in it.

Keywords: Groundwater, Infiltration, GEC, command, non-command, aquifer.

PCOS: A REVIEW OF THE CURRENT KNOWLEDGE

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Polycystic ovarian syndrome (PCOS) is a complex condition with some psychological, reproductive and metabolic manifestations that impacts health across the lifespan. In PCOS, the hormonal imbalance affects the follicular growth, during the ovarian cycle and thus causing accumulation of small follicles in the ovaries; hence contributing to the polycystic shape of ovaries. This infertility rates with polycystic ovaries is very high. And this syndrome is also characterized by the excess release of the male hormone (androgen) which causes male pattern hair growth in women. It has become a condition of clinical and public health importance as it has become very common affecting one in every 5 women. A recent study has revealed that about 18% of women in India, mostly from the east, suffer from polycystic ovarian syndrome. Therapy should

focus on both the short and the long term basis to curb with the effects of PCOS. Although there is no particular cure but a healthy and a sensible diet along with regular physical exercise can minimize the features of this syndrome.

TRAINING NEEDS OF YOUNG RURAL GIRLS IN SELECTED VOCATIONS

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Training is part of human growth and development. Training refers to the coaching and learning actions which are carried on for the primary reason of serving members of a society to acquire and relate the mandatory knowledge, skill and attitudes to carry out their jobs efficiently. Training is totality of instructions, planned and directed activity to which a person is subjected to induce learning. The word 'training' is accepted as synonym for all form of knowledge, skills, attitudinal development which a person needs to keep pace with the accelerating developments in life. Training has become a must for all professionals to update their knowledge and skills. Recognizing the need for new skills and deficiencies in formal educational systems to meet growing demands at fast pace, training has become integral part of work life.

REDUCING POST HARVEST HANDLING AND MAINTAINING QUALITY IN AGRICULTURAL PRODUCE MARKETING

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A large portion of all fresh produce is lost after harvest. It is estimated that a total of 20-40% of all crops in developing countries is lost to postharvest losses. Losses are due to decay, mechanical damage and physiological disorders during harvest, storage and transport. 10-20% of the total harvest is lost each year due to improper or inefficient storage and handling, although reduction of postharvest losses represents a large business opportunity and potential for economic benefit, it is a research and development area which is receiving limited attention. Apart from downright reject of damaged fruit, which sometime reaches the retail shelves, one of the most common causes of consumer dissatisfaction is poor quality fruit at the retail store due to poor harvesting, handling, storage, and transport conditions. Bruises, excess ripeness and decay cause automatic rejection by purchasing managers at retail chains. Growers and shippers in general try to reduce postharvest losses through earlier harvesting and shipping greener fruit. Often this fruit has not reached the maturity levels necessary for good eating quality. In order to reduce the losses, the natural reaction of producers has been to harvest green, unripe fruit. This change in harvest criteria results in less losses in transit, but is a major cause of rejection by consumers, leading to sales reduction. Consumers in general dislike unripe green fruit with no taste. Eventually, the fruit is equally rejected at the display in the markets, causing lost sales. When fruits are harvested at the proper maturity, ripening systems can improve significantly the eating quality of many fruits at retail. These systems have to be well designed, managed and controlled, so that they improve fruit eating and visual quality without damaging internal quality and reducing shelf life of the produce. In summary, the combination of large losses in fruits and vegetables after harvest due to improper handling transport and storage, in the form of rejected or downgraded produce, the chronic complaints among consumers regarding poor quality, the public concern for food safety and residues especially in fresh fruit produce, point out towards a significant business opportunity.

Keywords: Fresh Produce, Quality, Post Harvest Losses, Retail Chain, Consumers

IMPROVING SOCIOECONOMIC STATUS OF RURAL WOMEN THROUGH MUSHROOM CULTIVATION

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Women constitute almost fifty percent of the entire population. Rural women are invisible in statistics while women are extensively involved in agricultural activities. Rural women play a crucial role in agricultural development and allied fields. For the improvement of socio economic status of rural women mushroom cultivation plays an important role. Mushroom cultivation is a women friendly profession. Mushroom growing is one agricultural activity in which rural farm women can play a pivotal role without sacrificing their household responsibilities. Mushroom cultivation is simple, low cost, and suitable for rural areas, is less labor intensive and can provide employment in both the semi-urban and rural areas. Mushroom cultivation will improve the socio-economic condition of farmers, families and solve employment problems of both literate and illiterate, especially rural women. Mushroom cultivation is environment friendly and they biosynthesize their food from agricultural crop residues, which is readily available in rural areas. Mushroom have prized as the food of God on an account

of their nutritive value, special flavor and medicinal property which can fight against malnutrition and helps to maintain nutritional security in rural areas. Mushroom is an indoor crop, grown independent of sunlight and do not require fertile land. Hence, rural women can adopt mushroom cultivation on individual or group level and raise their income and employment opportunities which make them economically and socially empowered.

Keywords: Rural women, Mushroom cultivation and malnutrition.

OBSERVATIONS ON ZOOPLANKTON COMMUNITY OF NANAK SAGAR RESERVOIR, UTTARAKHAND

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The zooplankton density and diversity along with important physico-chemical parameters were studied on fortnightly basis from August, 2016 to March, 2017 in Nanak Sagar reservoir, Uttarakhand. Three sampling sites i.e. (A1, A2 & A3) were selected for regular sampling of zooplankton and water. The range of physico-chemical parameters i.e. water temperature, dissolved oxygen, free CO₂, transparency, pH, conductivity, total dissolved solid, total alkalinity, nitrate and phosphate during the study period were 16.9 to 34 °C, 3.2 to 9.6 mgL⁻¹, 0 to 6 mgL⁻¹, 67.9 to 194 cm, 7 to 8.7, 118 to 336 µS cm⁻¹, 91.7 to 156 mgL⁻¹, 60 to 140 mgL⁻¹, 0.22 to 0.64 mgL⁻¹ and 0.043 to 0.2 mgL⁻¹ respectively. The zooplankton mainly consisted of Rotifera, Copepoda, Cladocera, Ostracoda and Diptera. Out of 24 genera of zooplankton, 10 were from rotifera, 6 from cladocera, 5 from copepoda, 2 from ostracoda and 1 belonged to diptera group. The average density of zooplankton was 6250 individuals L⁻¹, 4125 individuals L⁻¹ and 4000 individuals L⁻¹ at site A1, A2 and A3 respectively. The diversity of zooplankton showed their own maximum and minimum abundance during a particular season. The water quality parameters of Nanak Sagar reservoir reveal that the environmental conditions are good from the fisheries point of view.

ROLE OF MASS MEDIA IN ORGANIC FARMING

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Mass media play a vital role in educating and strengthening the farmer. Now-a-days, every household have mass media like radio, television, newspaper etc. but the coverage of agricultural related by mass media is very limited. In India, still farmers are not aware about the important of the organic farming. Organic farming aims for human welfare without harming the environment. Nowadays demand for organic products especially in developed countries has been increasing. According to APEDA (2013-14) the total area in organic farming in India is 723039 Ha. It was found that more than half i.e. 52.22% of the certified organic farmer possessed medium level of mass media exposure followed by high 28.33% and low 19.45% levels. Certified organic farmers were found to be habituated use of radio, television, newspaper, magazines etc. Hence for the promotion and development of organic farming it is necessary to strengthen the farming community towards mass media and its use in knowing farm technologies and step toward organic farming as well as sustainable farming.

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zooplankton showed their own maximum and minimum abundance during a particular season. The water quality parameters of Nanak Sagar reservoir reveal that the environmental conditions are good from the fisheries point of view.

ATTITUDE OF POST GRADUATE STUDENTS OF JUNAGADH AGRICULTURAL UNIVERSITY TOWARDS AGRICULTURAL ENTREPRENEURSHIP

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The present study was conducted to find out the attitude of post graduate students of Junagadh Agricultural University towards agricultural entrepreneurship. Locale of the study was JAU, Junagadh in Gujarat state. Data was collected from 120 students of five colleges of JAU. The students were interviewed with the well designed and pretested questionnaire. It was found that majority of the students belonged to 22-24 years of age; while 46.67 percent of post graduate students belonged to first class. It was found that maximum number of respondents had medium academic achievement and family income (Above 2 lakhs) and majority of the respondents father's were graduate and above graduate. Study also indicated that majority of the students participated in the extracurricular activities. While, Majority (65 percent) had medium level reading habit, self-confidence, risk orientation and cosmopolitaness were found to be of medium level. The study revealed that 73.34 percent had favourable attitude towards agricultural entrepreneurship. While, 15 percent of the respondents had most favourable and only 11.66 percent of the respondents had less favourable attitude towards agricultural entrepreneurship. Practical oriented and skill based entrepreneurial activities should be imparted, training and demonstrations related to modern technology should be conducted on regular basis.

Keywords: Attitude, JAU, post graduate students, agricultural entrepreneurship.

IMPORTANCE OF SOIL HEALTH AND QUALITY AND HOW TO IT IMPROVE

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Soil health and soil quality are defined as the capacity of soil to function as a vital living system within land use boundaries. This function which sustains biological productivity of soil also maintains the quality of surrounding environment and human health. Thus the two terms are used interchangeably although it is important to distinguish that, soil quality is related to soil function, whereas soil health presents the soil as a finite non-renewable and dynamic living resource. The main role of health is soil organisms respond sensitively to land management practices and climate. They are well correlated with beneficial soil and ecosystem functions including water storage, decomposition and nutrient cycling, detoxification of toxicants, and suppression of noxious and pathogenic organisms. Soil organisms also illustrate the chain of cause and effect that links land management decisions to ultimate productivity and health of plants and animals. Healthy soils should be focused on four complementary themes: (i) mechanisms and assessment of carbon storage potential in soils across regions and systems; (ii) performance evaluation of best farming practices for soil carbon and impact on other greenhouse gases, food security, and other regulation and production services; (iii) innovation and its promotion by appropriate policies; and (iv) monitoring and estimating variations in soil carbon stock, especially at the farmer level.

Keywords: Soil health, Soil quality, Ecosystem functions

WATER SECURITY PLANNING FOR SARUA MICRO-WATERSHED, PRATAPGARH, UTTAR PRADESH USING SCS-CN METHOD

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The Study aims for water security planning using USDA Soil Conservation Services Curve Number (SCS-CN) method in Sarua watershed, located between 26°2'1" to 25°58'550"N latitude and 81°45'43"E longitude which is situated at Laxmanpur block of Pratapgarh district, Uttar Pradesh. A total of 40 single storm events were selected between the years 2005 to 2014 for the study. Antecedent moisture content (AMC) was calculated by taking preceding five days rainfall which gave three conditions AMC I, AMC II and AMC III. Weighted Curve Number (CN) for the entire selected micro-watershed was calculated based in site information of the watershed and found to be 81 for AMC II. The CN values corresponding to AMC I and AMC II were 64.16 and 90.74 respectively. The average annual runoff was estimated following Curve Number method and annual runoff was found 1902395.4 m³. The total annual water requirement by the population, livestock and crop was found 7483975.2 m³. It is observed that there is a deficit of 551576.8 m³ which is about 74% of total water requirement.

Construction of water conservation structures and community management of water resources to be encouraged for proper water security planning.

Keywords: Antecedent moisture content (AMC), Curve Number (CN)

DEVELOPMENT OF ANTIMICROBIAL FINISH USING LEMON PEELS EXTRACT

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Hygiene is a burning issue in the textile industry and consumers are very conscious of textiles which are hygienic. Being worn next to the skin and by virtue of their characteristics, textiles provide an excellent medium for the adherence, transfer and propagation of infection causing microbial species. Microbial action is a dominant factor in limiting the performance of the textiles. The detrimental effect of microbes can be seen on both the wearer and fabric. Several challenges have been created for textile researcher to develop special finishes to make fabric microbial resistant especially cotton being most demanded and usable fabric, but, susceptible to more microbial growth. Therefore, textile finishes with added value particularly for medical clothes are greatly appreciated and there is an increasing demand on global scale for these type of textiles. Hence, the use of non-toxic and eco-friendly anti-microbial textiles have become a matter of significant importance because of the increased awareness in order to avoid some hazardous synthetic anti-microbials. Although, many natural anti-bacterial agents are available at present, only few studies have been explored for their anti-bacterial activity on textile materials. Also, by considering the health problems faced by the consumers as well as understanding the importance of cotton in our life, the study on application of lemon peel for microbial resistance on cotton fabric was conducted. Anti-bacterial finish was applied on cotton fabric with lemon peels extract. Finish was applied on the fabric by method exhaust method. The percent reduction in bacterial growth was decreased with increase in incubation period after application of the lemon peels extract finish. Hence, lemon peels finished samples exhibited very good resistance against the growth of *Bacillus spp.* So, the textiles with anti-microbial finish not only protect the fabric, but also the user, from microbial infestation.

Keyword: non-toxic, eco-friendly, antimicrobial, *Bacillus spp.*

INNOVATIONS IN NATURAL COLOR EXTRACTION TECHNIQUES IN FOOD INDUSTRY

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Food pigments are compounds which are responsible for the color of edible products. The major natural pigment types comprises of the heme pigments (Mb and Hb), carotenoids, chlorophylls, anthocyanins, flavonoids, betalains, melanin, tannins, quinones, and xanthenes. These natural compounds are widespread in animals, plants, and microorganisms (including algae, fungi, and yeasts). The use of natural pigments for food coloring is receiving growing interest from both food manufacturers as well as consumers because of innumerable associated benefits and myriad therapeutic properties which are linked with the use of natural colorants in food industry. Extraction and purification of these compounds is one of the key processing steps in recovering the major ingredients contained in plant-based materials. Solvent extraction is the conventional method that is usually followed to extract colors from plant materials. Though the existing conventional extraction methods has more extractability than commercial methods, it also passes serious limitations and environmental issues, which gave rise to new novel "Green" extraction technology having potential to overcome all limitations of present technologies. The current advance techniques that are followed in color extraction are as follows: i. High Hydrostatic Pressure (HHP), ii. Pulsed Electric Field (PEF), iii. Sonication-assisted Extraction, iv. Gamma Irradiation, v. Enzymatic Extraction, vi. Membrane Technology.

Keywords: Natural colors, Green extraction techniques, Health benefits, Food industry

MNREGA: CONSTRAINTS OF WOMEN EMPOWERMENT IN PURABAZAR BLOCK OF FAIZABAD DISTRICT, UTTAR PRADESH

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The present research was conducted in Purabazar block of Faizabad district of Uttar Pradesh. To assess the impact of MNREGA on women empowerment. The data was collected through personal interview with help of interview schedule. The data finalized, tabulated and find out the percentage. It was observed that the entire MNREGA job holder belongs to below poverty line. The general constraints regarding of women empowerment, were 60:40 wage and material ratios is not maintained it was ranked first, constraints regarding, selection and registration, "Job cards are issued less in comparison to

registration" it was ranked first, constraints regarding preparation of job cards, job cards are not issued within 15 days of application consequently wastage of time, it was ranked first constraints regarding allotment of work, the 100 days wage employment is not given in a financial year, it was ranked first, constraints regarding Worksite amenities "Lack of facilities such as water shade medicine at worksite, it was ranked first constraints regarding Auditing and monitoring, Monitoring by NGOs and civil societies is not done, it was ranked first, constraints regarding Opening of account and withdrawal of money, "Withdrawal of money from bank is time taking, it was ranked first and constraints regarding "Non-cooperation from family members" it was ranked first were reported important by maximum respondent. The suggestion given by respondents "The job card should be issued within 15 days of application" and "Worksite facilities such as crèche, drinking water, medicine and shade should be provided" a like found to be important for further consideration.

Keyword: women, empowerment, employment, constraints, MNREGA

POTENT UNDERUTILIZED LEAFY VEGETABLE PLANTS FOR NUTRITION AND HEALTH FROM BAHRAICH (UP) INDIA

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Humans have used leaves as food since time immemorial. Different types of leaves, depending from the place and the season, were part of the human diet since prehistoric times. With the passing of the centuries many of those traditional leaf vegetables have been replaced by leaves that are more tender, have a more neutral taste or that are considered more refined. The leaves that were part of ancient traditional diets are still to be found in the wild, sometimes at the edge of cultivated fields, or near abandoned homesteads. Generally, they are found not far from inhabited places, indicating that they are the vestiges of ancient cultivated plants. Leaf vegetables, also called leafy greens, salad greens, pot herbs, vegetable greens, or simply greens, are plant leaves eaten as a vegetable, sometimes accompanied by tender petioles and shoots. Although they come from a very wide variety of plants, most share a great deal with other leaf vegetables in nutrition and cooking methods. Nearly one thousand species of plants with edible leaves are known. Leaf vegetables most often come from short-lived herbaceous plants, such as lettuce and spinach. Woody plants of various species also provide edible leaves. The leaves of many fodder crops are also edible for humans, but usually only eaten under famine conditions. Examples include; alfalfa, clover, most grasses, including wheat and barley. These plants are often much more prolific than traditional leaf vegetables, but exploitation of their rich nutrition is difficult, due to their high fibre content. Leaf vegetables contain many typical plant nutrients. This causes leaf vegetables to be the primary food class that interacts significantly with the anticoagulant warfarin. In Bahraich there are 95 plant species representing 69 genera belonging to 39 families. Fabaceae (Papilionoideae) is the biggest family being represented by 12 plant species whereas Fabaceae (Caesalpiniaceae) with 10 plant species followed by Brassicaceae with 8; Amaranthaceae with 7; Asteraceae with 6; Malvaceae with 4; Chenopodiaceae, Apiaceae, Cucurbitaceae, Lamiaceae and Portulacaceae with 3 plant species each; Cleimaceae, Araceae, Covelvulaceae and Boraginaceae with 2 plant species; rest 24 families viz., Mimosaceae, Plantigenaceae, Basellaceae, Nyctaginaceae, Capparaceae, Molluginaceae, Acanthaceae, Rubiaceae, Moringaceae, Menyanthaceae, Bignoniaceae, Poaceae, Oxalidaceae, Polygonaceae, Phyllanthaceae, Sapindaceae, Padillaceae, Caryophyllaceae, Urticaceae, Meliaceae, Verbenaceae, Marsileaceae, Solanaceae and Apocynaceae is being represented with single plant species each.

THE CONCEPT OF AGRO-TOURISM: EVOLUTION AND TRENDS

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India exhibits diverse form of art and culture entrenched through a rich heritage, which makes India a hot global tourist destination. India has a thriving tourism industry, which contributes over 6% to the national GDP and 8% of the total employment. It is thus capable of offering a wide variety of entertainment for the discerning tourists and has the capacity to diversify into new arena of agro-tourism. Agro-tourism offers an opportunity to experience the real enchanting and authentic contact with the rural life, taste the local genuine food and get familiar with the various farming tasks. It also provides the welcome escape from the daily hectic life in the peaceful rural environment and to relax and revitalize in the pure natural environment, surrounded by magnificent landscape. Agro-tourism can contribute towards a green economy transition through investments leading to energy and water efficiency, waste reduction, biodiversity and cultural heritage conservation, and the strengthening of linkages with local communities. Diversifying a farm to include recreation and leisure activities into agro-tourism is increasingly being adopted and is suggested to bring a myriad of economic and intrinsic benefits to farmers,

visitors and communities. Agro-tourism promises the benefits of keeping family farms in business and preserving agricultural heritage, maximizing the productivity of farmland resources through their recreational use, and even improving the economic situation of local communities. For most people, agricultural tourism refers to a visit to a working farm or any agricultural, horticultural, or agribusiness operation in order to enjoy, be educated by, or become actively involved in the activities of the farm or operation – in other words, getting a true farm experience. The Indian farming industry is facing decreasing profitability because of declining returns to production agriculture. The future sustainability of many farm operations is linked to the ability of farmers to generate supplemental income from existing farm resources. Agro-tourism is a strategy to promote agricultural economic development in India. Through this paper it is intended to inform policy makers and farmers about the nature of agro-tourism activities and the extent to which these activities enhance agricultural viability.

Keywords: Agriculture, Agro-tourism, Sustainable tourism, Rural tourism

MORPHOMETRIC ANALYSIS OF KOYNA RIVER BASIN USING REMOTE SENSING AND GIS TECHNIQUES

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For better watershed management in the river basin the characteristics of different morphometric parameter must be known. Morphometry includes the measurement and analysis of earth's form, surface, features and landform dimensions. The aim of this study is to identify morphometric characteristics of Koyna river basin which is an important tributary of Krishna river situated in Western Ghats region of Maharashtra state, India by using remote sensing and GIS technology. In this study different linear, areal and relief aspect of the Koyna river basin are analyzed. The morphometric analysis showed that the trunk order of the basin is sixth order. Dendritic and trellis drainage pattern is observed in the basin. Low mean bifurcation ratio indicates structurally less disturbed drainage network and relatively homogeneous lithology. The form factor, shape factor, circulatory ratio and compactness coefficient revealed that the basin is elongated one. Drainage density of basin is very coarser indicating permeable substrata, low relief and thick vegetation. Infiltration number indicates low runoff and more infiltration in the basin. Low stream frequency represents high permeability, low relief and maximum areal coverage by forest in the basin. Overland flow length in the basin is more due to higher infiltration rate of soil; it causes low catchment response to runoff. The high value of constant of channel maintenance indicates strong lithology, high permeability, high vegetative cover, low erodibility and low runoff from the basin; hence flood hydrograph will have flatter peak and longer base width. Relief ratio showed low to moderate slope of basin which is least susceptible to erosion process. Ruggedness number indicated that the basin has extreme roughness and unevenness; hence in the basin still the soil erosion process is in active nature.

HYDROCOLLOIDS AS FOOD

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Hydrocolloids are widely used in the food industry as gelling, stabilizing, thickening and suspending agents. These are polysaccharides composed of simple sugar building units and all of them have hydrophilic molecules, which combine with water to form viscous solutions. Hydrocolloids can be added to increase the consistency of the ketchup at lower total solids content. Hydrocolloids have been used since at least as far back in time as ancient Egypt and have been part of the human diet for several thousand years. They are produced from seeds, roots, red and brown seaweed extracts, tree sap, fruit peels, and animal extracts. There are microbiological hydrocolloids which are produced by the fermentation of bacteria; like Xanthan and gellan gums, and there are also cellulose derivatives, like methylcellulose. The hydrocolloid could provide extra body and mouth feel to a beverage or give a gel structure to a milk-based product, like a pudding. To stabilize a food product, refers to the prevention of physical changes in the product resulting from the separation of its components, for

example; a vinaigrette or salad dressing. Also, the handling and processing conditions of a product, such as high temperatures, can prevent a pie filling from melting and running when subjected to the heat of an oven. Hydrocolloids added to various food systems can influence the texture, increase the stability and reduce fat or calories in a food product.

POTENT WILD EDIBLE FRUIT PLANTS FOR NUTRITION AND HEALTH FROM BAHRAICH (UP) INDIA

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Collection of fruits from wild for food and domesticating food plants for multipurpose use is an age-old practice in Indian subcontinent. Mango, bael, aonla, banana, palmyra palm, coconut and such others are intimately associated with the culture, traditions, festivals and rituals of Indian communities. Medicinal uses of fruits like bael, emblic myrobalan, jackfruit, wild dates, wild fig, monkey jack, jamun, ber, mango, wood apple and many others find place in Indian Ayurvedic literature starting from the century BC to date. The rich diversity of wild fruits in Indian tropics and Himalayan belt not only provide nutritious food, but also income to tribal and poor people living close to forests and rural areas. Quite often, besides providing timber, firewood, fodder, they serve as famine insurance in periods of food scarcity. Many of the wild fruits are nutritionally very rich and of great medicinal value. Agricultural research and development however have not given due emphasis to these plant groups resulting limited literature on diversity, distribution, taxonomy, phenology and uses of wild edible fruit plants of India. An inadequate understanding concerning taxonomy, biology and local knowledge of these taxa has contributed to suboptimal utilisation of these valuable resources. It is essential therefore, to identify, evaluate, improve, propagate and cultivate these under-utilized species for its sustainable use which can broaden our choice of food and enrich the livelihoods of rural poor. In Bahraich there are 76 wild edible plant species representing 63 genera of 40 families. Moraceae and Anacardiaceae are found to be the biggest family represented by 5 plant species each whereas Malvaceae and Rhamnaceae with 4 plant species each; Rutaceae, Annonaceae, Euphorbiaceae, Sapotaceae, Solanaceae and Myrtaceae with 3 plant species each; Amaranthaceae, Vitaceae, Caesalpiniaceae, Lamiaceae, Capparidaceae, Apocyanaceae, Boraginaceae, Dilleniaceae, Sapindaceae, Rubiaceae and Combretaceae with 2 plant species each. The rest 19 families viz., Cornaceae, Phyllanthaceae, Avertroaceae, Nyctaginaceae, Bombacaceae, Lecythidaceae, Cucurbitaceae, Ebenaceae, Asteraceae, Flacourtiaceae, Molluginaceae, Acanthaceae, Verbinaceae, Lauraceae, Passifloraceae, Arecaceae, Portulacaceae, Aizoaceae, and Papilionoideae are being representing by single plant species each.

PERSPECTIVE OF AGRICULTURE GIRL STUDENTS TOWARDS HIGHER EDUCATION

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Higher education plays an immense role in inspiring students to realize their goals and achieve it. This fact has been realized by many girl students pursuing their studies in various courses of agriculture. The perspective of these girl students towards higher education plays a significant role in the development process of agriculture. Nowadays more number of girl students are seeking admission in various agriculture universities for acquiring higher education. The women agricultural research scholars are considered as important element in carrying out research on the agriculture and acquiring better position in agricultural occupation. The girl students obtaining higher education in agriculture faculty play a significant role in rural development and in enhancing national economy. There are several reasons behind the girl students opting higher education and some of them are: they want to establish themselves really well in the society, desire to ensure equal participation in the development process, need to be economically independent, desire to achieve their goals and fulfill their dreams, to obtain more equitable status, want to become an asset for their families, desire to take their own decisions, want to take the family responsibilities, desire to have better recognition and prestige in the society, desire to get better job opportunities, etc. They have perceived pretty well that the above needs and desires can only be fulfilled if they are highly qualified. Hence, maximum number of girls are having a positive attitude towards pursuing higher education. This optimistic attitude of girl students is playing a crucial role in expansion of agriculture.

RESOURCE MANAGEMENT: A KEY FACTOR FOR SUSTAINABLE AGRICULTURE

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This title addresses a modern days major topic; sustainability. Due to increase in the population, and continues decreasing in available land for agriculture, the sustainability of agricultural production is becoming more important. As compared to other aspect of sustainability, the resource management and allocation seems to be left with little exploration. And this is all about the importance of resource management for the advancement of the modern sustainable agriculture. There is a close relationship between resource management and sustainable agriculture. The resource management followed the demand for effective use of available agricultural resources like land, irrigation water and other inputs. Recent inefficient management of agricultural resources has resulted in the decrease the agricultural production and imbalance the sustainability. Therefore sustainable agriculture requires integration of resource management with the other aspects of cropping system for the long term sustainable achievement.

Keywords: Sustainability, efficient management, integration of resources, sustainable achievement.

INTEGRATED FISH FARMING TECHNOLOGY: WAY TOWARDS SOCIO-ECONOMIC UPLIFTMENT AND WOMEN EMPOWERMENT IN RURAL AREAS OF WEST KAMENG DISTRICT ARUNACHAL PRADESH, N. E. R, INDIA

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In India more than 75% of the total population, involves in agriculture / allied sectors and lives in rural areas at subsistence or near subsistence level. These rural folk are greatly under-nourished, requires not only a large supplement of animal protein in their diet but also new sources of gainful employment for their socio-economic upliftment. In this reference Integrated Fish Farming may become a one of the best examples of mixed farming for sustainable development of the rural farming community. This type of farming practices in different forms in the various countries is one of the important ecological balanced sustainable technologies. The systems gives a good returns to the farmers in term of fish production, a handsome quantity of other agri./allied products and may become new sources of gainful employment for their overall development. In view of the above facts the present study were undertaken in the three villages i.e. Sangti, Chug and Salari of Dirang Circle during the year 2016-17 under West Kameng district of Arunachal Pradesh through the involvement of women farming community, as they plays an important and major role at household level for the upliftment of their family socioeconomic status. This district is lying approximately between 91° 30' to 92°40' East longitudes and 26° 54' to 28° 01' North latitudes, blessed with complex climatic environmental conditions having foothill as well as complex hill eco-system with the varying elevation ranging about from 300-4200 meter and covers about 7422 Sq.KM of geographical region accounting for 8.86% of the total area of the state. During the experimental period the observations were made periodically on monthly basis from each segment and data were analyzed for the proper evaluation of the system. The encouraging results were recorded from this system (IFS) in comparison to mono-cropping pattern of farming. On the agricultural front, the district is still at the stage of subsistence level of farming in this context Integrated Fish Farming may become a one of the best examples of mixed farming for sustainable development of the rural farming community through conservation and efficient utilization of their natural resources.

Keywords: Integrated Farming, ecologically balanced, socioeconomic and sustainable etc.

HEAVY METALS IN COSMETICS: DISTRIBUTION AND POSSIBLE HARMFUL EFFECTS ON HUMAN VEENA CHAUDHARY

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During the last few decades cosmetic products have a big boost and applied to the human body for beautification. The cosmetic products include, care creams, talcum, face powder, lipstick, kajal, sindoor and eye makeup etc. There are concerns regarding the presence of harmful chemicals such as heavy metals in these products. These heavy metals can cause or are supposed to cause harmful effects such as cancer, allergic reactions, mutations, respiratory problems as well as development and reproductive problems. Dermal exposure is expected to be the most significant route because most of the cosmetics are directly applied to the skin. Oral exposure can occur from applying cosmetics around the mouth and also from hand to mouth contact. These metals bind with protein sites which are not made for them by displacing original metals from their natural binding sites causing malfunctioning of cells and ultimately toxicity. Previous research has found that oxidative deterioration of biological macromolecules is primarily due to binding of heavy metals to the DNA and nuclear proteins. Lead can substitute calcium even in picomolar concentration affecting protein kinase C, which regulates neural excitation and memory storage. Because of mutagenic properties of Cr (VI), it is categorized as a human carcinogen by the International Agency for

the Research on Cancer. In humans Mg^{2+} and Fe^{3+} are replaced by Al^{3+} , which causes many disturbances associated with intercellular communication, cellular growth, secretory functions and neurotoxicity. The iron produced hydrogen free radicals and those attack DNA, resulting in cellular damage, mutation and malignant transformations which in turn cause an array of diseases.

AN ANALYSIS OF CROPPING PATTERN IN MALAPRABHA PROJECT COMMAND AREA

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Analysis of cropping pattern in a region is of vital importance and it helps to decide which is the best suitable crop for particular geographical area. The present study was taken up in Malaprabha Project Zone (MPZ), Karnataka. It aimed at analyzing the cropping pattern prevailing in the study area and also comparing the recommended cropping pattern with the actual practice and identify the deviation. The study made use of both primary and secondary data for analyses. Primary data was collected from farmer respondents of villages in Head and Tail regions of Malaprabha Left Bank Canal (MLBC). Secondary data was collected from Department of Agriculture, Malaprabha Project Zone (MPZ). Markov Chain Analysis was used to analyze the time series data on area coverage of different crops grown in Malaprabha Project command area from 1999-2015 and simple tabular analysis was used to analyze the primary data. The results revealed that maize was the major cereal crop, pigeon pea, green gram and bengal gram were the major pulse crops. Ground nut and sunflower were the major oil seed crops. Vegetables were grown in summer and sugarcane, cotton and chilly were the major annual/bi seasonal crops grown by the sample farmers in the command area. It was also observed that cotton, maize and groundnut were predominantly and farmers deviated from the recommended cropping pattern by Command Area Development Authority (CADA).

Keywords: Cropping pattern, CADA and command area.

ROLE OF WOMEN IN SERICULTURE

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Sericulture is essentially a village based industry that provides employment to both skilled and unskilled labour, women and aged persons at homes at minimum risk. India continues to be the second largest producer of silk in the world and has 16.58% share in global raw silk production. Among the four varieties of silk produced as in 2016-17 the production increased up to 30265 MT. The employment generation in the country is raised to 8.51 million persons in 2016-17 compared to 7.65 million persons in 2012-13. The present article will mainly explore the role of women in sericulture and includes the concept of work, division of labour, segregation of occupations, and dimension of labour and household activities. This article will further discuss the preparation of women toward silkworm, feeding and so on. Women are mostly favoured because of their industrious nature. They are employed in a mulberry garden or silkworm rearing or in a grainage. Coming to the post cocoon technology, the involvement of the women is greater, commencing from silk reeling, weaving and garment manufacturing industry. However, their work has not always been properly recognized or suitably rewarded. Thus the analysis clearly establishes the importance of sericulture over other crops in the generation of fresh employment opportunities in rural areas. KEY WORDS-Women, Sericulture, employment, tribal, income.

RURAL LIVELIHOOD AND DEVELOPMENT IN ALLIED SECTOR ROLES, INTER- LINKAGES AND SIGNIFICANCE OF NON- FARM SECTORS IN BOOSTING RURAL ECONOMY OF INDIA: DOUBLING THE FARMER'S INCOME

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Importance of rural non- farm economy: The rural non-farm economy comprises all the non-agricultural activities which produce income to rural households (including income in-kind and remittances), either through waged work or in self-employment. The rural non-farm economy has interest of governments, non-governmental organisations (NGOs), bilateral and multilateral donor agencies as well as development practitioners due to its prevalence in both developing as well as transition economies. This economy is mostly small-scale which uses little capital, and has low productivity thus offers low returns, and activities which operate at larger scale with higher capital investment are found less prevalent (Davis, 2003). Driving factors for rural non- farm sectors: Distress-push diversification drives the majority of the rural poor into rural non-

farm employment and income generating activities (Bezemer and Davis, 2003). It has importance for policymakers to distinguish between distress-push and demand-pull since each may require different policy responses (Davis and Pearce 2001). The former requires policymakers to develop apt social safety net and interventionist policies to alleviate the short-run negative effects that from time to time accompany this type of diversification (for example, over-rapid urbanisation, negative environmental impacts etc.). Where demand-pull factors drive the process of diversification, thus policy-makers seek to deliver a suitable "enabling environment" to support the development of the rural non-farm economic activities and sustainable rural livelihoods. Tool and linkages for poverty alleviation: In transforming countries like most of Asia, the Middle East and North Africa and Central Asia, economic growth is fast in other sectors but a large number of the poor remain in rural areas. Growth in agriculture and in the associated rural non-farm economy is needed to reduce poverty and confine rising rural-urban income disparities (Davis, 2003). As agriculture grows, it stimulates growth of the rural non-farm sector through a number of key linkages such as rise of labour productivity on the farm which increases food supplies and provides scope for farm family workers to undertake non-farm activities, Increases in farm incomes through with high rural savings rates and ensuring capital availability for investment in non-farm activities. As the rural incomes increases, farm households spend much of their obtained income on wide range of consumer goods and non-farm services. Diversification of rural economy: The barrier to structural transformation and poverty eradication in rural area is the incongruity between the need for diversification of income and the opportunity to diversify, at the household and the community level among youth. It can be said "meso-paradox" at the level of community (Reardon, Berdegue and Escobar, 2001). Conclusion: There is urgent need to double the farm income of farmers with the present condition aim at advancement with sustainability by means of rural non-farm activities. The rural non-farm economy should be boosted to be the main alternative in the absence of proper agricultural wage labour market. Sustainability could be ensured by analysing forward-looking and speculative indicators rather than only objective indicators. Comparative analyses of different case study experiences should be promoted.

Keywords: Income, economy, sustainability, non-farm activities, diversification.

IMPACT OF ASCI IN AGRICULTURE AND ALLIED INDUSTRIES

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Agriculture Skill Council of India – ASCI was formed in 2013 as the 13th sector skill council to address the end-to-end skilling needs in a sector that employs more than 50% of the workforce. Though there are large numbers of people engaged in agriculture, the actual number of people actively involved is on the decline, apparently from 250 million to 119 million over next 7 years. This makes it imperative to look into the need for training, productivity enhancement and better outcomes. They have trained 1,37,000 under the PMKVY scheme and another 23,000 people through RPL for PMKVY. They have developed 168 Qualification Packs (QPs) for various job roles covering agriculture, horticulture, dairy, poultry, fishery, apiculture, agro forestry, water management, post-harvest (agri-supply cold chain). Besides the flagship programs of central government, They are also engaged with the state skill missions which include UP Skill Development Mission, Kerala, Himachal Pradesh State Skill Mission, MoU with West Bengal and Rajasthan – through training and certification. Agriculture is being introduced as a vocational subject from standard 9 to 12 in 533 different schools across 5 states under Rashtriya Madhyamik Siksha Abhiyan (RMSA) Program. Vocational programs are being run in 50 community colleges where agriculture programs are taken in at various levels like certificate, diploma and advanced diploma. When they started their journey, they didn't have trained trainers, now they have almost 700+ trained trainers, 600 assessors as well. They are operating in all the 29 states in India and also conduct assessments in 11 regional languages. First, they developed the QPs, now they have their model curriculum and they have reached the third stage of developing their training content.

Keywords: PMKVY, Skill Development

ADOPTION OF FARMERS ABOUT IMPROVED GINGER (*ZINGIBER OFFICINALE* L.) PRODUCTION TECHNOLOGY IN UDAIPUR DISTRICT OF RAJASTHAN

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Ginger is an important spice and medicinal crop. The present study was conducted in Udaipur district of Rajasthan. There are total eleven tehsils in Udaipur district, out of which two tehsils namely, Jhadol and Gogunda were selected on the basis of maximum area under ginger cultivation. Five villages from each identified tehsil were selected on the basis of maximum area under ginger cultivation. For selection of respondents, 100 ginger growers were randomly selected from identified villages (10 from each village) for data collection. The study revealed that 57.00% respondents fell in medium level of adoption group whereas, 16.00 % ginger growers were observed in the high level adoption group and remaining (27.00%) respondents

were possessed low level of adoption about improved ginger production technology. The study indicated that farmers had adequate adoption regarding recommended time of sowing, harvesting at proper time, follow the recommended irrigation management practices and recommended seed rate, where as they had less adoption regarding recommended seed treatment, adoption of scientific curing process, use of high yielding varieties, and recommended insecticides.

Keywords: Spice, Ginger, Adoption, Production, Technology

EFFECT OF PRESERVATION TECHNIQUES ON FOOD QUALITY

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The preservation is very effective term, because this term protects the food and food materials for longer time periods. In many years ago food is being stored in houses for the purpose of emergency. In addition to basic food items, people also store frozen or preserved garden-grown fruits, vegetables and freeze-dried or canned produce. Food preservation has long been an on-going challenge for human with the methods like, drying, salting and fermentation being traditionally done for preservation. Methods such as canning, freezing and irradiation are relatively recent developments and adopted for preservation of food. Quality and shelf life of food products depend greatly on the properties of microorganisms contaminating the food. The preservation techniques would retain the nutritional quality of food including vitamins, minerals, and essential flavors. There are many processes used for making foods stable and safe, e.g. heating, chilling, freezing, freeze drying, drying, curing, salting, sugar-addition, acidification, fermentation, smoking or oxygen removal. However, these many processes are based on relatively few parameters or hurdles, i.e. high temperature (F value), low temperature (t value), pH, preservatives, and competitive flora. Food preservation is viewed as a 'convenience' of an efficient food system as well as a key to ensuring the availability of food as a vital benefit, particularly in developing countries.

Keywords: Food, Preservation Techniques

STUDY OF ANTI-INFLAMMATORY ACTIVITY OF SOME SUBSTITUTED CHROMONES

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Heterocyclic compounds like thiazole acetic acids and pyrazole derivatives phenylbutazone and oxyphenylbutazone (Tanderil) are good anti-rheumatic factors. Though oxyphenylbutazone is less toxic than phenylbutazone, but still there is need for better alternatives. Hence, thiazole ring was created on chromone nucleus and other heterocyclic systems were developed on thiazole ring of thiazolylchromones with a view to study their anti-inflammatory activity and establish structure activity relationship (SAR). This paper studies SAR in them. Among these compounds 3-[2-(morpholinyl)thiazol-4-yl]-6-chloro-2-methylchromone [1] and 6-(2-methylaminothiazol-4-yl)-2,3-dimethylchromone [2] have shown good anti-inflammatory activities equal to 49 and 47 as compared to 53 for phenylbutazone standard. It is important to mention here that chromone ring is comparatively safer moiety as it is present in a number of fruits, vegetables and plants. Their safer nature is also evident by their ALD₅₀ values.

Keywords: Substituted chromones, thiazoles, pyrazoles, anti-inflammatory activity.

INDIAN DAIRY INDUSTRY

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India is the world's largest producer of dairy products by volume, accounting for more than 13% of world's total milk production, and it also has the world's largest dairy herd. As the country consumes almost all of its own milk production, India was neither an active importer nor an exporter of dairy products prior to year 2000. However, since the implementation of Operation Flood Programme, the situation changed significantly and imports of dairy products reduced to very small quantities. From 2001, India has become a net exporter of dairy products and after 2003 India's dairy import has dipped while exports have increased at a fast rate. Yet the country's share in global dairy trade still remains at minor levels of 0.3 and 0.4 percent for exports and imports respectively. This is due to the direct consumption of liquid milk by the producer households as well as the demand for processed dairy products that has increased with the growth of income levels, which have left little dairy surpluses for export. Nevertheless, India consistently exports specialty products such as casein for food processing or pharmaceuticals. The Indian dairy sector is also different from other dairy producing countries as India places its emphasis on both cattle and buffalo milk. In 2010, the government and the National Dairy Development Board have

drawn up a National Dairy Plan (NDP) that proposes to nearly double India's milk production by 2020. This plan will endeavour to increase the country's milk productivity, improve access to quality feeds and improve farmer access to the organized market. These goals will be achieved through activities that focus on increasing cooperative membership and growing the network of milk collection facilities throughout India.

Keywords: India, Dairy Industry and Milk

PROFILE CHARACTERISTICS OF ARECANUT GROWERS OF UTTARA KANNADA DISTRICT

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The present study was conducted during 2015-16 in Uttara Kannada district of Karnataka. Sirsi, Siddapur and Yellapur talukas of Uttara Kannada District were selected for the study in the view of their highest share in area and the production in the district. The total sample size was 180. The *ex-post-facto* research design was used for the study. Age education, land holding, area under arecanut, experience in arecanut cultivation, family size, annual income, extension contact, mass media exposure, economic motivation, scientific orientation, production orientation and market orientation are the personal and socio-economic characteristics of arecanut growers. Arecanut growers had medium level of extension contact (40.56%), mass media exposure (47.78%), economic motivation (46.11%), scientific orientation (39.44%), production orientation (43.33%), market orientation (44.44%), material possession (42.22%) and organisation participation (44.44%).

Keywords: National Income, Beetle nut, Gross National Product

IMPACT OF FOOD WASTAGE ON CARBON FOOT PRINT

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Global food production must increase by 60% by 2050 in order to meet the demands of the growing world population. Yet, more than one third of the food produced today is lost or wasted. Food loss refers to the decrease in edible food mass at the production, post-harvest and processing stages of the food chain, mostly in developing countries. Food waste refers to the discard of edible foods at the retail and consumer levels, mostly in developed countries. This food wastage represents a missed opportunity to improve food security and comes at a steep environmental price. One third of the food produced in the world for human consumption, every year approximately 1.3 billion tonnes gets lost or wasted. Food waste isn't just a devastating misuse of natural resources, it's also a huge part of the world's carbon footprint. A product's carbon footprint is the total amount of greenhouse gases (GHGs) it emits throughout its life cycle, expressed in kilograms of CO₂ equivalents. This includes the GHG emissions during the agricultural phase, including those from on-farm energy use and non-energy-related emissions (such as CH₄ and N₂O) from soils and livestock. On a global average, per capita food wastage footprint on climate in high income countries is more than double that of low income countries, due to wasteful food distribution and consumption patterns in high income countries. Global food loss and waste generate annually about 8% of total anthropogenic GHG emissions. This means that the contribution of food wastage emissions to global warming is almost equivalent (87%) to global road transport emissions. Strengthening the supply chain through the direct support of farmers and investments in infrastructure, transportation, as well as in an expansion of the food and packaging industry could help to reduce the amount of food loss and waste.

Keyword: food loss, food waste, carbon foot print, food wastage.

CONTRACT FARMING-PROSPECTS AND CHALLENGES IN INDIA

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India is a country where agriculture is an age old practice and back bone of the country. Nearly agriculture contributes 17-18 percent to the country's GDP. In India most of the farmer's are small and marginal farmer's and get lots of troubles at the time of capital requirement. Contract farming has been existing in India since many years. It is the agreement between the farmer's and the company for the production of quality agriculture produces. It also helps the farmer's in increasing their income levels, produce high quality products, gain high price than normal price. Increase in agriculture standards also indirectly helpful for the country's GDP. Contract farming is being done in agriculture sector and its allied sectors like dairy, aquaculture etc. Thus contract farming is the viable option for the development of agriculture in India and raises the standards

of farmer's also. Different models and problems of the contract farming from both sides that is farmer as well as company will be discussed in this paper.

Keywords:- Agriculture, Contract Farming, Pre-Arrangements, Increasing income, Challenges, Suggestions.

RURAL YOUTH EMPOWERMENT OF INDIA THROUGH USE OF ICT

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Integrating Information Communication Technology (ICT) with agriculture is identified in order as agriculture is an important sector with more than 70% of the Indian population living in rural areas and earns its live hood by agriculture. The sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products, improve rural livelihoods. ICT has become one of the basic building blocks of modern society. India has the largest population of youth in the entire world 66 per cent of the total population in the country is below the age of 35. Young people who are given early access to ICT tend to become early adopters and adapters of the technologies, skills valued for spurring innovation and economic growth. ICT initiatives in rural India emphasize the use of a more systematic approach for linking traditional knowledge systems (TKS) & ICT to ensure sustainability of rural e-governance. To empower poor people and to reduce digital divide, ICTs projects should be developed in local language prioritizing local needs and content; be a model of low cost solution so that poor people can replicate this model or can own or share the system, be able to adopt and utilize innovative ICTs; A national agenda on a C-8 thrust towards: Connectivity provision, Content creation, Capacity augmentation, Core technologies' Creation, Cost reduction, Competence building, Community participation and Commitment . The ICT tools can change the ideas, activities and can adopt appropriate measures at the time of need. ICT has great relevance in today's world. With the IT boom in India technology is easily accessible to the government machineries with relevantly cheaper and convenient manner. Proper training and implementation of ICT programmes in simple way and language which is easily understandable by the rural people can surely bring about revolution in rural development.

Keywords: ICT, Traditional knowledge systems

SOCIO-ECONOMIC STATUS OF BT COTTON'S FARMER IN INDIA

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Bt or *Bacillus thuringiensis* is a soil bacterium which contains a toxic gene called Bt gene what makes the cotton crop resistant against bollworm. Therefore genetic engineering plays an important role in inserting a gene into the cotton-seed. It has been commercialized in a number of countries, including the United States, Australia, China, Mexico, Argentina, South Africa, and India. The country with the highest area under transgenic crops, at 75 Mha, is the USA. Bt cotton was first approved in India in 2002. India has the world's fourth-largest cultivated area under genetically modified (GM) crops after USA, Brazil, and Argentina. Significantly, the entire 11.57 Mha GM crop area in India under Bt cotton and nearly 96 percent of the country's cotton area is now covered by Bt hybrids. There is a number of problems which are faced by Indian Bt cotton's farmers, such as, there are also reports claiming genetically modified (GM) crops in general and Bt cotton in particular, are unsuitable for developing countries, causing negative impacts on small farm sector. India takes an influential position in cotton growing countries where the crop is mostly cultivated by smallholder farmers. Another problem is that, the Bt cotton was developed for cold temperate countries but India has a hot climate. In India, subsidies are so tiny that the risk-taking capacity of farmers is insubstantial. Indian farmers also faced lots of problems against agricultural and climatic conditions. There are many kinds of cotton pests in India apart from the bollworm. In tropical countries, pest attack is far more intense and the number of insects per acre. Another problem is that insects develop resistance quite fast against Bt toxicity. Apart from this, Bt cotton also contains a number of advantages. Bt cotton improves the income of farmers because it increases the yield of cotton due to effective control of bollworms and reduction in insecticides used in the cultivation of Bt cotton. It also fixed a potential reduction in the cost of cultivation due to low or no use of insecticides, Bt cotton plays a vital role in diminishing health hazards due to rare use of insecticides.

Keywords: Bt cotton, *Bacillus thuringiensis*, Bollworm, Transgenic crops, Genetically modified.

AGRIBUSINESS IN INDIA: SCOPE, OPPORTUNITIES AND CHALLENGES

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Division of Agricultural Extension Education, SKUAST- Jammu, J&K, India

In developing countries like India, the agribusiness sector consists four distinct sub-sectors, viz. agricultural inputs; agricultural production; agro-processing; and marketing and trade. There is a need to shift from 'agriculture' to 'agribusiness', as it is being viewed as an essential pathway to revitalize Indian agriculture. Over the years, while the agricultural marketing and trade scenario has undergone tremendous changes. This helps in increasing the incomes of farmers, saving the national loss of farm products along the traditional supply chain and makes a valuable contribution in terms of creating additional employment in the non-farm sector. Sound development of agribusiness provides a new frontier by creating an environment of much needed investment in agricultural marketing and trade. For improving the efficiency of the agricultural marketing system, there is a need of substantial investment in marketing infrastructure, both physical and institutional. Several initiatives have been taken during the past ten years, which have created a favourable environment for the growth of agribusiness. Keeping this in view the government has set up several agri export zones (AEZs) for agri-exports. It improves quality of services to the consumers and creates employment for the youth. It also helps in achieving international quality standards and thus boost exports, leading to increase in farmers' incomes. However some of the constraints and challenges are observed towards practicing agribusiness. In order to overcome such constraints and challenges are observed towards practicing agribusiness, some of the suggestions can be considered like by giving priority in the investment in agro business giving more focus on area expansion in cultivation , crop production and processing.

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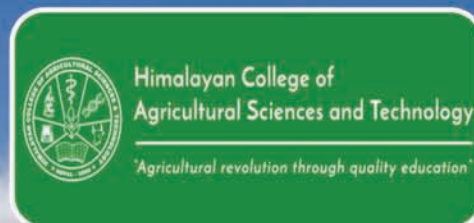


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MOLECULAR AND BIOCHEMICAL FINGERPRINTING OF CLUSTERBEAN- FINGERPRINTING WITH SPECIAL REFERENCE TO RESISTANCE AND SUSCEPTIBLE TO BACTERIAL LEAF BLIGHT OF CLUSTERBEAN**PRAHLAD***Dept. of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner, Rajasthan (334006), India*

Molecular and biochemical fingerprinting used to identification of superior genotypes are the basic objectives of any crop improvement program. The recently developed molecular markers and isoenzymes assay has opened up new visits for the assessment of fingerprinting among genotypes at molecular and biochemical level. In the present investigation, one multi loci molecular markers viz. RAPD (19 Primers), one single locus molecular markers viz. SSR (19 Primers) and three isoenzyme assay viz. PO, PPO and PAL were used to assess the fingerprinting among 12 genotypes of clusterbean, which includes six resistance and six susceptible to bacterial leaf blight genotypes. Fingerprinting analysis was done with the help of statistical analysis such as marker index, polymorphism information content, dendrogram and pi-chart. The present study clearly elucidated the RAPD, SSR and isoenzyme assay could be used as a good tool for detecting fingerprinting and can be precisely used for grouping and selection of diverse parents. From the present study like GG-2, HG-75 and HG-365 and GAUG-0522 may be utilized for breeding good genotypes with high yield and resistance to bacterial blight in clusterbean.

AN EVALUATION OF MARKET CHANNEL/SUPPLY CHAIN OF POMEGRANATE IN AHAMADNAGER DISTRICT OF MAHARASHTRA**SUJIT SUDAM MOHALKAR¹, SHAKTIKUMAR ANANDA TAYADE², RAJESH VASANTRAO SHROTE³**^{1,3} *Agriculture Economics, Comprehensive Scheme, M.P.K.V. Rahuri, Maharashtra, India.*² *Scholar Department of Horticulture, M.P.K.V. Rahuri, Maharashtra, India.*

Horticulture is better way of economic development. India stands second after china in production of fruit crops. Maharashtra stood first in production of pomegranate. Maharashtra shares 70 % production to total production of pomegranate in India. Pomegranate fruit crop produced in drought prone area of Maharashtra include Solapur, Sangali, Pune, Ahmednagar, Nashik, Dhule and some part of Osmanabad districts. In Ahmednagar districts mostly Karjat, Jamkhed, Shrigonda, Rahuri, Sangamner, Rahata and Ahmednagar tehsils were prominent in pomegranate production. Market is last and an important step in pomegranate cultivation. So market chain in pomegranate is very complicated. purpose of study market chain in Ahmednagar because centrally located district for Mumbai, Hyderabad, Solapur, and Surat market on transport and prices arriving from this market. The present study related with market chain, relation between growers rates and market chain or channel rate. For present study random sampling design methodology is apply for selection of villages, growers and data evaluation has been made on distance between growers and consumers. For good returns chain must smaller. There are certain market chain between growers and consumers i.e. pre- and post harvest contractors. Every market chain gets its own benefit hence rate of fruit is increased. It has been survey and on study seen that when growers get Rs.40/Kg rate then its selling price for consumer is Rs.100/kg. it seen that growers get Rs.45 and market chain gets Rs.60. For getting good returns for growers must have market awareness to sell is fruits in smaller chain or growers could reach directly to consumers to avoid market chain.

Keywords: market channel, supply chain, pre-harvest contractor, commission agent, wholesaler, aggregator.

SEED GERMINATION METRICS IN TEAK (TECTONA GRANDIS LF) FOR PROVENANCE EVALUATION OF DANG FORESTS WITHIN WESTERN GHATS OF INDIA**RAVINDRA KUMAR DHAKA AND SUMAN KUMAR JHA***Department of Forest Biology and Tree Improvement, College of Forestry, ACHF, Navsari Agricultural University, Navsari, Gujarat – 396 450 India*

The most valuable timber of the world called as king of timber (teak) and widely used due to its strong wood properties. It has very high demand in national and international market. It was distributed throughout India and south east Asia. Due to high demand of teak wood, farmers are taking interest for planting with agroforestry systems in Dangs region of south Gujarat of Western Ghats as well as throughout the tropical world. But lower germination and spread of drupe germination is a significant problem from a long period after a lot of research study. The present investigation was carried out in the year 2015-16 at College of Forestry, ACHF, Navsari Agricultural University, Navsari to evaluate seed germination metrics among five selected indigenous provenances. Results reveled that among all the five provenance, maximum seed germination percentage (61.75 %) was recorded in Vyara

followed by Chikhli provenance (56.75 %) and least (41.75 %) in Vandsa National Park. Day of first germination was 4-5 day after sowing (DAS) and day of last germination was 13-14 day after sowing seeds in sand tray. The time spread of seed germination was very less as compared to drupe germination. Germination rate index (GRI) was recorded maximum in Vyara provenance (7.61 %/day) followed by Chikhli provenance (7.24 %/day) and lowest (5.15 %/day) in Vandsa NP. Similarly, Germination and Peak Vales are found highest in Vyara provenance. Germination percentage was highly positively correlated with time speed of germination, germination rate index, mean daily germination, peak value and germination value and negatively associated with time of first germination. Similarly mean daily germination and germination value was highly associated with peak value. On the study basis, it is recommended that a mechanical device should be developed for breaking drupes without harm embryo of teak to enhance seed germination and reduce time spread of germination.

Keywords: King of timber, Seed, Provenance, Germination percentage, Correlation

STUDIES ON SELECTION PARAMETERS FOR YIELD IMPROVEMENT IN TUBEROSE (*POLIANTHESTUBEROSA* LINN.)

MOHIT CHAUDHARY¹, SUNIL MALIK¹, RAJENDRA SINGH² AND VIVAK UJJWAL¹

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Present investigation, SVP UA & T., Meerut on twenty-two genotypes were undertaken to examine the genetic variability, heritability, genetic advance, correlation coefficient, path coefficient analysis and genetic divergence. All twenty-two genotypes were grown in randomized block design with 3 replications with row to row and plant to plant spacing of 30 cm and 20 cm, respectively during 2015-16. Observations were recorded on various characters viz; days taken to sprouting, plant height, number of leaves per plant, length of longest leaf, width of longest leaf, number of sprouts per bulb, days required for visibility of first spike, days taken to opening of first flower, number of florets per spike, diameter of flower, number of spike per bulb, diameter of spike, length of spike, length of rachis, longevity of spike, vase life, number of bulbs per plant, number of bulblets per plant, yield of bulb per plant, diameter of bulb, yield of bulb and bulblets per plant, yield of bulb. Analysis of variance revealed substantial amount of variability among the genotypes for all the characters, under study, indicated wide spectrum of variability among the genotypes. High genotypic and phenotypic coefficient of variation was observed for number of sprouts per bulb and number of bulbs per plant and moderate was observed for number of leaves per plant, length of longest leaf, number of spikes per bulb, length of rachis, number of bulblets per plant, yield of bulb plant, yield of bulbs and bulblets per plant, yield of bulb. While, low GCV and PCV was observed for days taken to sprouting, plant height, width of longest leaf, days required for visibility of first spike, days taken to opening of first flower, numbers of florets per spike, diameter of flower, diameter of spike, length of spike, longevity of spike, vase life, diameter of bulb. High heritability coupled with high genetic advance were observed for length of longest leaf, number of bulbs per plant and number of bulblets per plant. Bulb yield exhibited significant and positive association with days taken to sprouting, plant height, length of longest leaf, width of longest leaf, days required for visibility of first spike, days taken to opening of first flower, number of florets per spike, number of spikes per bulb, number of bulbs per plant, number of bulblets per plant, yield of bulb per plant, diameter of bulb, yield of bulb and bulblets per plant at both genotypic and phenotypic level. This might be due to linkage of genes determining these characters. Thus, it can be inferred that selection based on any one of these characters either alone or in combination, will help to identifying high yielding genotypes. Genotypic correlation was of higher magnitude as compare to their corresponding phenotypic correlation in most of the character combination, thereby, suggesting strong inherent association between genotypic and phenotypic level. Path coefficient analysis showed that days taken to opening of first flower, days taken to sprouting, number of florets per spike, number of sprouts per bulb, number of spikes per bulb, length of spike, vase life, yield of bulb per plant, yield of bulb and bulblets per plant were the most important characters, controlling directly to seed yield. Whereas, days taken to sprouting via number of spikes per bulb, number of florets per spike, and number of leaves per plant characters may improve bulb yield indirectly. Mahalanobis D² statistic revealed considerable genetic diversity among the genotypes. The genotypes grouped into four clusters. The Cluster III having the maximum number of genotypes (15 genotypes). This envisage that the genotypes grouped within a particular cluster are more or less genetically similar to each other and apparent wide diversity is mainly due to the remaining genotype distributed over rest of the other cluster. In the present study, the maximum inter cluster distance was revealed between Cluster I and II (10.24). The least inter cluster distance was revealed between Cluster II and III (3.47). Divergence study suggested that crosses suggesting genotypes like Sardar local, Sikkim selection, Nirantha Extension, Pragya Culum, Arka Nirantha for getting desired segregates from breeding point of view.

BIOCATALYSTS: GREEN METHODS -IN PHARMACEUTICAL CHEMISTRY**POONAM GUPTA***Department of chemistry, M.M.H. College, Ghaziabad, U.P., India*

The enzymes are a gift of nature that is being used in biological as well as chemical processes. The ability of enzymes to make chemical processes environment friendly has made them an important tool to control pollution. Enzymes are nature's catalysts, present in every living organism to carry out a wide range of chemical reactions. Enzymes had a larger impact recently in the pharmaceutical industry. They have the ability to reduce multistep reaction to single step in a green way. Many drug substances are difficult to synthesize, requiring multiple steps, large amounts of solvents, and extensive purifications which release many hazardous chemicals also. Biocatalysts provide a green solution to all these problems. They make pharmaceutical manufacturing processes that are more atom-efficient, that reduce solvent use and waste generation, and that employ non-toxic, biodegradable catalysts instead of hazardous chemicals and cost effective. In this way biocatalysts also follow the twelve principles of green chemistry making it environment friendly. This is why even in the pharmaceutical industry; everybody is looking at the enzymatic conversion processes.

DRYING CHARACTERISTICS OF GREEN CHILLIES (*CAPSICUM ANNUM* L.)**RAVI KUMAR, VIVAK KUMAR, KAVINDRA SINGH, TARUN KUMAR***Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut- 250110*

Chilli (*Capsicum annum* L.) from family Solanaceae, is one of the universal spices and is grown in almost all states of India for domestic market and export purpose. Chilli has health benefiting alkaloid compound in them known as capsaicin which gives strong spicy pungent character. The colour of chilli is due to the presence of red pigmented carotenoids, the main being Capsanthin, Capsorubin, Zeaxanthin and Cryptoxanthin. Drying is defined as the process of moisture removal due to simultaneous heat and mass transfer. Harvesting is done when the pods are well ripened and partially withered on the plant itself. The harvested pods are kept in heaps either indoor or in shade away from direct sun light for 2 or 3 days so as to develop uniform red colour and then dried in the sun by spreading them on clean dry polythene sheets, cemented/concrete drying yards etc. Pods are spread out in thin layers for uniform drying with frequent stirring to prevent mold growth and discolouration. The initial moisture content of chillies ranged from 300-400 per cent (db) which is very high for processing and storage. Therefore reduction of moisture in chilli to a safe level of 8-9 per cent (db) becomes necessary before their processing and storage. In fresh chilli oxidation is catalysed by peroxidases. Most of the vitamins, and pigments are lost during drying. So drying has been used for decades in chemical and food processing industries for long term preservation of the final product. The chilli is very sensitive to temperature. Normally, conventional hot air drying temperature is maintained between 50-70°C.

Key words: Chillies, Drying, Moisture, Temperature.

MOLECULAR CHARACTERIZATION FOR CONSERVATION OF PLANT GENETIC RESOURCES**SHIKHA THAKUR AND PRABHAT TIWARI***Rani Lakshmi Bai Central Agricultural University, Jhansi- 284003, U.P.*

The conservation and use of plant genetic resources are essential to the continued maintenance and improvement of agricultural and forestry production and, thus, to sustainable development and poverty alleviation. Plant genetic resources comprise diversity of genetic material contained in traditional varieties, modern cultivars, crop wild relatives and other wild species. Forest genetic resources are a heritage for future generations. Increased use of forest resources to meet increasing world demand for wood and other forest products and a shrinking forest land base threaten forest sustainability and highlight the importance of conservation and sustainable management of these resources. Genetic diversity is widely recognized as the key component for long-term survival of the species. It is the foundation of sustainability because it provides raw material for adaptation, evolution, and survival of species and individuals, especially under changed environmental and disease conditions. The emphasis is now to understand the distribution and extent of genetic diversity available in forest species, so that the genetic diversity can be safely conserved and efficiently used. It is generally recognized that genetic diversity changes in time and space. The extent and distribution of genetic diversity in a species depends on its evolution and breeding system, ecological and geographical factors, past bottlenecks, and often by many human factors. Much of the large amount of diversity of a species may be found within individual populations, or partitioned among a number of different populations. A better understanding of genetic diversity and its distribution is essential for its conservation and use. It will help us in determining what to conserve as well as where to conserve, and will improve our understanding of the taxonomy and origin and evolution of plant species of interest. Conservation and protection of genetic diversity should, therefore, be a high priority in forest

management (FAO, 2014). In conserving forest genetic resources, we are concerned primarily with conserving genetic diversity within and among populations of a species. Rare species may be at increased risk of losing individuals and populations and whatever unique genes or genotypes they possess. Marginal and disjunct populations may be of special interest to conservation (Rajora et al., 2000). The principles and concepts of population genetics and conservation biology, together with molecular genetics, offer great opportunities for assisting *in situ* and *ex situ* conservation of forest genetic resources. Molecular markers can assist in assessment of genetic diversity and other population genetic parameters, evolutionary forces that shape up and maintain genetic diversity and population structure, and determination of minimum viable population size, whereas assessment based on adaptive traits provides information for conservation of forest genetic resources for specific adaptive traits. Ideally, use of a combination of molecular genetic markers and adaptive traits or molecular variation of genes controlling adaptive traits would provide more precise tools guiding genetic resource conservation. Resource conservation should be considered as complementary to efficient and effective resource use.

MOLECULAR MARKER BASED IDENTIFICATION OF RICE RESTORES AND THEIR VALIDATION IN TEST CROSS HYBRID

JYOTSNA MISHRA

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The study of hybrid rice and their evolutionary system is based on the fertility restoration system. Keeping this view of fertility restoration system of hybrid rice, the present study was carried out with the objective of molecular marker based identification of rice restorer and their performance in test cross. In this study the marker RM 6100 was used for the allele specific identification of rice restorer. 60 rice germplasm have been testing for the identification of rice restorer and out of 60 24 were found to be positive for the fertility restoration gene *Rf*. These *Rf* gene positive rice germplasm were crossed with cytoplasmic male sterile line (CMS line) and developed 24 hybrids for yield and yield components in comparison to commercial check hybrid PA6444. From these 24 test cross hybrids, the spikelet were ranged from 53.5 to 95.4 per cent with an average spikelet fertility of 74.4 per cent. The single plant yield were also calculated as 18.5 to 24.6 gm with an average single plant yield of 21.5 gm. The extent of heterosis in the test cross for yield and yield components were computed over the performance of the pollinator parents and standard heterosis over the commercial check PA6444. Out of 24 test cross hybrid 4 showed superiority of 16.8 per cent over the commercial check PA6444. However, this findings concluded that the identified rice restorer play a major role in hybrid rice production technology in respect to spikelet fertility and other major yield attributing components.

WAY OF DOUBLING FARMERS INCOME THROUGH SUSTAINABLE MEANS

A.H. KHAN

Monad University Hapur (UP)

There is the need to involve the under-employed adults in rural households in low-skilled non-crop activities that integrate output from these activities into the existing or future markets. Central to this approach is creating a market-place that supports a rural enterprise which is partly agricultural and partly non-agricultural. Thirty years ago, the shampoo market in India exploded, mainly driven by a spike in consumption due to a rupee denominated sachet, locally assembled in small units spread across rural areas in Tamil Nadu. Similarly, localising the assembling of sanitary napkins in small units set up by enterprising women in villages can create a rural-based production system that generates employment and creates basic industrial. Goat rearing, studies by various researchers point to the potential for net annual income of ₹1,200-1,300 per goat which can increase to ₹2,000 per goat through value addition to milk and leather processing. An average herd size of 10-15 goats can produce an annual income ₹12,000-19,000 per household which is also driven by the growing market for meat. The declining bee population is a cause of concern for agricultural scientists in India. Apart from helping in pollination of crops, apiaries can be a low-cost source of income for rural households. Each hive produces about 40 kg of crops have great potential for value addition. Potato production in India has ranged between 45-48 million tonnes. Prices collapse when production touches the higher end of that range. If 5-7 mt were to be absorbed for use in the mid-day meals as processed potato flake-based products, a massive new food industrial segment would emerge. Biofuel crops like *Jatropha* should be permitted for genetic modification for increased oil yields. Oil companies should help village entrepreneurs to set up collection and processing units for absorbing every kg of seed produced and the output blended with hydrocarbon fuels as done in Brazil.

Key words: Bio-fuel market, Goat rearing, Honey production, Value addition to crops

TOPOSEQUENCE EFFECT ON SOIL CHARACTERISTICS AND CLASSIFICATION IN ALMORA REGION, UTTARAKHAND**BASSEL MHALLA¹, NAYAN AHMED¹, S. K. MAHAPATRA²***1 Division of Soil Science and Agricultural Chemistry, IARI, New Delhi.**2 ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre, IARI Campus, New Delhi*

Topographic position is one of the dominant factors that govern soil development in the hilly areas. The aim of this research is to study the change in morphological, physical and chemical characteristics of soil profiles along a toposequence in Almora region. Four soil profiles representing different physiographic units vis hill top (Sitlakhet), side slope (Dhamas), foot hill (Hawalbagh) and narrow valley land (kosi) were studied. Soil samples were collected horizon wise from each profile and analyzed using the standard procedures. The soils were brown mixed with shades of yellow in colour, moderately shallow to very deep in depth. The sand, silt and clay content ranged from 10.35 to 86.02, 9.18 to 56.51 and 4.8 to 47.42% respectively. These soils were non saline, slight to strongly acidic in reaction (pH 5.09 to 6.64) and pH increased with depth, except in hill top soil profile where the pH decreased with depth (5.75 to 5.09). Cation exchange capacity was in the range of (1.6 – 15.47 Cmol(P⁺) kg⁻¹) and base saturation ranged from 45.88 to 72.29%. Soil surface horizons were characterized with medium to high organic carbon content, low to medium in available nitrogen and sulphur, medium to high in available P, low to high in available K which further decreased with depth. The soils showed varying degree of profile development from A-C to A-Bw-C. The profiles of side slope and narrow valley belonged to Entisols order under the subgroup of Typic Udipsamments, while the hill top and foot hill soils were classified as Pachic Humudepts and Dystric Eutrudepts subgroups of Inceptisols order respectively based on USDA Soil Taxonomy.

Key words: Toposequence, soil classification, soil characteristics, Almora

TO MEASURE THE AWARENESS LEVEL ABOUT FUNCTION OF KRISHI VIGYAN KENDRA AMONG STS, SCS & OBCS SOYBEAN GROWERS IN SEHORE DISTRICT OF MADHYA PRADESH**JITENDRA VERMA^{1*}, ARUN KUMAR² AND KRISHNA KUMAR RANA³***Department of Agriculture Extension Education, Dr. B.R. Ambedkar University of Social Sciences (BRAUSS), Dr. Ambedkar Nagar (Mhow), M.P., India*

This study was conducted in Sehore and Icchawar blocks of Sehore district of Madhya Pradesh to measure the awareness level about function of Krishi Vigyan Kendra among STs, SCs & OBCs Soybean Growers in Sehore district of Madhya Pradesh. The study was entirely concerned with innovative activities conducted by Krishi Vigyan Kendra, Sehore. Cumulative lists of village panchayats were prepared of STs, SCs & OBCs soybean growers who received training under KVK Sehore in Icchawar & Sehore blocks. The village panchayats having maximum number of trained soybean growers were selected from prepared list and five village panchayats in descending orders were selected from each selected block, thus a total of ten village panchayats were selected from both blocks, similarly five village panchayats were also selected from the each block that is uncovered under KVK training programme. Therefore, a total number of 20 village panchayats were selected to select soybean growers. Through probability to proportion sampling methods a total of 200 soybean growers were selected from Sehore & Icchawar block of Sehore district for the study, in which 100 soybean growers were trained and 100 soybean growers were untrained. The data reveals that (65%) of trained soybean growers had medium awareness level about function of KVK, while untrained soybean growers (60%) had low awareness level about function of KVK. The trained soybean growers have regular contact with KVK staff & attended training programme conducted by KVK about improved technology of soybean crop. Due to proper link of trained soybean growers with KVK staff & other field level personnel they have aware about function of KVK also. Therefore, the reason of low & negligible awareness level of untrained soybean growers is not connected with KVK staff and trained soybean growers.

Keywords: Soybean, Krishi Vigyan Kendra, Awareness level.

FIELD EFFICACY OF CERTAIN CHEMICALS AND NEEM PRODUCTS AGAINST SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE) ON BRINJAL (*SOLANUMMELONGENAL.*) IN TRANS YAMUNA REGION OF ALLAHABAD

KOLHEPRALHADSARJERA, ASHWANI KUMAR AND ANOORAGTAYDE

Department of Entomology, SHUATS, Allahabad

A field experiment was conducted during kharif 2016 at Central agriculture field, SHUATS (Sam Higgin bottom University of Agriculture, Technology and Sciences), Allahabad, Uttar Pradesh (India). to determine field efficacy of certain chemicals and neem products against shoot and fruit borer (*Leucinodes orbonalis* Guenee) on brinjal (*Solanum melongena* L.) in trans Yamuna region of Allahabad. The result showed that the carbosulfan 25 EC @ 0.05% was found most effective and showed (6.50%) shoot infestation, per cent fruit infestation (8.70%), followed by Quinalphos 20 EC @ 0.05% (7.96%) and (9.75%), Cypermethrin 25 EC @ 0.05 (8.02%) and (10.29%), Chlorpyrifos 20 EC @ 0.05% (8.07%) and (11.42%), Neem oil @ 2% (8.61%) and (11.62%), NSKE @ 5% (10.94%) and (12.58%) and Neem leaf extract @ 5 % (12.11%) and (16.45%) respectively.

Keywords: *Leucinodes orbonalis*, insecticides, neem products.

RESIDUAL EFFECT OF TILLAGE AND INM ON FODDER LATHYRUS AFTER GROWING DIRECT SEEDED SALI RICE

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A field experiment was conducted at Instructional-cum-Research (ICR) farm, Assam Agricultural University, Jorhat during 2016-2017. The experiment was laid out in split-plot design with three replications. The treatments consisted of three different tillage practices in main plots viz., minimum tillage, zero tillage with non-selective herbicide (Glyphosate) and conventional tillage along with sources of nutrient - recommended doses of fertilizer (RDF) 60:20:40 N:P₂O₅:K₂O kg/ha, 50% N replacement through Vermicompost + 50% RDF of N and full RDF of P₂O₅ and K₂O and 50% N replacement through Enriched compost + 50% RDF of N and full RDF of P₂O₅ and K₂O in sub plots. The results of the experiment revealed that plant height, number of branches, plant population/m², green fodder yield and dry matter yield of lathyrus were found to be non-significant but the highest results were recorded in minimum tillage and 50% N replacement through Enriched compost + 50% RDF of N and full RDF of P₂O₅ and K₂O.

Keywords: minimum tillage, zero tillage, conventional tillage, vermicompost, enriched compost

OVIPOSITIONAL PREFERENCE OF POTATO TUBER MOTH, *PHTHORIMAEAOPERCULELLA* (ZELLER) ON SOME POTATO VARIETIES AND ITS MANAGEMENT THROUGH SOME PLANT VOLATILE OILS.

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The Potato Tuber Moth, *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae) is a cosmopolitan dominant pest in sub-tropical and tropical areas and it is responsible for important losses in potato production (Das et al., 1992). The moth has high reproductive potential and is apparently developing resistance to some insecticides. It can cause damage to foliage and to tubers in the field especially high potential to destroy potatoes in storage. The principal economic damage occurs towards the end of the growing season when tubers become exposed and are infested by PTM prior to all during harvest (Lacey et al., 2007). The effect of five potato varieties on fecundity and hatchability of PTM was studied and the highest fecundity per female was recorded when larvae were fed on Kufri Kanchan (67.5 eggs) followed by Kufri Jyoti (62.5 eggs). The larvae that fed on Kufri Sindhuri showed the lowest fecundity of 43.75 eggs. The descending order of fecundity with respect to varieties was Kufri Kanchan (67.5 eggs) > Kufri Jyoti (62.5 eggs) > Kufri Himilini (53.75 eggs) > Kufri Gridhari (53.75 eggs) > Kufri Sindhuri (43.75 eggs). Kufri Jyoti proved to be highly susceptible variety which encouraged female to deposit the largest number of eggs (61.5) followed by Kufri Kanchan with an average number of 59 eggs. Kufri Gridhari and Kufri Himilini showed to be moderately susceptible with an average number of deposited eggs of 44.75 and 43.75 respectively. The least susceptible variety was Kufri Sindhuri which was significantly different from all the other tested varieties. Effectiveness of five plant volatile oils at five different concentrations and their relative toxicity were evaluated against PTM. The mortality data obtained by bioassay against PTM caused by different concentrations of plant volatile oils revealed that the larval mortality was significantly much higher in all the concentrations and the percent larval mortality decreases as the concentration of the plant volatile oil decreases. After 24 hours of treatment at high concentration of

1.0% Patchouli oil gave highest mortality of 79.99% followed by Citronella oil with 70% mortality and Lemongrass oil with 66.66% mortality. After 48 hours of treatment, the highest larval mortality was obtained in Patchouli oil with 79.99% mortality followed by Citronella oil (73.33%) and Lemongrass oil (69.99%) at the highest concentration of 1.0%. The larvae treated with Patchouli oil at the concentration of 0.8% and 1.0% and Citronella oil@ 1.0% failed to pupate whereas the pupation percentage was maximum in case of control (89.99%) showing that the plant volatile oils at higher concentration suppress the pupation success. The lowest percentage of adult emergence of 8.34% was obtained when treated with Lemongrass oil@ 0.4% concentration while the highest percentage of adult emergence (96.66%) was obtained when treated with Citronella oil @ 0.2% concentration. The LC_{50} values of Citronella oil, Lemongrass oil and Patchouli oil were 0.727%, 0.772% and 0.525% respectively after 48 hours of treatment. Patchouli oil showed the lowest LC_{50} value and proved to be the most toxic plant volatile oil followed by Citronella oil. Lemongrass oil shows the highest LC_{50} value and proved to be the least toxic to the larvae of PTM. The descending order of toxicity of the plant volatile oils with respect to LC_{50} value is as Patchouli oil (0.526%) > Citronella oil (0.727%) > Lemongrass oil (0.772%). In the present investigation, when the relative toxicity of the different plant volatile oils against the larvae were calculated considering the LC_{50} values of the least toxic plant oils i.e., Lemongrass oil as unity, Patchouli oil was 1.46 times and Citronella oil was 1.06 times more toxic than Lemongrass oil. The order of relative toxicity was Patchouli oil (1.46) > Citronella oil (1.06) > Lemongrass oil (1.00).

COMPARATIVE ANALYSIS OF CARBOHYDRATES IN ACACIA NILOTICA SEED AND SEED PARTS

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Acacia nilotica indigenously known as 'Babool' and belong to family Leguminosae. *A. nilotica* has many traditional and ethanobotanical uses. All the plant parts of *A. nilotica* are important, but seeds are rich in phytochemicals viz. protein, sugar, starch, fatty acid, oil, alkaloids, glycosides, steroids, tannins, phenolics, flavanoid and cyclitols with high nutritional value and therapeutic effects viz. anti-microbial, antifungal, anti-pyretic, analgesic, anti-inflammatory, anti-diarrhoea, anti-asthmatic, cytotoxic and anti-diabetic. Carbohydrate is an important group of phytochemical with such nutritional and medicinal properties. Thus, *A. nilotica* seeds and their parts evaluated for carbohydrates to compare the part specific potential for safer utilization to mankind. *A. nilotica* seeds along with cotyledon and endosperm were separated mechanically and powdered to 40 mesh. Powdered materials were then extracted in differential solvents viz. hexane, chloroform, acetone, ethanol and water. These extracts were used for qualitative study of carbohydrates. The quantitative estimations viz. total carbohydrate, sugar and starch were carried out in powdered materials according to the standard methods. Ethanol and water extracts of seed, cotyledon and endosperm showed the presence of carbohydrates. Quantitative estimation revealed that total carbohydrate and total sugar were high in cotyledon i.e. 17.83% and 4.73% than seed and endosperm respectively whereas total starch was less in cotyledon than seed and endosperm i.e. 2.3%. Study revealed that cotyledon has rich nutritional and medicinal carbohydrates than the seed and endosperm. Thus, it may be specifically and better utilized for carbohydrate rich supplements and for useful bioactive extracts as natural products for sustainable health benefits.

Key words: *Acacia nilotica*, Carbohydrate, Health, Medicinal, Nutritional.

DIRECT MARKETING IN AGRICULTURE

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The middlemen take the lion's share in the marketing of produce. This involvement of middlemen increases the price spread as middlemen purchase produce at a low price and sell to consumers at significantly higher prices. One of the solutions to this is Direct Marketing. Direct marketing in agriculture means markets where farmers directly transact with the produce consumers. These markets have helped in reducing exploitation of farmers and consumers by better price realisation by farmers and lower prices paid by consumers. The quick movement of produce from farmer to consumer saves losses substantially. Such markets are operating in different States in the name of Apnimandis in Punjab, Haryana, Rythu bazaars in Andhra Pradesh and Telangana, UzhavarSandhai in Tamil Nadu, Shetkari Bazaars in Maharashtra and RaithaSanthe in Karnataka. In these markets small scale farmers can sell directly to the consumers, thereby eliminating middlemen. The farmers get a bigger share in the consumer's rupee. While, consumers are more satisfied by purchasing fresh and quality produce at economical prices. However, the sales are limited to the local consumer and therefore future growth is limited. Any production that is in surplus to the absorption capacity in the market region requires proper management. Still, direct markets have helped to reduce the price spread, increase efficiency

and mitigate the problem of patchy supply chain.

Keyword: - Direct Marketing, ApniMandi, UzhavarSandhai, Rythu bazaars, RaithaSanthe.

CRITICAL LIMITS OF SULPHUR FOR GROUNDNUT (*ARACHIS HYPOGAEA* L.) IN ALLUVIAL SOILS OF EASTERN INDIA

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Sulphur (S) is very essential for growth and development of oilseed crops like groundnut. Deficiency of S is wide spread in soils of India and it is becoming a major concern for the quality and yield of groundnut crop (*ArachisHypogaea* L.). A pot experiment was conducted at Gayeshpur, BCKV farm, to investigate the response of groundnut to S application in alluvial Inceptisols of West Bengal with four levels of S i.e. 0, 15, 30 and 45 kg ha⁻¹. For this purpose collected 20 soil samples from different agro-climatic zone of different district of West Bengal. The critical limits of Sulphur in soil and plant for deficiency, adequacy and toxicity were determined from Bray percent yield (BPY). The amount of 0.15% CaCl₂ extractable S in soils varied from 11.90 to 29.17mg kg⁻¹ while the critical level for deficiency of S to groundnut was 18.6 (graphical method) or 19.58 (statistical method) mg kg⁻¹ in soils. Application of Sulphur significantly increased groundnut dry matter yield, concentration and uptake of S in plant. The critical limit was determined to be 3.0 g kg⁻¹ for groundnut plants and 4.42 g kg⁻¹ for groundnut nuts at harvest.

PROTEOMIC ANALYSIS OF RICE BRAN LIPOLYTIC ENZYME

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Rice bran obtained during milling of rice is getting commercial importance in the world due to the fact that it contains nutritionally superior oil and a number of health beneficial compounds. Rice bran contains significant amount of oil, protein, carbohydrates and other micronutrients. During milling process rapid rancidity from the activity of enzymes such as lipase and lipoxigenase deteriorate the nutritional values in rice bran and limits the wide usage of rice bran as a food ingredient. The effective utilization of rice bran is possible only by deactivating the lipolytic enzymes such as lipase, lipoxigenase responsible for the hydrolytic rancidity. Lipase are carboxyesterases acting on long chain acylglycerides and classified as serine hydrolase class due to their catalytic triad mechanism of serine protease. Ubiquitous nature and wide range of distribution across different kingdoms made lipase a worth research platform to work on. Currently lipases from microbial sources are exploited commercially. Though plant lipase is the least commercialized but still a lot of research progress has been made in the field of rice bran lipase. Hence it is a viable option of commercial exploitation. Present research work was undertaken to study the functional proteomics of rice bran lipase (RBL) in the local high yielding variety (HYV) 'Ranjit'. This investigation aims at an alternative way of characterizing and utilizing the lipolytic enzymes from the bran in various process which is otherwise a waste during the stabilization process. Proximate analysis showed 10.11% moisture, 5.26% reducing sugar, 36.44% carbohydrate, 16.13% crude protein, 7.18% fibre, 8.47% ash content. The crude protein extract from the defatted bran was obtained. The total soluble protein in the above extract was determined by and found to be 90µg/ml. Partial Purification by ammonium sulphate precipitation was done and the RBL specific activity was analysed by titrimetric method using tributyrin as substrate which was found to be 444 U/mg protein. SDS-PAGE analysis of the crude enzyme showed four possible major bands whose lipolytic activity was accessed by in-gel assay using 4-methylumbelliferyl butyrate as a fluorescent substrate. This study opens up a possibility of utilization of lipases commercially replacing microbial source which is otherwise produced by a complex process.

Key words: Bran, Lipase, Serine hydrolase, RBL, HYV- Ranjit, Functional Proteomics.

ESTABLISH OF FODDER BANKS FOR DEFICIT FODDER IN RAINFED CONDITION**DEVENDRA KUMAR MEENA¹ AND SONIKA SHARMA²**¹College of Agriculture, Bharatpur, ²College of Agriculture, Udaipur

To bridge the gap between fodder demand and supply, intensive production system with improved inputs is desirable. Male population from rural areas in India is migrating to cities for their livelihood leaving their family behind. This advocates proper training and policy support to women for maximization of quality fodder production and employment generation at household level. Milk production and productivity depend on the quality and quantity of fodder. Feed & fodder constitute about 60-70 per cent cost of milk production. Fodder has an important role in meeting requirement of various nutrients to dairy animals for producing milk more economically as compared to concentrates. Fodder production and its utilization depend on the cropping pattern, climate, socio-economic conditions, available sources and the type of animals. Fodder crisis in the arid region has been debated long back however, gap is widening between increasing demand and decreasing area under fodder. The government agencies, NGOs and community organizations should work to create awareness about the improved fodder production & preservation practices through appropriate extension tools and techniques by using the suggested strategy based on findings of the study.

CONSERVATION AGRICULTURE**AVINASH KUMAR GAUTAM***ICAR-Central Institute of Agricultural Engineering, Nabi-bagh, Bhopal – 462038*

Conservation Agriculture is a system of integrated management of soil, water and biological resources combined with external inputs. It is based on agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while conserving the environment with resource saving. Interventions such as mechanical soil tillage are reduced to an absolute minimum and the use of external inputs such as agrochemicals and nutrients of mineral or organic origin are applied at an optimum level and in a way and quantity that does not interfere with, or, disrupt, the biological process. Conservation tillage as compared to conventional practices, showed better performance in terms of increased benefit cost ratio (2.17 –2.47) and water operational energy (5.1 – 26.1%). Zero tillage, improves the soil drainage with draught checks-worm channels-old root systems and soil pores all inking together to help to remove rain water quickly, and therefore, avoiding the sponge effect created by normal cultivation. The effect of direct seeding/planting has been found to be advantageous in terms of improved traffic ability, decreased soil compaction in long run and reduced soil erosion due to wind and water. It also leads to decreased water evaporation and increased availability water in to the soil and decreased lodging.

INFLUENCE OF RESOURCE CONSERVATION TECHNIQUES ON ORGANIC CARBON AND PHYSICO-CHEMICAL PROPERTIES OF SOIL**SHAUKAT ALI, A.M. PATEL and B.L. KUMHAR***Department of Agronomy, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat 385 506*

The field experiment was conducted on loamy sand soils at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar (Gujarat) during the years 2012-13 and 2013-14 to study influence of resource conservation techniques on organic carbon and physico-chemical properties of soil. The soil of the experimental plot was low in organic carbon (0.20 %) and available nitrogen, medium in available phosphorus and potash with particle density of 2.784 g/cc and bulk density of 1.639 g/cc. The experiment was laid out in split plot design along with three replications. Sixteen treatment combinations comprising of four cropping system treatments viz, C₁ : Cotton- Summer Pearl millet, C₂ : Greengram + Kharif Castor (Relay), C₃ : Greengram - Mustard - Summer Pearl millet and C₄ : Greengram - Rabi Castor and two residue incorporation treatments viz, R₀ : No residue incorporation and R₁ : Residue incorporation as well as two fertilizer doses viz, F₁ : 100 % RDN through inorganic fertilizer and F₂ : 75 % RDN through inorganic fertilizer + 25 % RDN through FYM were evaluated in the study. Cotton - summer pearl millet cropping system recorded significantly the highest organic carbon and porosity at end of crop sequence. EC, pH, particle density and bulk density were found to be non significant among the different cropping system treatments. Residue incorporation secured top position by recording significantly the highest organic carbon and porosity as well as the lowest bulk density at the end of the cropping sequence. In the case of EC and pH as well as particle density, residue incorporation treatment did not excrete any significant effect. The application of 75 % RDN through inorganic fertilizer + 25 % RDN through FYM was found significantly superior by recording the highest organic carbon and porosity as well as the lowest

bulk density at the end of the cropping sequence. In the case of EC, pH and particle density, fertilizer treatments were found to be non-significant.

BIOINFORMATICS: USES IN AGRICULTURE

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Bioinformatics is a new field of science but it is making progress in every field of biotechnology very rapidly. Bioinformatics is an interdisciplinary field mainly involving molecular biology and genetics, computer science, mathematics and statistics. The field of agriculture has also taken advantage of this field because microorganisms play an important role in agriculture and bioinformatics provide full genomics information of these organisms. The genome sequencing of the plant and animals has also provided benefits to agriculture. There are species of food plants, the genome of which has been mapped completely for example *Arabidopsis thaliana* and *Oryza sativa*. *Arabidopsis* is a small plant belonging to brassica family and researchers took interest in its genome because of its smaller genomic size and studied the plant developmental processes. Its genome consists of 5 chromosomes on which ~125 Mbp DNA is distributed. It reproduces in 5 weeks and makes new generation. These findings suggest that information obtained from the model crop systems can be used to suggest improvement to other food crops. Recently, success in transferring genes into rice to increase levels of vitamin A, iron and other micronutrients. Progress has been made in developing cereal varieties that have a greater tolerance for soil alkalinity, free aluminium and iron toxicities. These varieties will allow agriculture to succeed in poorer soil areas thus, adding more land to the global production base. Research is also in progress to produce crop varieties capable of tolerating reduced water conditions. Bioinformatics is used to improve the efficiency and well-being of farm animals and the quality of their useful products for the wide range of human needs by using genetics, genomic and molecular tools.

Keywords: Bioinformatics, Agriculture

USE OF CROP MODELING FOR GROWTH ANALYSIS

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Plant or crop models, that use systems approach to simulate the interaction between crops and environment, is an important tool to assimilate knowledge gained from field experiments, to promote the understanding of biological system behaviors and underlying eco-physiological functions, and to supply mathematical analysis for solving agriculture and biological problems. Plant growth models aim at describing the interaction between the growth of plants and their environment. Ideally, model parameters are designed to be stable for a wide range of environmental conditions, and thus to allow characterizing genotypes. They offer new tools to analyze the genotype × environment interaction and they open new perspectives in the process of genetic improvement. The model is extremely simple in its physiological components, and therefore at present mainly suited to perform conceptual studies, but has the potential of becoming a fully quantitative tool. Although calibrated by optimization to reconstruct observed, prototypic plants, the model is able to simulate some of the plant's phenotypic plasticity resulting from competition among sinks for resources. This, as well as the dynamic simulation of complex morphogenetic processes using the principle of sub-structures, constitutes important innovations in plant architectural modelling.

GENETIC VARIABILITY OF CHICKPEA (*CICER ARIETINUM* L.) GENOTYPES AGAINST *PRATYLENCHUSTHORNEI* AND *RHIZOCTONIA BATATICOLA*

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Root Lesion Nematode (RLN; *Pratylenchus thornei* Sher and Allen) is a threat to chickpea production, either alone or in presence of *Rhizoctonia bataticola*. The effects of inoculation of 22 chickpea genotypes with *P. thornei* alone or with joint inoculation with *R. bataticola* were investigated in a pot experiment. Culture of *P. thornei* was developed under aseptic conditions on chickpea (JG 62). The populations developed on roots were inoculated @ 1000 *P. thornei*/genotype with four treatments: Nematode alone, Nematode + DRR fungus, DRR alone and untreated. Treatments were replicated five times. Observations were recorded after 40

days of inoculation from soil and roots of each treatment. During the course of investigation, the extents of damages developed by RLN and DRR individually as well as their combinations were recorded. The study revealed, above the four times rate of reproduction due to *P. thornei* was noticed in JG 62 over the ICCV2 and JG11, suggested that JG 62 is more vulnerable to RLN as well as DRR, while the ICCV 2 and JG11 showed resistance.

Key words: RLN, DRR, Plant height, shoot weight and root weight

DETERIORATING RESOURCE BASE: AN EMERGING ISSUE FROM THE PRESENT TECHNOLOGY

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During post-green revolution period, our endeavor to augment food problem and attain self sufficiency in food production through large inputs of agrochemicals, inevitable dependence on irrigation and high cropping intensity has led to contamination of food with harmful chemicals, pollution of ground water, eutrophication of surface water, degradation of soil quality, damage to agriculturally beneficial microorganism and deterioration of air quality. There is increasing damage to the system ecology, such as forests, biodiversity and the atmosphere and there are distinct possibilities for adverse changes in climate and sea level. In many regions, both surface and groundwater are already becoming unfit for human and animal consumption due to high concentration of NO₃-N and pesticide residues. Several pesticides have entered into the food chain and have severely endangered human/animal health. Indiscriminate exploitation of agricultural and forest ecosystems disturbs the ecological balance, disrupts the carbon-cycle, depletes soil and biotic pools and lead to emission of C (CO₂ and CH₄) and N (N₂O and other oxides of N) into the atmosphere. These gases (CO₂, CH₄, N₂O) being relatively active (greenhouse gases) can influence the global climate. Intensified agriculture, coupled with indiscriminate use of irrigation water and non-judicious fertilizer application, especially in irrigated areas of the country has led to various kinds of physical and chemical degradation of the soil. Over exploitation, climate change related problems and industrial growth are leading to deterioration of irrigation water quality and quantity.

Keywords: eutrophication, pollution, fertilizer, climate change

ECONOMICAL POTENTIAL OF PARTHENOCARPC CUCUMBER VARIETIES UNDER PROTECTED CULTIVATION

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The protected cultivation can be a key for sustainable crop production and to achieve food security in the regions facing the problems of food scarcity. The field experiment was conducted at college of agriculture, Mandor Agriculture University Jodhpur to study the response of parthenocarpic cucumber varieties under insect net proof house condition. Biometric characteristics viz., days to flower appearance, average diameter of fruit, average length of fruit, average weight of fruit, length of vine at last harvest, number of fruits per vine and yield of fruit were observed throughout the growth period. The result was reported insect proof net house conditions have potential for better performance and higher fruit yield with quality fruits for year round production of parthenocarpic cucumber in water scarce and harsh climatic conditions of western Rajasthan. This is helpful for increasing the socio-economic status of small farmers through high profitability.

ASSESSMENT OF GENETIC DIVERSITY CRITICALLY ENDANGERED SPICES *COMMIPHORA WIGHTII* USING RAPD MARKERS

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Guggal (*Commiphora wightii*) is a pharmacologically, economically and ecologically important species. It is found in wild form in western India and eastern Himalayas and grow abundantly in Karnataka, Gujarat and Rajasthan. The guggulosterones present in the guggul gum of *C. wightii* plants have antioxidant activity as well as Guggulipids from the resin is effective as anti-inflammatory, anti-bacterial, antimicrobial, anti-oxidant, anti-arthritis, anti-malarial, antimycobacterial, anti-schistosomal, hepatoprotective, muscle relaxant, larvicidal, and molluscicidal. The objective of present study to evaluate the genetic variability between the samples collected from different locations of India. Randomly amplified polymorphic DNA (RAPD) analysis was

conducted to find genetic relationship among 21 *Commiphorawightii* accessions collected from Rajasthan, Madhya Pradesh, and Gujarat. Seven RAPD markers showed clear banding patterns and resolution in the accessions of *C. wightii*. These 7 RAPD markers produced 30 amplified loci ranging between 250 to 2000 bp. Twenty eight loci (93.33%) were found polymorphic in 21 accessions and the average percentage of polymorphic loci was 4%. Cluster analysis was performed based on Jaccard's similarity coefficient matrices and a dendrogram was generated. Based on phylogenetic analysis, 21 accessions of *C. wightii* were grouped into two major clusters with two sub-groups (A and B) having 10 and 11 accessions respectively. The cluster A contains 10 accessions namely CW-1 to CW-8 collected from Jodhpur, Rajasthan and accessions CW-9 and CW-10 from Anand, Gujarat. The cluster B contains 11 accessions CW-11 to CW-17 from Gujarat and CW-18 to CW-21 collected from Murena, Madhya Pradesh. Present study concluded that there is a significant diversity between collected samples revealed using RAPD primers and the information derived in this study will certainly help in improvement of guggal for commercial utilization.

Key words: RAPD; Molecular marker; Dendrogram; *Commiphorawightii*; Genetic diversity;

NUTRITIONAL QUALITY OF CAPEGOOSEBERRY

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Capegooseberry (*Physalis Peruviana*) belongs to solanaceae family includes annual and perennials herb bearing globular fruit. It is also known as Poha berry in Hawaii, Goldenberry in South America and Husk berry, Peruviana ground cherry, *Mokai* in India. Capegooseberry fruit contains 11.5% carbohydrate, 1.8% protein, 0.2% fat, 3.2% fiber, 0.6% mineral matter and 49mg ascorbic acid per 100g edible portion of fruit. Carotene is also present as a Vitamin-A 2380IU. Capegooseberry is highly valued for its unique flavor, texture and color. Food industry is using gooseberry in different products including beverage, syrup, sauce, chutneys, ice cream and jam. The fruit has excellent medicinal properties which include those of antiasthmatic, dermatological, diuretic, antiseptic, rheumatism, anti-ulcer and agent strengthener of the optic nerve. The fat-soluble bioactive compounds, phytosterols present in the fruit act as an effective agent in reducing cholesterol levels, treating throat infections and eliminating intestinal parasites and amoebas and albumin from the kidneys. The high unsaturated fatty acid composition makes capegooseberry species fruit for nutritional application. Capegooseberry pulp, seed and pomace oil might serve as excellent dietary sources of vitamin K, linoleic acid, essential fatty acid tocopherols and carotenoids. This will be important as an indication of the potential nutraceutical and economical utility of capegooseberry as a new source of bioactive photochemical and functional foods.

Key word- Capegooseberry,

HABITAT MANAGEMENT IN ORGANIC FARMING FOR SUSTAINING NATURAL RESOURCES- A REVIEW

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Most of the agroecosystems are unfavorable for our natural enemies due to high levels of disturbance in the environment. Habitat management is the medium or ecologically based approach for conserving biological control and aimed at favoring natural enemies and enhancing biological control in agricultural systems. To provide/ create a suitable ecological infrastructure within the agricultural landscape such as food for adult natural enemies, alternative prey or hosts and shelter from adverse conditions. These resources must be integrated into the landscape in a way that is spatially and temporally favorable. The rapidly expanding literature on habitat management is reviewed with attention to practices for favoring predators and parasitoids, implementation of habitat management, and the contributions of modeling and ecological theory to this developing area of conservation biological control.

Keywords: Habitat management, landscape, predators, parasitoids, conservation

DOUBLING OF FARMER'S INCOME BY FARMING SYSTEM APPROACH FOR FOOD SECURITY & BOOSTING RURAL ECONOMY

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The majority of people (more than 60 per cent of the entire population) of India have a traditional mode of agriculture which is the major source of their income. The growth of population is increasing at an alarming rate and does not match with the agriculture production. Catering the needs of the farmers the NITI Aayog of India has developed an idea to double the farmer's income. The National

Round Table on “Doubling Farmer’s Incomes by 2022” was organized by Indian Council of Food and Agriculture on 30 April 2016 in New Delhi, involving top experts from the Government, industry, research and academic bodies, farmers organizations, parliamentarians and NGOs. For doubling of the farmer's income some strong strategies need to be adopted looking into the basic requirement of the farmers. These strategies might be massive investments in agricultural research and development, adaption of Good Agricultural Practices (GAP), conservation agriculture technology, as well as implementation of making farmers friendly policies along with the precise use of all the resources as well as inputs, irrigation, fertilizers, market facility, MSP reform, supported by adequate and timely availability of bank credit etc. It has been reported that MSP will raise farmer income by 13-26 per cent. India is also the world's largest and fastest growing market for milk and milk products. On an average, livestock contributes about 12 per cent of farmers' income in India. Smart farming and credit supporting smart farming are one of another possible strategy for double farmers' income. Diversification can be a major game changer. When we talk about diversification it is mostly about high value crops. Food security means availability, accessibility and affordability of food to all people at all times. Let us hope for doubling of farmers' income with this much of efforts, we will achieve the target. Climate change is likely to increase damages from extreme weather events by \$140 billion in 2003–13. The impact of climate change is also likely to worsen water scarcity for the 1.6 billion people around the world already living in water stress. According to the latest Lancet report, in 2007–16, 306 disasters were recorded on an average out of which over 90 per cent were associated with weather-related events in the last 20 years. Asia was the most affected. India, like other developing countries, is suffering the brunt of climate change. According to 2017 German Watch report, India is ranked as the fourth most vulnerable country. The Economic Survey 2017–18 reveals that on an average annual rainfall in India has declined by about 86 mm in the last three decades. While kharif rainfall has declined on an average by 26 mm, the decline in rabi rainfall has been by 33 mm. There has also been a 12.8 per cent decline in kharif yields and 6.7 per cent in rabi yields due to extreme rainfall shocks. According to the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, climate change in India has about 4–9 per cent impact on agriculture each year, which results in a loss of about 1.5 per cent in the gross domestic product (GDP) annually. The World Bank reports that by 2030, rice and wheat are likely to see a drop of about 6–10 per cent in yield. Developing countries have a limited capacity to deal with the impacts of climate change and are hence more vulnerable. For instance, according to the estimates stated in climate action plan or the Nationally Determined Contributions (NDC), India will require a whopping \$2.5 trillion to deal with the impacts of climate change by 2030. Madhya Pradesh is the second largest state in India with an area of 308,245 km², constituting 9.38% of the geographical area of the country. It lies between 21°17' and 26°52' N Latitude and 74°08' and 82°49' E Longitude. Physiographically, the State can be divided into four regions: the low-lying areas in the north and north-west of Gwalior, Malwa Plateau, and the Satpura and Vindhyan ranges. The rivers Chambal, Betwa, Sone and Narmada are the State's four most important rivers. Rainfall decreases from south-east and east to north-west and west. The average annual rainfall varies from 800 mm to 1,800 mm and annual temperature ranges from 22.5°C to 25°C (FSI, 2009).

WEED MANAGEMENT IN BLACKGRAM

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Black gram [*Vigna mungo* L.] is one of the most important pulse crops of India, it belongs to family Leguminosae. India is the largest producer and consumer of black gram in the world. It is rich in protein, which contains about 26 per cent protein, and supplies a major share of protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse, which is an essential protein supplement of cereal based diet. The combination of pulse-rice or dal-roti is an important ingredient in the average Indian diet. The biological value improves greatly, when wheat or rice is combined with it because of the complementary relationship of the essential amino acids such as arginine, leucine, lysine, isoleucine and valine etc. Uncontrolled Weeds at critical period of crop-weed competition caused a reduction of 80-90 per cent in Blackgram yield depending upon type and intensity of weed infestation (Kumar *et al.*, 2001). To control weed the traditional method of weed control i.e. hand weeding although effective but it is expensive, tedious and time consuming (Yadav *et al.*, 2009). Moreover, hand weeding and mechanical weeding are difficult due to continuous rainfall and less availability of labours at the critical stage of crop-weed competition. Use of herbicide not only improve crop yield but also makes available significant labour for other productive activities (Kurchania *et al.*, 2001).

IMPORTANCE OF VERMICOMPOST IN IMPROVE OF SOIL FERTILITY**DEEN DAYAL BAIRWA***Department of Agronomy, RCA, MPUAT, Udaipur (Raj.)- 313001*

Application of chemical fertilizers reduces land productivity and crops become dependent on inputs of the chemical fertilizers. Land, need to be prevented from degradations. Soil fertility can be improved and maintained initially through use of organic inputs like well decomposed organic manure/Vermicompost. Vermicompost could be used as an excellent soil amendment for main fields. Waste generated from the city consists of biodegradable organics can be converted into valuable bio-compost by applying vermicomposting technology. Vermicomposting is the most important environment and eco-friendly technique which are primarily used to produce organic fertilizer from different kind wastes. Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better product. Vermicompost is the excreta of earthworm, which are capable of improving soil health and nutrient status. Vermiculture is a process by which all types of biodegradable wastes such as farm wastes, kitchen wastes, market wastes, bio-wastes of agro based industries, livestock wastes etc. are converted while passing through the worm-gut to nutrient rich vermicompost. Vermicompost not only adds microbial organisms and nutrients that have long lasting residual effects, it also modulates structure to the existing soil, increases water retention capacity. Vermicompost may also have significant effects on the soil physical properties. Vermicompost play an active role in improving the soil fertility (Soil character like pH, OC, N, P, K). Vermicompost has a direct physiological effect on plants; it stimulates the development of root systems and reduces the harmful effects of pollutants.

Key words: Vermicompost, Soil health and Soil fertility

EFFECT OF MICROBIAL CONSORTIA AS BASAL APPLICATION AND FOLIAR SPRAY OF *GLUCONACETO BACTERDIAZOTROPICUS* ON MAIZE (*ZEAMAIZE*)**GARIMA PADWAR* AND TIKAM CHAND YADAV***Department of Soil Science and Agricultural Chemistry, Jawaharlal Nehru Krishi Vishwa vidhyalya, Jabalpur (M.P.) India*

The experiment on “Effect of microbial consortia as basal application and foliar spray of *G. diazotrophicus* on maize (*Zea maize*)” was carried out during Kharif 2018 in the experimental field under Department of Soil Science & Agricultural Chemistry. The experiment was laid out under randomized block design (RBD) with 3 replications having 18 treatments of microbial consortia of *Arthrobacter* sp., phosphate solubilizing bacteria (*Bacillus* sp.) and potash solubilizing bacteria (*Fraturiaaurantia*) as seed treatment and additionally, *Gluconacetobacterdiazotrophicus* was applied as foliar application at 25, 45 and 65 DAS of the crop growth stages. The seeds of maize (cv. JM 216, duration 110 days, seed rate 20 kg/ha) were sown in the prescribed plots (size 3m x 2m) on 28.06.2018 providing 60 and 20 cm (rrx and ppx) spacing. The crop was supplemented with recommended dose of fertilizers 120:60:40 (N:P₂O₅:K₂O kg/ha) at basal application. Besides these, two types of control plots were maintained as fertilized uninoculated control (FUI) and unfertilized uninoculated control (UFUI). Plant growth attributes were determined through measurements of plant height and biomass, leaf chlorophyll content at 35, 55 and 75 DAS; yields and nutrient contents (NPK) in grain and stover were recorded at harvest of the crop. Microbial populations (*G. diazotrophicus*, *Bacillus* sp. and *Fraturiaaurantia*), cellulase enzyme activity as a measure of endophytic nature of the microbes, and available nutrient contents (NPK) in soil at harvest (03.10.2017) were estimated. The rhizospheric population of *Arthrobacter* could not be estimated due to some insurmountable problems. The data recorded were statistically analyzed to test the significance of variance among different treatment means. Regarding findings towards study of growth, yield and nutrient uptake by maize, the treatment combinations of F+*G. diazotrophicus*+*Arthro*+PSB+KSB increased plant height by 75.5, 42.8 and 26.7%, plant biomass (fresh and dry) by 87.3, 26.3 and 36.6%, and 8.72, 41.9 and 28.1%, respectively and leaf chlorophyll content by 49.6, 48.5 and 16.6% at 35, 55 and 75 DAS. The same treatment combination yielded maximum grain and stover at harvest by 33.4 and 77.9%, respectively over the control (2146 and 6029 kg ha⁻¹) with major nutrient contents by 17.5, 14.7 and 18.9% more in N, P and K, respectively. With respect to study the microbial population, cellulase enzyme activity and available major nutrient in soil at harvest, the treatment combination of F+*G. diazotrophicus*+*Arthro*+ PSB + KSB increased microbial population in the rhizospheric soil by 1.74, 1.84 and 1.86 log fold for *G. diazotrophicus*, PSB (*Bacillus* sp.) and KSB (*Fraturiaaurantia*), respectively and the cellulase enzyme activity by 46.9%. Available major nutrients in soil at harvest of the crop were also increased with the same treatment combination by 21.31, 21.31 and 60.6% of N, P and K, respectively. The best performing treatment was consistently followed by the treatment combination of F+*Arthro*+PSB+KSB for all the parameters. Co-inoculation of bio-inoculants of *G. diazotrophicus*, *Arthrobacter*, PSB (*Bacillus* sp.) and KSB (*Fraturiaaurantia*) as seed treatment and foliar application on maize (*Zea maize*) augmented growth, nutrient uptake,

yield, microbial population, cellulase enzyme activity and available major nutrient in soil at harvest. These were all the positive influence of *G. diazotrophicus* and *Arthrobacter* when crop was supplemented with sufficient available nutrient particularly phosphorus with PSB, as the soil was moderately deficient of phosphorus. However, response of KSB was not evident since the soil was sufficient with potash

Key words: growth, yield, soil properties, microbial population count, cellulase enzyme activity.

SUSTAINABLE LAND USE MANAGEMENT USING GEOSPATIAL TECHNOLOGY WITH THE INTEGRATION OF RUSLE

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Soil erosion is one in all the key world environmental issues inflicting negative impacts on agriculture, water quality, environment, soil degradation and hydrological systems. It is a complex process that depends on soil properties, land use/land cover (LU/LC), climate, topography, rainfall amount and intensity. In India, Soil erosion encompasses a major result on the atmosphere, agricultural sector, reservoirs siltation, soil degradation etc. Almost one hundred thirty million hectares of land (i.e. forty fifth of the whole geographical surface area) is suffering from serious erosion through the gorge and valley, shifting cultivation, cultivated wastelands, sandy areas, deserts and water work (Kothyari, 1996). Erosion is triggered by a combination of factors like slopes, climate (long dry periods followed by serious rainfall) and inappropriate LU/LC patterns (Renschler et al., 1999). Moreover, some intrinsic options of a soil will build it additional vulnerable to erosion. Numerous erosion models exist with completely different degrees of complexity. Among them, one amongst the foremost wide used empirical models for estimation of the sheet and rill erosion is that the Universal Soil Loss Equation (USLE) (Wischmeier and Smith in 1965). Initially, USLE was developed primarily for erosion estimation in crop land and gently sloping topography however later its revised (RUSLE) and modified (MUSLE) versions (Wischmeier and Smith, 1978; Remort Van et al., 2001; Lee and Lee, 2006), were developed that is wide employed in an outsized range of studies in soil loss estimation. The integration of those erosion models with field and remote sensing (RS) information by using Geographic Information Systems (GIS) is seem to be a plus for more studies (Fernandez et al., 2003; Gitas et al., 2009; Xu et al., 2009).

PERFORMANCE OF MAKHANGRASS UNDER DIFFERENT SOWING WINDOWS AND NITROGEN LEVELS

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A field experiment was conducted during two consecutive years from rabi 2016-17 and 2017-18 at Agricultural Research Station, Ummedganj Farm, Kota (Rajasthan), entitled "Performance of makhangrass (*Lolium multiflorum*) under different sowing windows and nitrogen levels". The maximum green (1184 q/ha), net return (Rs. 1,50,600/ ha) and B:C ratio (5.58) of makhangrass were recorded with the sowing on 05th November in the pooled analysis over sowing of makhangrass on 15th and 25th November, respectively. The application of 150% RDN gave higher green fodder yield (1094 q/ha) and net return (Rs. 1,28,900/ ha) over application of 100% RDN and 125% RDN, respectively. However, it was found at par with the application of 200% RDN in the pooled analysis.

Key words: Makhangrass, nitrogen levels and sowing windows

TO STUDY THE RESPONSE OF BIO REGULATORS ON YIELD ATTRIBUTES AND YIELD OF HYBRID RICE.

NIRMAL KUMAR*, DEEPAK KUMAR RAWAT AND BALWAN SINGH

CSAUAT, Kanpur U.P.

The growth regulators have not only provided a useful tool to agriculturists for modifying plant growth as well, but have also been helpful in overcoming practical agricultural problem in areas, where genetic or other manipulation have not been possible.

Key word- growth regulators, agricultural genetic and etc.

THE IMPACT OF ORGANIC MANURES AND MOISTURE CONSERVATION PRACTICES ON GROWTH AND DEVELOPMENT OF SHOOT AND ROOT OF ASHWAGANDHA**MAYANK KUMAR^{1*}, MAHENDRU KUMAR GAUTAM² AND KAUSAL KUMAR³**^{1,3}Department of Soil Conservation & Water Management /Forestry, Chandra Sekhar Azad University of Agriculture & Technology, Kanpur and ²IAS, BHU, Varanasi India.

The application of an integrated plant nutrient supply system is becoming popular as it is scientifically sound and assures sustainable development in agriculture. The use of judicious combination of organic and inorganic fertilizer source is essential not only to maintain soil health but also sustain productivity (Malewar et al., 1998). The importance of organic manures to enhance the quantity and quality components has to be further studied in Ashwagandha with decrease rates in applied quantities of inorganic manures which seems to reduce the cost of production to maximize the yield upto optimum levels to that of synthetic fertilizers

DIAGNOSIS AND RECOMMENDATION INTEGRATED SYSTEM (DRIS) AND APPLIED IN FRUIT CROPS**MAHENDRU KUMAR GAUTAM*, MUKESH KUMAR NAYAK¹, SATYANARAYAN REGAR² AND VAIRAGYA NARAYAN³***IAS, BHU, Varanasi, (U.P.), ¹CCSHAU, Hisar (Haryana), ²SKRAU- Bikaner (Raj.) and ³Bundelkhand University, Jhanshi (U.P.)

Plant nutrient analysis considered very promising tools to assess the nutrients analysis for requirements of plants and soil and its also crop costing and environmental eco-friendly Horticulture. Importance of nutrient balance in determining yield and quality of crops is well established but there was no means to quantify it until the introduction of the Diagnosis and Recommendation Integrated System (DRIS) in which leaf analysis values are interpreted on the basis of inter-relationship among nutrients, rather than nutrient concentration themselves. The DRIS is based on the comparison of crop nutrient ratios with optimum values from a high yielding group (DRIS norms). The DRIS provides a means of simultaneously identifying imbalances, deficiencies and excesses in crop nutrients and ranking them in order of importance. Modified DRIS diagnoses of the N, P, K and S status of swards were compared with those made using the critical value approach. The major significance of this approach lies in its ability to minimize the effect of tissue age on diagnosis, thus enabling one to sample over a wider range of tissue age than permissible under the conventional critical value approach. Several researchers affirm that once DRIS norms based on foliar composition has been developed for a given crop; they are universal and applicable to that particular crop grown at any place and at any stage of its development. A DRIS model for perennial ryegrass, based on data collected from a glasshouse experiment, was used to diagnose the nutrient sufficiency status of perennial ryegrass swards growing in field situations. Initially, DRIS overestimated the N and P status of these swards and underestimated their S status.

Key word- DRIS, Nutrients Status, fruit crop, yield etc.**PRECISION AGRICULTURE****SATYANARAYAN REGAR¹, MAHENDRU KUMAR GAUTAM² AND MUKESH KUMAR NAYAK³**

SKRAU- Bikaner (Raj.), IAS, BHU, Varanasi, (U.P.) and CCSHAU, Hisar (Haryana)

Precision Agriculture (PA) can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other conditions. PA substitutes information and knowledge for physical inputs. Other benefits include a reduction in pesticide resistance development. One limitation of the papers reviewed is that only a few actually measured directly environmental indices, such as leaching with the use of soil sensors. Most of them estimated indirectly the environmental benefits by measuring the reduced chemical loading. Results from an on-farm trial in Argentina provide an example of how site-specific information and variable rate application could be used in maintaining profitability while reducing N applications. Results of the sensitivity analysis show that PA is a modestly more profitable alternative than whole field management, for a wide range of restrictions on N application levels. These restrictions might be government regulations or the landowner's understanding of environmental stewardship.

Key word- Precision Agriculture, environmental,

SUSTAINABLE AGRICULTURE**UDAYPRATAP SINGH* AND MAHENDRU KUMAR GAUTAM**

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Challenge: people most affected by increasing hunger are smallholder subsistence farmers on marginal soils in developing countries, lack access to inputs and product markets, as well as financial resources to buy costly chemical fertilizer and other agrochemicals that might enhance the productivity of their land. So although conventional agriculture has had significant achievements. An agriculture able to continually provide food and other resources to a growing world population is of crucial importance for human existence and hence for any human activity. However, there are a great number of problems that threaten this ability of agriculture to fulfill human needs now and in the future, including climate change; a high rate of biodiversity loss; land degradation through soil erosion, compaction, salinization and pollution; depletion and pollution of water resources; rising production costs; an ever decreasing number of farms and, linked with that, poverty and a decrease of the rural population.

Key word- water resources, chemical fertilizer, product markets and etc.

EFFECT OF MOISTURE CONSERVATION PRACTICES AND ZINC FERTILIZATION ON GROWTH, YIELD AND QUALITY OF PEARL MILLET [*Pennisetum glaucum*(L.) R. BR. EMEND STUNTZ]**SAROJKUMARI YADAV AND VIJAY LAXMIYADAV**

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An agronomic investigation on Effect of moisture conservation practices and zinc fertilization growth, yield and quality of pearl millet [*Pennisetum glaucum*(L.) R. Br. emend Stuntz])” was carried out at Agricultural Research Station, Jobner, Jaipur during kharif season of 2017. The experiment comprising of twenty treatment combinations consisting of 5 moisture conservation practices (control, dust mulch, stover mulch, pusa hydrogel, pusa hydrogel + stover mulch) and 4 zinc fertilization levels (control, 2 kg/ha, 4 kg/ha, 6 kg/ha) were tested in randomized block design with three replications. Results showed that the moisture conservation practices and zinc fertilization brought considerable improvement in growth, yield and quality of pearl millet. Among moisture conservation practices stover mulch proved significantly superior to control, dust mulch, pusa hydrogel with respect to growth attributes (plant height, dry matter accumulation, total number of tillers) and remained at par with pusa hydrogel + stover mulch. The yield attributes (number of effective tillers/plant, number of grains/ear and length of ear), and grain yield (2513), stover yield (5765) and biological yields (8276) were also significantly higher under the treatment stover mulch over control, dust mulch, pusa hydrogel but remained at par with pusa hydrogel + stover mulch. The stover mulch recorded significantly higher N, P, K and Zn concentration and uptake than control, dust mulch, and pusa hydrogel. Significantly higher net returns (₹ 35352/ha) and B:C ratio (1.80) were achieved under treatment stover mulch over rest of the treatments. Results further indicated that plant height, dry matter accumulation, total number of tillers per plant, effective tillers per plant, ear length, number of grains per ear, test weight, grain, stover and biological yield, harvest index, Zn concentration and uptake in plant, net returns and B: C ratio significantly increased with zinc fertilization @ 4 kg Zn/ha over control observed suitable dose of Zn for pearl millet which remained at par with 6 kg Zn/ha. The net return and B:C ratio attained with 4 kg Zn/ha practice was ₹ 38347/ha and 1.56, respectively.

Keyword: pearl millet, moisture conservation, zinc fertilization, yield.

IMPACT OF CLIMATE CHANGE ON AGROFORESTRY BASED CROPPING SYSTEM**VIJAY KUMAR¹, MANISHA VERMA², SATISH KUMAR¹ & RAM NARAYAN KUMHAR³**

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Climate change is likely to increase damages from extreme weather events by \$140 billion in 2003–13. The impact of climate change is also likely to worsen water scarcity for the 1.6 billion people around the world already living in water stress. According to the latest Lancet report, in 2007–16, 306 disasters were recorded on an average out of which over 90 per cent were associated with weather-related events in the last 20 years. Asia was the most affected. India, like other developing countries, is suffering the brunt of climate change. According to 2017 German Watch report, India is ranked as the fourth most vulnerable country. The Economic Survey 2017–18 reveals that on an average annual rainfall in India has declined by about 86 mm in the last three decades. While kharif rainfall has declined on an average by 26 mm, the decline in rabi rainfall has been by 33 mm. There has also been a 12.8 per cent decline in kharif yields and 6.7 per cent in rabi yields due to extreme rainfall shocks. According to the Central

Research Institute for Dryland Agriculture (CRIDA), Hyderabad, climate change in India has about 4–9 per cent impact on agriculture each year, which results in a loss of about 1.5 per cent in the gross domestic product (GDP) annually. The World Bank reports that by 2030, rice and wheat are likely to see a drop of about 6–10 per cent in yield. Developing countries have a limited capacity to deal with the impacts of climate change and are hence more vulnerable. For instance, according to the estimates stated in climate action plan or the Nationally Determined Contributions (NDC), India will require a whopping \$2.5 trillion to deal with the impacts of climate change by 2030

ECONOMICALLY IMPORTANCE LIFE CYCLE OF MAIZE CYST NEMATODE AND THEIR MANAGEMENT IN MAIZE PRODUCTION

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Maize (*Zea mays* L.) is considered as the queen of cereals and cultivated under the wide range of agro-climatic conditions all over the world including India. Maize has multidimensional utilization and mainly used as food, feed and fodder and as an industrial raw material for starch and processed food industries. It is primarily cultivated as a *kharif* crop but presently, it is also being popularized as an important *Rabi* and summer crop in certain parts of the country depending upon the environmental conditions and irrigation facilities. It is grown for human consumption as it provides high quality of staple food among rural masses. Maize suffers from number of nematodes in India (Koshy and Swamp, 1971; Mehta *et al.*, 2015). Plant parasitic nematodes viz. *Heterodera*, *Pratylenchus*, *Tylenchorhynchus*, *Meloidogyne*, *Hoplolaimus*, *Helicotylenchus*, *Rotylenchus*, *Longidorus*, *Trichodorus*, *Xiphinema* and *Belonolaimus* (Yadav and Verma, 1971; Windham, 1998 and Singh *et al.*, 2007) were found to be associated with rhizosphere of maize. These nematodes cause annual losses of 10.2% in maize world over (Sasser and Freckman, 1987). Nematodes also interact with other disease causing agents (pathogens and soil insects) and adversely affect the quantity and quality of maize production. Among nematodes, maize cyst nematode, *Heterodera zeae* is considered to be the most important nematode pest of maize in India (Kaushalet *et al.*, 2007; Meena *et al.*, 2013). It was first reported by Koshy *et al.* (1970) from Chhapli village of Rajsamand district of Rajasthan. It is widely distributed in maize growing areas of Rajasthan, Delhi, Punjab, Haryana, Himachal Pradesh, U.P., Bihar, M.P., Gujarat, Tamil Nadu, Karnataka, A.P. and Maharashtra. (Singh and Rathore, 2001; Rathore *et al.*, 2007). Srivastava and Chawla (2005) reported yield losses of maize to the extent of 17-29% by maize cyst nematode, *H. zeae* in India at varied inoculum levels and soil conditions.

INTERCROPPING: A SUSTAINABLE AGRICULTURE

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Agroecology is the study and application of ecological principles to agricultural systems in order to improve yields and resource use in an environmentally sound way. The importance of this field grows as the human population increases and requires a more efficient and sustainable food supply. This practice has its roots in Southeast Asia and Latin America, such as the planting of corn and cassava in the Philippines. The combination improves land use, as corn grows quickly and can be harvested before the cassava is mature. Long term research shows that intercropping has fewer negative implications compared to today's industrialized agriculture that focuses on monocultures. The monocultures in modern industrial agriculture lack the benefits of polycultures and thus require the use of pesticides and fertilizers. Viewing agriculture as its own ecosystem, agroecology aims for sustainable yet optimal approaches to farming, including alternative agriculture strategies such as intercropping. There are very close relationships between yield advantage and nutrient acquisition in intercropping systems. Intercropping is an efficient cropping system in terms of resource utilization. The large amounts of nitrogen fertilizer used in industrial agriculture have their own costs: fertilizers end up in rivers, lakes and streams causing eutrophication; increased nitrogen input allows farmers to neglect the long term health and fertility of the soils; and the extraction and production of these fertilizers cause ecological damage around the world. Initially, monocultures decrease insect biodiversity. However, monocultures eventually cause an increase in herbivory as the insect populations become more uneven. These increase in herbivory are mitigated by pesticides which become less effective each year since insects adapt rapidly to them under the heavy selective pressure. Ecosystem service approaches should emphasize that intercrops could achieve food security with reduced anthropogenic inputs and lower environmental impact. Therefore, increased plant diversity in cropping systems has the potential to increase soil physical stability and resilience of microbially mediated nutrient cycling processes.

Keywords: Intercropping, sustainable agriculture, monoculture and industrial farming

SOIL HEALTH AND MANAGEMENT**KAVITA*, ¹KAVINDER AND ¹AMIT KUMAR***Department of Soil Science, CCS Haryana Agricultural University, Hisar-125004, ¹Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004*

Soil health depicts the overall picture of the soil properties and processes and also referred as soil quality, is defined as the capacity of soil to be as a living entity to sustain vital living ecosystem that sustains viz., plants, animals, and humans etc. Soil quality integrates the physical, chemical and biological properties of soil. Soil isn't an inert growing medium, but rather is teeming with billions of bacteria, fungi, and other microbes that are the foundation of an elegant symbiotic ecosystem. Soil is an ecosystem that provides nutrients for plant growth, absorb and harvest rainwater for use during dryer periods, as a filter and buffer for potential pollutants, to serve as a firm foundation for agricultural activities, and provide habitat for soil microbes to keep the ecosystem running smoothly. Healthy soil gives us clean air and water, bountiful crops and forests, productive grazing lands, diverse wildlife, and beautiful landscapes. Soil has both inherent and dynamic properties. Inherent soil quality is a soil's natural ability to function within an ecosystem. Dynamic soil quality is how soil changes depending on soil management practices. Understanding soil health means assessing and managing soil so that it functions optimally now and it is not degraded for future use. Managing for soil health is mostly a matter of maintaining suitable habitat for the myriad of creatures that comprise the soil food web and supplying of the nutrients needed for optimal plant growth in the right quantity and at the right time while minimizing nutrient losses to the surrounding environment. This can be achieved by disturbing the soil as little as possible or conservational tillage adoption, growing as many different species of plants as practical, crop rotation of instead of monocrop, integrated crop, keeping living plants in the soil as often as possible, recycling of on-farm waste as soil conditioners and biofertilizers and keeping the soil covered all the time. By monitoring changes in soil health, a land manager can determine if a set of practices is sustainable or not.

Keywords: Soil, organic matter, diversification and health**EFFECT OF VARYING FERTILIZER DOSES AND CROP GEOMETRY ON NUTRIENTS UPTAKE OF LATE SOWN INDIAN MUSTARD (*BRASSICA JUNCEA* L.)****NAVEEN RATHI *, V.S. HOODA,¹MOHAMMED MOHSIN AND HARENDER***Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004, ¹Department of Agronomy, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan- 313004*

A field experiment was conducted at Regional Research Station of CCS Haryana Agricultural University, Bawal in *rabi*(winter) season of 2015-16. The experiment was laid out in split-split plot design with three replications involving four fertilizer dose viz. F₁: 80 % RDF, F₂: 85 % RDF, F₃: RDF (Recommended dose of fertilizer i.e. 80 kg N + 30 kg P₂O₅ + 20 kg K₂O + 40 kg S per hectare), F₄: 115 % RDF as main plots, six crop geometry as sub plots viz. C₁: 30 cm x 10 cm, C₂: 25 cm x 15 cm, C₃: 30 cm x 15 cm, C₄: 25 cm x 20 cm, C₅: 30 cm x 20 cm and 25 cm x 25 cm. Results revealed that nutrient uptake (N, P, K and S) in seed increased with successive increase in fertilizer doses 70%, 85%, 100% and 115% RDF. However, application of 85% RDF recorded significantly higher values of nutrient uptake (N, P, K and S) in seed over 70% RDF, but the differences among 85%, 100% and 115% RDF were found to be non-significant. Crop geometry (25 cm x 15 cm i.e., 2.66 lakh plants/ha) had higher nutrient uptake (N, P, K and S) in seed over other crop geometries (30 cm x 15 cm, 25 cm x 20 cm, 30 cm x 20 cm and 25 cm x 25 cm), respectively. Application of 85% RDF recorded significantly higher values of nutrient uptake (N, P, K and S) in stover over 70% RDF, but at par with the 85% and 100% RDF. Crop geometry (25 cm x 15 cm i.e., 2.66 lakh plants/ha) had higher nutrient uptake (N, P, K and S) in stover over all other crop geometries.

Keywords-Fertilizer doses, crop geometry, mustard and Haryana**INFLUENCE OF NUTRIENT MANAGEMENT ON UPTAKE OF MACRONUTRIENTS BY MAIZE (*ZEA MAYS* L.) UNDER SANDY CLAY LOAM SOIL OF KARNAL, HARYANA****HARENDER*, V.S. HOODA, NAVEEN RATHI AND ¹MOHAMMED MOHSIN***Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004, ¹Department of Agronomy, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan- 313004*

The current investigation was carried out at the Regional Research Station, Karnal of CCS Haryana Agricultural University during *kharif* 2015 in randomized blocks design with three replications. Experiment contains twelve nutrients application treatments

combination viz., T₁ (control), T₂ (N 150 kg/ha), T₃ (NP 150, 60 kg/ha), T₄ (NPK 150, 60, 60 kg/ha), T₅ (NPK + S 150, 60, 60, 40 kg/ha), T₆ (NPK + Zn 150, 60, 60, 25 kg/ha), T₇ (NPK 150, 60, 60 kg/ha + foliar spray of Fe), T₈ (NPK 150, 60, 60 kg/ha + foliar spray of Mn), T₉ (NPK + S + Zn 150, 60, 60, 40, 25 kg/ha), T₁₀ (NPK + S + Zn + Fe), T₁₁ (NPK + S + Zn + Fe + Mn) and T₁₂ (Soil test based application of NPK 150, 60, 40 kg/ha). Foliar spray of FeSO₄ 1% and MnSO₄ 0.5% was given twice at 30 and 45 days after sowing. Results revealed that the treatments where N was applied (T₂ to T₁₂) showed significantly higher concentration of N in the leaves (<96.0 kg/ha) as compared to the treatment without nitrogen application i.e. T₁ (68.3 kg/ha). Treatments where phosphorous was applied (T₃ to T₁₂) showed significantly higher concentration of P in the leaves (<58.3 kg/ha) compared to the treatments without phosphorous i.e. T₁ and T₂ (<46.8 kg/ha). The uptake of potassium was not differed significantly with the application of K along with other nutrients. Treatments which consists of Sulphur (T₅, T₉ to T₁₁) showed higher concentration of S in the leaves (<51.2 kg/ha) and lower concentration in treatments without Sulphur dose i.e. T₁ to T₄, T₆ to T₈ and T₁₂ (<37.3 kg/ha). The leaves of healthy plants have shown good concentration of nutrients, high yield and quality parameters.

Keywords:- Nutrient management, Macronutrients, Maize and Haryana

ORGANIC FARMING: NEED AND SCOPE

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The population of the planet is skyrocketing and providing food for the world is becoming extremely difficult. The need of the hour is sustainable cultivation and production of food for all. The Green Revolution and its chemical based technology are losing its appeal as dividends are falling and returns are unsustainable. Pollution and climate change are other negative externalities caused by use of fossil fuel based chemicals. Organic farming is preferred as it involves less input costs for cultivation and preserves the ecological balance while promoting biological diversity and protection of the environment. Organic farming is a farming method which involves growing and nurturing crops without the use of synthetic based fertilizers and pesticides and also no genetically modified organisms are permitted. This is a farming method that works at grass root level preserving the reproductive and regenerative capacity of the soil, good plant nutrition and soil management that produces nutritious food rich in vitality which has resistance to diseases. Total area under organic certification process (registered under National Programme for Organic Production) is **3.56 million Hectare** (2017-18). This includes 1.78 million ha (50%) cultivable area and another 1.78 million Hectare (50%) for wild harvest collection. Among all the states, **Madhya Pradesh** has covered largest area under organic certification followed by Rajasthan, Maharashtra and Uttar Pradesh. Organic farming relies on ecologically balanced agricultural principles like crop rotation, green manure, organic waste, biological pest control, mineral and rock additives. Organic farming enhances the nutrients of the soil which is passed on to the plants and animals and use natural farming techniques that don't harm humans and environment. These foods keep dangerous diseases like cancer and diabetes at bay. Organic farming does not make use of poisonous chemicals, pesticides and weedicides. It care for the larger environment and conservation of natural habitats and wildlife.

Keywords:- Future Prospective, Natural farming, Organic Farming,

HEAT UNITS AND CROP MANAGEMENT

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Growth and development of are strongly dependent on temperature. For an example, Corn develops faster when temperatures are warmer and more slowly when temperatures are cooler. A string of warmer than normal days in late spring will encourage faster leaf development than normal. Temperature controls the developmental rate of many organisms. Rates of most biological processes are affected markedly by temperature. Growth and development of whole organisms show a temperature response which results from the integrated effect of temperature on the many individual physiological processes involved. Plants require a certain amount of heat to develop from one point in their life cycles to another. This measure of accumulated heat is known as physiological time. The amount of heat required to complete a given organism's development does not vary; the combination of temperature (between thresholds) and time will always be the same. Physiological time is often expressed and approximated on hourly or daily time scales using units of degree-hour (°hr) or degree-day (°D). Despite general acceptance of this close relationship, the use of temperature indices has not been generally extended to growth analysis. Growth analysis has been a valuable tool in the quantitative analysis of plant and crop growth. The growth functions; AGR, RGR and NAR, increase with temperature and light flux within a range specific for a given crop. Growth functions calculated in the traditional manner will necessarily include the effect of controlled and uncontrolled environmental variables.

Keywords: Heat Unit, AGR, RGR, NAR and light flux

OPTIONS AND STRATEGIES FOR DOUBLING FARMERS' INCOME

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The Indian economy is largely agrarian, with around 65% of the population dependent for their livelihoods on agriculture and allied sectors that generate 15% Gross Value Added (GVA) (GoI2017a). Indian farmers are vulnerable to impacts of climate change, water scarcity and land degradation. In addition, increasing fragmentation of holdings, extreme weather events, rising input costs and post-harvest losses pose an enormous challenge to sustaining agricultural growth. The target of doubling farmers' income in a short period requires identification of sources of income growth and enabling conditions for harnessing their growth potential therefore, we can examine the sources of agricultural growth, and suggest technological, institutional policy options for making agriculture a remunerative enterprise. Technology is identified as one the most important sources of growth, and there are sufficient evidences to show that investment in agricultural research yields good dividends. There exist huge gaps between realized and potential yields of most crops that can be bridged to a large extent by enhancing farmers' access to key inputs, irrigation, markets, credit and extension services. Diversification of production portfolio towards high-value crops has considerable potential to accelerate growth in agriculture and farmers' income. However, extreme volatility in prices acts as disincentive to adopt productivity-enhancing technologies and diversification. Post-harvest management and small-scale processing would help farmers capture benefits of value addition. Effective coordination between centre and states is important in mainstreaming and channelizing policies and investment to achieve the target of doubling farmers' income by 2022.

Key words: Agriculture, Diversification, Farmers' income, policies & Technology

TRANSFORMATION OF PEA WASTE (BY PRODUCTS) INTO VALUE ADDED PRODUCTS

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Pea is the second most consumed and important food legume in the world. In the present study, efforts have been directed to possible utilization of the pea shells, not only from the point of preservation and waste management, but as a profitable adjunct to the food processing industry. Therefore in the present investigation an attempt was made to utilize these nutrients rich pea shells by incorporating them products were evaluated organoleptically for sensory characters. The study revealed that the pea shells are a good source of crude protein, crude fiber, dietary fiber, calcium, iron, potassium, magnesium and bioactive compounds. In this connection, fibrous coat of shells separated and shells will be cut into small pieces and kept in hot air oven for drying at 40-50⁰ C and make ground to fine powder. In this research five products are prepared at different levels of supplementation to possible utilization of pea shells powder. In current study the cake were devised by substituting shells powder in place of refined wheat flour at 10% and 20% levels. The sweet biscuits, sweet and salty biscuits were devised by substituting pea shells powder in place of refined wheat flour at 5%, 10% and 15% levels. The *macroni* and noodles were devised by substituting pea shells powder in place of refined wheat flour at 10%, 20% and 30% levels. All the product result of sensory score is 7-8 point using 9 Hedonic Scale. The result indicates that the mean scores are higher in those product which are supplemented with pea shells powder, compare to Control. The products are advantageous for people suffering from lifestyle diseases as these contain high amount of fiber and minerals. Value addition is important in meeting food requirements of growing population by eliminating avoidable losses and making food items more nutritive by processing and fortification of low-grade raw commodities. This study highlights the scope for value addition with pea shells powder. Incorporation of pea shells for value addition in bakery, confectionery and extruded products can be encouraged and popularized in order to improve the intake of protein, dietary fiber and minerals. In this way peels can also be utilized for human consumption otherwise this important source of nutrients goes wasted.

Keywords: Organoleptic, Pea shells, Sensory, Substituting, Supplementation, Value addition

BIOACTIVE COMPOUNDS AND ANTIOXIDANT POTENTIAL OF PEA PEEL (PEA WASTE) EXTRACT**AMITABENIWAL* AND DARSHAN PUNIA*****Department of Foods and Nutrition, I.C.College of Home Science CCS Haryana Agricultural University, Hisar, Haryana, India*

Pea shells which otherwise are discarded in bins or used for animal feed contains many beneficial nutrients. Pea waste by-products are promising sources of compounds which may be used for nutritional properties and as possible source of functional compounds. The presence of bioactive compounds in pea pod is equal to that present in pea cotyledon which indicates that pea pod can also be consumed. In this connection, fibrous coat of shells separated and shells will be cut into small pieces and kept in hot air oven for drying at 40-50⁰ C and make ground to fine powder. In the present investigation, an attempt was done and found the bioactive compounds and antioxidants activity in fresh pea shells and pea shells powder. Total phenolic content in fresh pea shells was 36.46 mg GAE/100g and pea shells powder contained 304.62 mg GAE/100g. The Flavonoids content in fresh pea shells was 7.30 mgRE/100gm and pea shells powder contained 24.44mgRE/100gm. The ferric reducing antioxidant power (FRAP) and free radical scavenging activity (DPPH) of fresh pea shells was 133.33 mgTE/100gm and 2595.69 mgTE/100gm, respectively. The ferric reducing antioxidant power(FRAP) and free radical scavenging activity (DPPH) of pea shells powder was 1000.00 mgTE/100gm and 2595.69 mgTE/100gm, respectively. Antioxidant activity was higher in fresh pea shells compared to pea shells powder. Antioxidant properties for centuries and indigenous plants have been used in herbal medicine to cure various diseases for this point of view the value added products were developed such as *chapattis*, dry vegetable, *tikki*, cutlets, cake, biscuits, macaroni and noodles. Development and utilization of such value added foods will not only improve the nutritional status of the general population but also helps those suffering from degenerative diseases, constipation and colon irritation. The products are advantageous for people suffering from lifestyle diseases as these contain high amount of bioactive compounds. Incorporation of fresh pea shells and pea shells powder for value addition in foods products can be encouraged and popularized in order to improve the nutritional status. In this way peels can also be utilized for human consumption otherwise this important source of nutrients goes wasted.

Keywords: Bioactive Compounds, Flavonoids, Nutritional, Ferric reducing activity, Free radical Scavenging activity.

PRODUCTIVITY AND QUALITY OF CLUSTERBEAN (CYAMOPSIS TETRA GONOLOBA(L.) TAUB.) AS INFLUENCED BY ZINC AND SULPHUR**SUNIL, SEEMA DAHIYA, M.S. BHATTOO, RAJBIR SINGH KHEDWAL¹ AND RAJESH KATHWAL***Chaudhary Charan Singh Haryana Agricultural University, Hisar- 125001, India, ¹Department of Agronomy, Punjab Agricultural University, Ludhiana-141004, India*

A field experiment was conducted during *Kharif* 2015 at cotton research station, Sirsa, CCS HAU, Hisar (India). The experiment was conducted in RBD with three replications. The experiment consist of 16 treatments in which N and P were applied as per recommended dose (N= 20 kg/ha, P₂O₅= 40 kg/ha) along with different doses of Zn (10, 20 and 30 kg/ha) and S (20, 30 and 40 kg/ha) and their combinations. Based on the research investigation it was found that the application of T₁₆ (N@20 kg + P₂O₅@40 kg+ ZnSO₄@30 kg + S @40 kg/ha) recorded highest grain, straw, gum and protein yield as compared to other nutrient treatments. Quality parameters viz. gum content and protein content were recorded highest in T₁₆. It may be concluded that T₁₆ resulted in highest yields and quality parameters. Further study can be explored to optimize the nutrient requirement for yield maximization, profitability and sustainability.

Key words: Clusterbean, N, P, S and Zn doses, quality, gum and protein yield

TRANSGENIC PLANTS AND ITS APPLICATIONS**VIJETA GUPTA¹ AND VIKAS²***¹Department of Genetics and Plant Breeding, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar- 125004 ²Department of Fruit Science, Dr. YS Parmar University of Horticulture and Forestry*

Before the creation of transgenics, the alteration of crops to improve their production was performed through the basis of selection. This selection has been going on for thousands of years. By the year 2050, world population may reach nine billions. Food production will need to increase at the high rate in order to satisfy the needs of such an enormous number of people in some older centuries. So, there is a need to use the genetic techniques to improve crops over the recent decades. Through the use of transgenics, one can produce plants with desired traits and even increased yields. The transgenics would allow for more crops that last longer and offers opportunities for the creation of insect, virus and herbicide-resistant plants by insertion and expression in planta of various genes. Abiotic stresses, especially salinity and drought, are the primary causes of crop loss worldwide.

Transgenes protect and maintain the function and structure of cellular components and enhance tolerance to stress and also help in reducing micronutrient malnutrition among people at highest globally by enriching major staple food crops with micronutrients like amino acid, lipid, vitamin and iron through genetic engineering techniques. Transgenic plant production will allow us to feed the growing population and to produce more desirable products like secondary metabolites as antibodies and also help in preparation of edible vaccines. Genetic engineering also allows delayed ripening in fruits and helps to reduce fruit wastage. Molecular farming allows cost effective production of therapeutic products such as antibodies, blood products, cytokines, growth factors, hormones, recombinant enzymes and human and veterinary vaccines. The future of GM crops remains a vital debate, as its applications have several advantages and disadvantages.

Keywords: Transgenics, Genetic engineering, Resistance

ENVIRONMENTAL PROTECTION AND SUSTAINABLE AGRO ECOSYSTEM THROUGH ADOPTING ORGANIC FARMING

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Organic farming is the agricultural production system focused on maintaining soil health, sustain ecological issues and minimize environmental hazards through excluding the use of synthetic fertilizers, pesticides and genetically modified organisms and plant growth regulators in crop production. Continuous application of synthetic inputs degrades ecological conditions and also causes health problems. Therefore, better option to mitigate these troubles is adopting organic farming which promotes a less polluting agricultural system. Organic farming is a proactive approach follows the rule of nature and uses principles of sustainability. Positive effects of organic agriculture on natural resources favours interactions within the agro-ecosystem that are crucial for both nature conservation and agricultural production. It encourages soil flora- fauna, and helps in improving structure, texture, water holding capacity, nutrients contents and bio diversity in the soil. In many agriculture areas, pollution of ground water courses with synthetic fertilizers and pesticides and leaching losses of nutrients is major problem which will be managed by well managed organic system with better nutrient retentive abilities, greatly reduce the risk of ground water pollution. It also helps in reducing non-renewable energy use by decreasing agrochemical needs and contributes to mitigating the greenhouse effect and global warming through its ability to sequester carbon in the soil resultantly increase the return of carbon to the soil, raising productivity and favouring carbon storage which enhances the mitigation potential of agriculture against climate change. In the last sustainable and environment safe agro ecosystem can only be obtained from adopting organic farming.

Key words: Agriculture, Diversification, Farmers' income, policies & Technology

KHEJRI (*PROSOPIS CINERARIA* L.): A WONDER TREE OF ARIDS

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Prosopis cineraria (L.) commonly called "khejri" (synonyms: jambi, shumi and jandi) is a leguminous, multipurpose tree species distributed in the arid and semi-arid regions of India, Afghanistan, Pakistan, Iran and Arabia. *P. cineraria*, also known as the 'king of the desert'. It is a small to medium-sized tree, which can withstand extremes of temperature up to 48°C and less than 100 mm rainfall. Farmers have been consciously maintaining and promoting a few randomly growing trees, most commonly the *P. cineraria* (L.), in their fields with the aim of obtaining fodder from the foliage and fuel from pruned branches. The winter availability of 'sangri' (local name of Khejri pod as vegetable), which is a rich in protein fetches more market price due to its demand and presence of lesser seeds in the pod. Khejri wood is useful for house construction and for making cart and agricultural implements. So, this tree is also called 'Kalpataru'. It also helps in sustaining the nutrient value of the soil and ensuring a good yield. It is known to improve soil fertility; it aids nitrate retention in soil. It is used traditionally for treatment of various ailments like leprosy, dysentery, asthma, leucoderma, dyspepsia and earache etc. Hence, it has become an integral part of the traditional agriculture and the lifeline of the desert inhabitants. The dried pods are consumed as a vegetable and leaves as traditional medicine to cure a wide range of diseases in the state of Rajasthan, India. Khejri has a long history of use in herbal medicine in arid and semi-arid regions of India, Burma and Sri Lanka.

Keywords: -Khejri, Multipurpose tree, King of the desert and Indian fodder tree

DIRECT SEEDED RICE: IMPORTANCE, SCOPE AND CHALLENGES**AKSHIT*, PRIYANKA SAINI AND AMIT DHANKHAR***Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004*

Rice (*Oryza sativa* L.) is an important food crop for over half of the world's population. The crop is largely established by transplanting method which involves growing seedlings in a nursery bed and later transplanting them in water ponded puddled field. The demand of cereals to meet the food requirements of the burgeoning population is increasing while on the other hand most vital inputs of agriculture viz. water and labour are depleting. Transplanted rice system is a second most (1st is livestock) major source of agriculture greenhouse gas (GHG) emission, particularly methane gas causing global warming and climate change. Major issues and constraints in rice production are water management, stagnation of yield of succeeding non rice crop, global climate change, nutrient management, weed management, productivity and efficiency in rice production and most important is environmental pollution. Efforts, therefore, have to be made to mitigate GHG emission from rice and develop strategies to grow rice with less water. More efficient alternative methods of rice productions are needed and direct seeded rice can be one of the approach for further production in terms of sustainability. Direct Seeded Rice (DSR) is a rice establishment method in which seeds can be directly sown either through dry or wet (pre-germinated) seeding. DSR needs only 34 per cent of the total labour requirement and saves 27 per cent of the total cost of the transplanted crop. Furthermore, earlier crop maturity (8-10 days), more efficient water use due to reduced crop duration and increased benefit-cost ratio are other advantages of DSR. Despite several advantages, various production obstacles are also encountered in DSR in which heavy weed infestation is major one. Uncontrolled weeds reduced the rice grain yield by 75.8 and 70.6 per cent under dry-seeded and wet-seeded conditions.

Keywords: DSR, Importance, GHG-emission and Challenges

HIGH DENSITY ORCHARDING OF GUAVA**HITESH AGARWAL¹, RAMESH CHAND CHOUDHARY¹, PUSPENDRA SINGH¹ AND MANISH KUMAR²**

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Guava is an important fruit crop in tropical and subtropical regions of the country due to the hardy nature of its tree and prolific bearing even in marginal lands. It is one of the common and major fruits of India and is considered the fourth most important fruit in area and production after mango, banana and citrus. Its cultivation requires little care and inputs. But, of late, this crop has exhibited a paradigm shift in the production system, from subsistence farming to commercial production. The traditional system of cultivation has often posed problems in attaining desired levels of productivity due to large tree canopy. Hence, a need arose to improve the existing production system, besides increasing its productivity. Currently, there is a worldwide trend to plant fruit trees at higher density or meadow orcharding to control tree size and maintain desired architecture for better light interception and ease in operations such as pruning, pest control and harvesting. The high density orcharding facilitates enhance production and quality of fruits. One such that strategy is the high density planting including the adoption of appropriate plant density, Crop management, quality planting materials and support with appropriate inputs. The growth behaviour of guava provides opportunity for high density planting of guava for harvesting maximum yield per unit area by means of control of plant vigour by pruning and efficient nutrient and water management. Many guava farmers have been adopting this technology successfully. High density plantation results in maximum of unit area yield and availability of the market early which fetch the better price.

Keywords: - High density planting, guava orcharding and growth behaviour

ROLE OF TRANSGENICS IN PEST MANAGEMENT**JAYANT YADAV* AND MAHA SINGH***Department of Entomology, CCS Haryana Agricultural University, Hisar-125004*

A transgenic crop plant contains foreign gene which have been artificially inserted instead of the plant acquiring them through natural pollination. Growers throughout the world are rapidly adopting genetically modified crops with 189.8 million hectares globally in 2017. GM crops have been developed for different traits as herbicide tolerance, insect resistant and quality traits in mainly soybean, cotton, maize, canola etc. Insect resistant (IR) genes are mainly classified as *Bt* genes, protease inhibitors (PI) genes, α -amylase inhibitor genes, lectin genes and enzyme inhibitory genes. The effect of *Bt* cotton on non-target insect pests (leafhoppers, whiteflies, ash weevils, aphids and cotton bugs) and generalist predators (ladybirds, chrysopids and spiders) under

insecticide protected and unprotected conditions was studied and reported that the populations of major non-target insect pest and the generalist predators did not differ significantly between the *Bt* and non-*Bt* cottons, while their numbers were lower in insecticide protected than under unprotected conditions. One elite transgenic rice line, *BtE15*, was identified with 80-92% levels of resistance against two major lepidopteran insect pests viz., yellow stem borer (*Scirpophagacincertulas*), rice leaf folder (*Cnaphalocrocismedinalis*) and one minor insect pest, oriental army worm (*Mythimnaseparata*) at the vegetative and reproductive stages. A protease inhibitor from the seeds of *Butea monosperma* (BmPI) was studied for its influence on developmental physiology of *Helicoverpa armigera* under *in-vitro* conditions and measurable inhibitory activity on total gut proteolytic enzymes of *H. armigera* and bovine trypsin was reported. Bioassays conducted on second instar larvae of *Spodopteralitura* fed on leaves of transgenic tobacco having *Sclerotium rolfii* lectin (SrL) showed 90% larval mortality in 48 h. The huge potential of transgenic technology to enhance crop production and protection cannot be ignored. Emphasis should be given on monitoring and management of insect resistance towards transgenic crops.

Keywords: Transgenics, Bt genes, Protease inhibitors and Insect resistance.

REPRODUCTIVE BIOLOGY AND FLOWERING BEHAVIOR OF *AILANTHUS EXCELSA* ROXB.

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Ailanthus excels Roxb. is a versatile tree species and is commonly known as mahaneem or maharukh. However, in spite of its high value, required efforts have not been made for its improvement. The knowledge of phenology and breeding system is pre-requisite for any improvement work therefore, the present investigation on the reproductive biology and floral behaviour was carried out on randomly selected trees of mahaneem growing at the campus of University, Hisar. Studies on reproductive biology of Mahaneem (*Ailanthus excelsa*) indicated that mild defoliation started in mid of March and continued up to end of February, majority being from May 13-28. Leaf primordia started appearing after all the leaves had shed off. Within a week of new foliage appearance, the panicle with small protruding buds appeared. The floral buds took 9-13 days to come to bloom. More than 80 per cent floral buds opened between 0800-0900 h. The number of days required from panicle initiation to fruit maturity ranged from 132-140. Fruit set under open-pollination was higher as compared to the fruit set in self-pollinated and a highly significant difference in growth characters of self versus open pollinated progenies formed a strong evidence for xenogamous behavior of mahaneem.

Keywords: Reproductive biology, Phenology, Defoliation, Anthesis and Mahaneem

GENOMIC IMPRINTING: AN EPIGENETIC PHENOMENON

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Genomic imprinting results in monoallelic gene expression in a parent-of-origin-dependent manner. It is achieved by the differential epigenetic marking of parental alleles. Over the past decade, studies in the model systems *Arabidopsis thaliana* and maize (*Zea mays*) have shown a strong correlation between silent or active states with epigenetic marks so genomic imprinting is an epigenetic process such as DNA methylation and histone modifications. These epigenetic marks are established ("imprinted") in the germline (sperm or egg cells) of the parents and are maintained through mitotic cell divisions in the somatic cells of an organism, but the nature of the primary imprint has not been clearly established for all imprinted genes. Phenotypes and expression patterns of imprinted genes have fuelled the perception that genomic imprinting is specific to the endosperm, a seed tissue that does not contribute to the next generation. However, several lines of evidence suggest a potential role for imprinting in the embryo, raising questions as to how imprints are erased and reset from one generation to the next. Imprinting regulation in flowering plants shows striking similarities, but also some important differences, compared with the mechanisms of imprinting described in mammals. For example, some imprinted genes are involved in seed growth and viability in plants, which is similar in mammals, where imprinted gene regulation is essential for embryonic development. However, it seems to be more flexible in plants, as imprinting requirements can be bypassed to allow the development of clonal offspring in apomicts.

Keywords: Genomic Imprinting, Epigenetic, Phenotypes, Embryonic Development

TOOLS FOR INTEGRATED STORAGE PEST MANAGEMENT***DIGAMBER, PREETI DHANKER¹ AND DHARMENDAR SINGH²****Department of Seed Science & Technology, CCS HAU, Hisar-125004, ¹Department of Chemistry, CCS HAU, Hisar-125004,**²Department of Entomology, CCS HAU, Hisar-125004*

Most populations of the world depend on an agro-based economy for their livelihood where a very significant portion of the gross domestic product comes from agriculture. However, in most under developed countries, due to subsistence farming, low education levels and lack of proper and well developed technology inputs into agriculture, agricultural activities are not advanced, leading to production under optimum level and poor storage of the produce. A storage pest may be referred to any organism that infests and damages stored food, books and documents, fabrics, leather, carpets, and any other dried or preserved item that is not used shortly after it is delivered to a location, or moved regularly. Generally these pests include various micro-organisms like fungi and bacteria, arthropods such as insects and mites and rodents. Losses can occur at several stages of the crop cycle, including threshing, storage, transport, milling, wholesale and retail distribution. Losses caused by insects include not only the direct consumption of kernels but also include accumulations of frass, exuviae, webbing and insect cadavers. High levels of this insect detritus may result in grain that is unfit for human consumption. Insect induced changes in the storage environment may cause warm, moist 'hotspots' that are suitable for the development of storage fungi causing further losses. Direct insect feeding on food grains results in a number of qualitative changes such as chemical changes in grain content. The contamination of grains with moult skin and body parts also makes them more susceptible to the spread of pathogenic micro organisms. Various eco-friendly as well as chemical methods can be used to protect heavy losses in stored grains. These methods reduce or check the infestation and damage caused by the storage pests, which ultimately prolongs the storage life of grains.

Keywords: storage pests, food, grains, pest-management.

DIRECT SEEDED RICE (DSR)**AMIT KUMAR *, NARESH KUMAR, HARENDER, ISHMADHU AND SINTU MALIK***Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004*

About 90% of the world's rice is grown and produced (143 million ha of area with a production of 612 million tons of paddy) in Asia. Rice provides 30–75% of the total calories to more than 3 billion Asians. Global rice demand is estimated to increase by 26% in next 25 years. Possibility of expanding the area under rice in the near future is limited. Therefore, this extra rice production needed has to come from a productivity gain. Production of conventional puddled transplanted rice facing several constraints because of growth in productivity is stagnated, high water consumption, labour scarcity, soil impedance due to puddling, and climate change. Hence, for sustainable rice production direct seed rice (DSR) may be a feasible alternate to conventional puddled transplanted rice with comparatively high potential to save water, reduce labour requirement, reduce fuel charges to prepare field operation, mitigate emission of green-house gases (GHSs) particularly methane gas and adapt to changing climate. The yield potential of DSR is comparable with transplanted rice if crop is managed properly. However, the DSR suffers from some constraints particularly high weed infestation. The system has been proved cost-effective and farmers' friendly but require further improvement in technological approach to realize greater benefits. Researchers are concentration to sort out these constraints in DSR to achieve acceptable results by developing suitable varieties, weed management measures and agronomic package for promoting DSR.

Keywords:- DSR, GHS, Methane Gas, Paddy, Productivity, Puddling.

JEEVAMRUT: A BOON TO FARMERS**RAJESH BAJIA^{1*}, KISHOR KUMAR SAHU¹ AND KAVITA²***Yashwant Singh Parmar University of Horticulture and Forestry, ¹Department of Soil Science & Water Management, Nauni 173230 Solan, Himachal Pradesh, ²Department of Soil Science CCS Haryana Agricultural University, Hisar*

Organic agriculture has been developed by the conscious efforts of inspired people to create the best possible association between the earth and men. It aims at sustaining and increasing the productivity by improving soil health and overall improvement of agro-ecosystem. The increasing concern of environmental safety and global demand for pesticide residue free food has evoked keen interest in crop production using eco-friendly products which are easily biodegradable and do not leave any harmful toxic residues besides conserving nature. So it is necessary to use natural products like Jeevamrut to produce chemical residue free food crops and hence this can play a major role in organic farming. Preliminary reports on Jeevamrut revealed that the yield with its

application is 2.775 tons /acre in Masura and 2.625 tons /acre in Hamsa variety of rice which were 3.0 tons and 2.5 tons per acre by chemical method of farming and the economic analysis showed that Jeevamrut production method is commercially viable since it registered better net returns than recommended dose of fertilizers in rice production. Significant differences with respect to nitrogen, phosphorus and potassium uptake in soil due to application of varied levels of Jeevamrut spray. The results also indicated higher increase in P-solubilizers and N-fixers population which directly enhanced the uptake of phosphorus and nitrogen in soil with the application of Jeevamrut. Similarly higher concentration of nitrogen, phosphorus and potassium in plants and higher grain yield was recorded with the soil application of Jeevamrut @ 1000 l/ha. Thus, liquid organic formulations applied through soil as well as spray contributed for improved fertility status of soil, promotes immense increase in biological activity of soil, enhance nutrient availability to crop, toxic free food and sustainable productivity, which eventually enhances farmer's output considering it to be the best and cheaper input available.

Keywords: Jeevamrut, Nutrient Uptake, P- Solubilizers, N- Fixer, Growth, Fertility

DRIP FERTIGATION- HIGHLY REMUNERATIVE TECHNIQUE FOR MODERN DAYS FARMING

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Water and fertilizer are the two important inputs for agricultural production and are interrelated in their effect on plant growth and yield. Since, water and fertilizer are costly inputs, every effort must be made to enhance water and fertilizer use efficiency by reducing their wastage. In recent years fertigation – a technique of application of both water and fertilizers via an irrigation system was shown to be very effective in achieving higher water and fertilizer use efficiency. For minimizing the cost of irrigation and fertilizers, adoption of drip irrigation with fertigation is essential which will maximize the nutrient uptake, while using minimum amount of water and fertilizer. Fertigation gives advantages such as higher use efficiency of water and fertilizer, minimum losses of N due to leaching, supplying nutrients directly to root zone in available forms, control of nutrient concentration in soil solution and saving in application cost. In sugarcane, nitrogen use efficiency increases by approximately two fold when the N fertilizer was injected into the drip irrigation network. Fertigation at 300 kg N/ha provided the highest tuber yield (38.3 q/ha) in potato. Higher water use efficiency (374 kg ha⁻¹ cm⁻¹) was recorded with drip irrigation over furrow irrigation (214 kg ha⁻¹ cm⁻¹). Apart from water saving, higher yield, higher water use efficiency and fertilizer use efficiency, higher benefit cost ratio is also obtained in drip irrigation as compared to surface irrigation. So, Fertigation becomes prerogative for increasing the yield of most of the crops under drip irrigation.

Keywords: Fertilizer use efficiency, Water use efficiency, Drip fertigation, Furrow irrigation and Benefit Cost Ratio

ASSESSMENT OF INTEGRATED NUTRIENT MANAGEMENT IN HYBRID MAIZE BASED ON STV GROWERS IN HARDA DISTRICT OF MADHYA PRADESH

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¹Krishi Vigyan Kendra, Harda (M.P.), ²Krishi Vigyan Kendra, Shahdol (M.P.), ³Krishi Vigyan Kendra, Balaghat (M.P.)

A field experiment (On Farm Testing) was conducted during Kharif season of 2013-2014 at Farmer's field in Harda district (Madhya Pradesh) for the study "Effect of integrated nutrient management on growth and yield attributes of Hybrid maize (*Zea mays* L.)". The experiment was laid out in randomized block design with replicated five times which were covered 2 ha area of farmer's field. The experiment treatments viz., T1 (Farmers practices) 100 kg /ha DAP +200kg Urea and T2- 100% RDF+5 kg/ha Zn+ 2 t/ha FYM +3 kg /ha Azatobactor culture and PSB culture. On the basis of results summarized at 30, 60, 90 DAS and at harvest, the maximum growth were recorded in T2 Compare to T1. Experiment data revealed that the maize yield increases with application of 100% RDF+5 kg/ha Zn+ 2 t/ha FYM +3 kg /ha Azatobactor culture and PSB culture. The average maize yield about 42.0 q/ha was harvested by average cost of cultivation Rs. 24648/ha. However, the average yield from farmers practice about 31 q/ha by cost of cultivation Rs. 22725 /ha. By adopted this technology, yield increased about 35.48 % compare to farmers practice. Farmers were got average net return Rs 38352/ha with B:C ratio is 1:2.55. The experiment concluded that INM technology would be helpful to reduce the cost of cultivation as well as increases the yield per ha with social and environmental harmoniously benefit to mankind and Animal.

TO MEASURE THE KNOWLEDGE LEVEL OF SOYBEAN GROWERS ABOUT IMPROVED PRODUCTION TECHNOLOGY THROUGH KRISHI VIGYAN KENDRA IN SEHORE DISTRICT OF MADHYA PRADESH**JITENDRA VERMA^{1*}, ARUN KUMAR² AND KRISHNA KUMAR RANA³**^{1&3}Research Scholar and ²Assistant Professor, Department of Agriculture Extension Education, Dr. B.R. Ambedkar University of Social Sciences (BRAUSS), Dr. Ambedkar Nagar (Mhow), M.P., India

Soybean is one of the most versatile crops grown around the world. Soybean also known as “golden bean”, or “miracle crop” because of its several uses. It is an excellent source of protein and oil. It contains good quality protein (43%), carbohydrate (21%), mineral (5%), moisture (8%), fat (20%), fiber (4%) and reasonable amounts of vitamins. Presently soybean contributes 43% to the total oilseeds and 25% to the total oil production in the country. Soybean has largely been responsible in uplifting soybean grower's economic status in many areas of the country but soybean crops low yield may create problem in uplifting of economic condition of the soybean growers. Today Krishi Vigyan Kendras (KVKs) play a very crucial role as actor in the Agricultural Innovation System at district level in India as a knowledge partner for development in agriculture and allied sector due to its contribution in adaptive trials and technology transfer frontline extension system in the country. The mandate of Krishi Vigyan Kendra is technology assessment, refinement and demonstration for its application and capacity development under different farming situations across the country. Therefore, keeping the above facts in mind, the study was entirely concerned with innovative activities conducted by Krishi Vigyan Kendra, Sehore. The village panchayats having maximum number of trained growers were selected from prepared list and five village panchayats were selected from each selected block, thus a total of ten village panchayats were selected from both blocks, similarly five village panchayats were also selected from the each block that is uncovered under KVK. Therefore, a total number of 20 village panchayats were selected to select soybean growers. In view of the objectives of study two types of soybean growers, trained and untrained were selected. A total 200 growers in which 100 growers trained and 100 growers untrained were selected through random sampling method from the selected village panchayats.

Keywords: Soybean, Krishi Vigyan Kendra, Knowledge level.**EVALUATION OF DIFFERENT MIDLATE NEW GENOTYPES OF SUGARCANE UNDER FERTILITY LEVELS ON JUICE QUALITY AND ECONOMICS****SATENDRA KUMAR¹, M.L.SRIVASTAV¹, S.P. YADAV², S.C.SINGH², PRATAP SINGH¹**¹Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Kushinagar, ²U.P. Council of Sugarcane Research, Shahjahanpur

Performance of the sugarcane crop mostly depends on the balance use of fertilizer, types of genotypes and also other factors. The most important factor is ability of genotypes to efficiently utilize the applied nutrients especially NPK. Main reasons for lower cane yield are lack of high potential varieties, limited irrigation resources, fertility and lack of awareness of technology. Field experiments were conducted at research farm of Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Uttar Pradesh during 2015-16, 2016-17 and 2017-18 in spring season to find out the fertility levels of newly released sugarcane varieties with economics. The experiment consisted of nine treatment combinations.. Three genotypes i.e. V₁- CoSe 11453, V₂- CoS 09232, V₃- CoSe 08452 and three fertility levels i.e. F₁-75% Recommended dose of NPK, F₂- 100% Recommended dose of NPK and F₃ - 125% Recommended dose of NPK were tested in factorial randomized block design. Recommended dose of fertilizers (RDF) was 180, 80, 60 (NPK) kg per ha and applied according to treatments. Two budded sugarcane setts were planted in furrows at 90 cm row to row distance. The experimental soil plots were medium in organic carbon and available phosphorus, low in potash with above neutral pH condition. On the basis of pooled data of three years, juice quality parameter like sucrose and CCS per cent were recorded significantly higher in genotype CoSe 08452 (18.39 and 12.74 per cent), respectively. Economics was proved better in genotype CoSe 11453 which gave the significantly higher net return (Rs.167273) and benefit: cost ratio (1.58). Net return and benefit: cost ratio increased by 14.32 and 15.33 per cent due to selection of genotype from tested genotypes. Performance of genotypes on cane yield, CCS per cent, sucrose per cent, CCS t/ha, gross income, net income, benefit: cost ratio increased with increased the fertility levels.

COST & RETURNS OF POTATO CULTIVATION IN AGRA DISTRICT**ARJUN SINGH^{1*}, ANURAG MAURYA², RANJANA³, KM DAULI CHAUDHARY⁴, SHRAWANI***Department of Agricultural Economics, College of Agriculture, RBS College, Bichpuri, Agra, Sanskriti University, Mathura*

The study reports the economics of potato production based upon the primary survey of 44 growers grouped into small (20), medium (14) and large (10) based upon the area of cultivation of potato crop from Agra district during 2011-12. The overall total cost of cultivation of potato came to Rs. 140303.7 per farm, Rs. 78657.98 per hectare. Among all the inputs, per hectare value of seed of potato was 25%, human labour 14% to total cost that varies directly with farm size because of more hired labour employed on larger farms. The total variable cost 78% on overall farms, showed decreasing trends with the farm size. Total fixed cost was 22% per ha to the total cost on overall farms. Overall total cost C_3 of potato was Rs. 154334.07 per farm, Rs. 86523.78 per hectare. The gross income received by farms with overall average of Rs. 188370. Analysis of the efficiency of potato production under different categories of farms showed overall cost of production of potato was Rs. 292.3 per quintal. Overall the output/input ratio was 1:2.39, being 1:3.42, 1:2.61 and 1:2.21 on small, medium and large farms respectively. Thus, it can be concluded that with the investment of one rupee in potato cultivation small, Medium and large farmers earned Rs. 3.42, Rs. 2.61 and Rs. 2.21, respectively.

Keywords: Cost, Returns, Potato, Agra, Cultivation, Output/input ratio.

SCREENING OF SELECTED SPINACH CULTIVARS FOR THEIR RESPONSE TO THE ROOT-KNOT NEMATODE, MELOIDOGYNE INCOGNITA**MOHAMMAD SHARIQ*, MOHD.ASIF, AMIR KHAN, FARYAD KHAN, MOH. TARIQ, TARUBA ANSARI AND MANSOOR A. SIDDIQUI***Section of Plant Pathology and Nematology, Department of Botany, Aligarh Muslim University, Aligarh, India.*

The Root-knot nematode, (*Meloidogyne incognita*) is the most damaging pathogens of vegetables, especially in the tropical and subtropical regions. Increasing restrictions of chemical nematicides have given rise to growing attention and interest in alternative nematodes management. Among the non-chemical methods available to nematode control, the use of resistant cultivars can be one of the most effective and environmentally safe alternatives over chemical control. An investigation was carried out to assess the level of resistance in five selected spinach cultivars viz., All green, Green Flavour, Kantedar, Pure green and Super green against *M. Incognita* under greenhouse condition. The nematode development and host damage were evaluated by recording the nematode infestation parameters and percentage reduction of plant growth. All the tested cultivars varied significantly in causing reductions in growth parameters over their controls. Similarly, all the cultivars behaved differently regarding the formation of galls and egg masses and the nematode development. It was observed that none of the tested cultivars was immune or highly resistant. The cultivar Kantedar was found moderately resistant against *M. Incognita* as it showed minimum root gall index and reduction in growth parameters while cultivar All green was found highly susceptible showing the highest root-knot index and reduction in growth parameters. Similarly, the cultivar Green flavour and Pure green were susceptible; the cultivar Super green was moderately susceptible against the nematode damage. A significantly negative correlation was found between the number of galls and plant growth parameters.

Keywords: *Meloidogyne incognita*, Screening, Spinach, Resistance.

COMPATIBILITY OF CHEMICAL INSECTICIDES WITH ENTOMOPATHOGENIC NEMATODE, HETERORHABDITIS INDICA FOR FIELD APPLICATIONS**PUNEET KUMAR***Department of Zoology, AMU, Aligarh (U.P.)*

There is an increasing demand for safe pesticides with low toxicity, short term persistence, low mobility in the soil to avoid ground water contamination and limited effects on non-target organisms. Entomopathogenic nematodes are efficient biocontrol agents since they kill a broad range of insect hosts within 24-48 h of application, can be applied easily using standard spray equipments and can tolerate or can be applied along side many types of pesticides. The present investigations were carried out to select an insecticide compatible with indigenous strain of *Heterorhabditis indica* for use in field against insect pests later on. Three insecticides namely; Triazophos (Hostathion 40 EC @ 0.08%), Novaluron (Rimon 10 EC @ 0.01%) and Thiodicarb (Larvin 75 WP @ 0.075%) were used in recommended concentrations. The experiment was laid in six well tissue culture plates. 1ml of the double strength solution was added per cavity along with 1ml of EPN (100 IJs) in water and observations on mortality of IJs were

recorded after 6, 12 and 24 h. The infectivity of these IJs was tested on *Galleria mellonella* larvae after completing the experiment. Only those insects with brick red colour were considered as killed by nematodes and per cent mortality was calculated. All the insecticides in aqueous solutions were compatible with *Heterorhabditis indica* IJs. The per cent survival of IJs ranged from 98.1-100. The survival was not decreased even after 24 h of exposure. The IJs were tested further for infectivity on *Galleria* larvae and were found infective in all the treatments.

Key words: Insecticides, Entomopathogenic nematodes, *Heterorhabditis indica*, mortality.

OPTIMIZATION OF CROP FARM ACTIVITIES: APPLICATION OF A LINEAR PROGRAMMING MODEL TO A RURAL FARMER IN DISTRICT MEERUT OF UTTAR PRADESH

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The cropping intensity was maximum 162.10 per cent on the marginal farms, while the cropping intensity of small and medium farms was found 157.06 and 153.41 per cent, respectively. The overall cropping intensity of sample farms was found 157.66 per cent, in the observation find out cropping intensity is lower due to sugarcane is a one year crop. It was found that average employment generated through sugarcane based farming system was 576 man days while category wise marginal farms generates highest employment was 582 man days followed by medium farms 575 man days and small farms 573 man days. For the marginal farms linear programming resulted to find that increase in net returns which was 150 per cent higher than the existing plan and labour recruitment man days in optimal plan 138 per cent higher than the existing farm plan. Small farms linear programming model resulted that increase in return which was 33.72 per cent higher than the existing farm plan and labour man days 69.59 per cent higher than the existing plan. Medium farms linear programming model included that net return which was 25.08 per cent higher than the existing farm plan and labour man days 37.01 per cent higher than the existing plan. Overall linear programming model included in optimal plan compare to net return which was 27.03 per cent higher than the existing farm plan and labour man days 65.21 per cent higher than the existing farms plan. Income and employment can be increased through alternative farming plan. Rank of constraints given in order were problem of late payment of sugarcane based farming system by sugar factories (98.33 per cent), it was ranked in first number, fragmentation and sub-division of land (97.5 per cent), it was ranked in second, high prices of quality seeds (92.5 per cent), it was ranked in third, lack of availability of micro-nutrient fertilizers (90.00 per cent), it was ranked in fourth, lack of timely availability of good quality seed at low price (88.33 per cent), it was ranked in fifth. In dairy farming rank of constraints given in order were problem low productivity in local cows and Buffaloes it was ranked in first number, lack of hospital and veterinary facilities in villages it was ranked in second followed by the some other constraints.

Keywords: linear programming; whole-farm plan; optimal crop combination; maximizing income, Employment generation, Livestock and Land allocation.

EFFECTS OF HEAVY METAL TOXICITY ON FREE LIVING NEMATODE *METARHABDITIS*

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Nematodes are used as model organisms in various biological studies. Toxicity tests using nematodes are an important aspect to analyze the biological effects of toxicants in soil environments. Among the different parameters of toxicity, lethality is the most widely accepted to assess the effects of heavy metals. A single species toxicity tests gave suitable initial step toward the ecological risk of assessment of pollutants. The toxicity effects of lead, mercury, copper and cadmium on *Metarhabditis* exposure to different concentrations on the mortality at two different age groups nematode were evaluated. Nematodes were extracted from manure by modified sieving and decantation and Bermann's funnel techniques and cultured on NGM supplemented with *E. coli* OP50 as food source. Solutions of $HgCl_2$, $Pb(NO_3)_2$, $CuCl_2$, $CdCl_2$ were used in 0, 10, 20, 40, 80 and 100 μM concentrations respectively. Two different age groups nematode i.e. six days old and twelve days old nematodes were used. Exposures were performed in 12 well sterile tissue culture plates and experiments were carried out at $25 \pm 1^\circ C$. All assays were replicated three times and the numbers of dead worms were counted in each well. The rate of mortality at 0, 10, 20, 40, 80 and 100 μM concentrations were analyzed in two different age groups nematode. Mortality rate of *Metarhabditis* after treatment with various concentrations of lead, mercury, copper and cadmium for 24hr and 48hr were significantly different. Among these heavy metals mercury is most lethal and cadmium is less lethal on both age groups nematode.

Keywords: Nematode, Toxicity, Heavy Metals, Mortality.

SOIL SUITABILITY AND MANAGEMENT CRITERIA FOR CROP PRODUCTION**RAMESH CHAND BANA*¹, RANJEET SINGH BOCHALYA¹, RAJ SINGH CHOUDHARY², SAPNA CHAUDHARY³,**¹*Division of Agronomy, Sher-e-Kashmir University of Agricultural Science and Technology, Chatha, Jammu-180009 (J&K) India,*²*Division of Soil Science and Agricultural chemistry, Sher-e-Kashmir University of Agricultural Science and Technology, Chatha, Jammu-180009 (J&K) India,* ³*Dolphin PG collage of Science and Agriculture, Chunni Kalan, FGS-140407, Punjab*

Each plant species requires definite soil and site conditions for its optimum growth. Although some plants may be found to grow under different soils and extreme agro-ecological conditions, yet not all plants can grow on the same soil and under the same environment. The conspicuous absence of Pinus species in inter-tropical and of eucalyptus in the temperate (cold) regions are examples. Since the availability of both water and plant nutrients is largely controlled by the physicochemical and micro environment of soils, the success and/or failure of any plant species, in a particular area, is largely determined by these factors. The deep rooted forest or orchard plantations respond differently to soil depth and soil texture than the shallow-rooted arable crops such as rice, wheat, green gram, black gram, pigeon-pea, groundnut etc. Several soil-site studies for different plant species have been reported in the literature. These illustrate how soil depth, (sub) soil texture, salinity and drainage conditions are related to soil-site quality. The objectives of various soil-site evaluation studies have been to predict and classify land for plant growth. Observations on growth inhibiting factors for certain species and tolerance of others to extremely adverse conditions have been evaluated by many scientists.

Keyword: Soil, Soil suitability classes, Land resources, production**RESOURCE USE EFFICIENCY OF SUSTAINABLE FARMING PRACTICE: A STUDY OF MAIZE AND RAJMASH INTERCROPPING UNDER NORTH-WESTERN HIMALAYAN REGION OF J&K****SANJEEV KUMAR¹, S.P. SINGH², RAVINDER SHARMA³ AND RAJ RANI SHARMA⁴**^{1,2}*Division of Agricultural Economics and ABM, SKUAST- J, Main Campus, Chatha-180009,* ^{3,4}*Department of Social Sciences, Dr. YSP UHF, Nauni, Solan (H.P.) 173230*

The Himalayan region extends all along the Northern boundary of India. The diverse eco-habitat of Himalayan region hosts a wide range of plant diversity as well as crop diversity on which native people rely for their food and nutritional security. Keeping in mind the end goal to expand the yield of crops and improve the livelihood security of hill farmers, distinctive frameworks have been identified, one of these frameworks is intercropping. The present study has been carried out under North-Western Himalayan region of J&K state. Bhaderwah and Bhalla blocks of Doda district of the state were selected purposively as these two blocks are having maximum area and farmers under maize and rajmash intercropping in the district. A sample of 100 farmers was drawn using multistage sampling technique. Cobb-Douglas production function and marginal value productivity (MVP) were the analytical tools used in analyzing the data. The results of the study revealed that elasticity coefficients of human labour (0.621) and manure & fertilizers (0.467) were positively significant at 5 per cent and 1 per cent, respectively while seed (-0.474) gave a significant negative elasticity coefficient. The coefficients for machine labour (0.125) and plant protection chemicals (0.413) were found to be statistically insignificant. The significant value of R^2 (0.88) indicated that the explanatory variables included in the model explained 88 per cent variation in the dependent variable (gross returns). The positive value of MVP for human labour and manure & fertilizers showed that additional one rupee spent on these inputs would add Rs. 3.172 and Rs.5.274, respectively while the negative MVP value of seed (-3.251) indicated that use of this input was more than the optimum and would decrease the gross returns with each additional unit of this input.

Keywords: Cobb-Douglas production function, Marginal value productivity, Elasticity**RESPONSE OF DIFFERENT LEVELS OF N P K AND FYM ON SOIL HEALTH AND YIELD OF OKRA (ABELMOSCHUS ESCULENTUS L.) VAR. ARKA ANAMIKA****PRABHOO SINGH***Department of Soil Science and Agricultural Chemistry, S.K.N. COA, JOBNER*

A field experiment was conducted during *Kharif* (rainy) season of 2016 on Response of different levels of N P K and FYM on Soil Health and Yield of Okra (*Abelmoschus esculentus L.*) Var. Arka Anamika” on central research farm department of Soil Science and Agricultural Chemistry, SHUATS, Allahabad. The soil of experimental area falls in order Inceptisol and soil texture was sandy loam. There were nine treatments combination replicated thrice in 3x3 factorial Randomized Block Design. The best application of T8 - (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹) has effect on physical and chemical property

of soil and yield of okra. The observed in post harvest soil resulted were significantly increased maximum values of water holding capacity (63.42%), % pore space (62.17%), organic carbon (0.74 %), nitrogen (304.90 kg ha⁻¹), phosphorus (33.58 kg ha⁻¹) and potassium (186.03 kg ha⁻¹) was with treatment T8 – (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹). The combination of T8 – (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹) showed slight decrease in pH (7.12), bulk density (1.30 Mg m⁻³), and particle density (2.51 Mg m⁻³), the same treatment EC (dS m⁻¹) was slightly increase 0.35 in post harvest soil. The maximum cost benefit ratio (C:B) 1:3.44, maximum gross return 224250.00, maximum net profit 159100 ha⁻¹, and highest yield 149.50 q ha⁻¹ with T8 – (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹).

Keywords: Soil nutrients, yield attributes, FYM, NPK and Okra.

EFFECT OF NUTRIENT MANAGEMENT ON CHEMICAL AND FERTILITY STATUS IN RELATION TO SOIL

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Long-term experiments are the primary source of information to determine the effect of nutrient management on soil sustainability. The long-term experiment plays an important role in understanding the complex interaction of plants, soils, climate and management practices and their effects on soil productivity. Since, sustainability of the production system depends on the sustainable use of soil resources, it is necessary to develop and adopt nutrient management technologies that increases the soil nutrient status and improves the soil chemical properties to keep lands productive on the sustainable basis (Ali *et al.*, 2012). It is evidence that all long-term nutrient management systems may not be sustainable as it may leads to depletion of natural resources of many agro-ecosystems jeopardising future productivity (Baishya *et al.*, 2015). Declining trend in soil chemical properties and nutrient status of soil due to continuous use of chemical fertilizers alone have been observed in several long term experiments all over India (Nambiar, 1994), while integration of organic sources sustain the productivity (Baishya *et al.*, 2015). Thus, the new paradigm of sustainable intensive cropping systems attempt to balance the system in which yields are increased from the same land while conserving resources and reducing negative impacts on the environment. It can be concluded that long-term studies are of utmost important to understand the impact of nutrient management practices under intensive agricultural production system; which ultimately emphasized that balanced fertilization is must to recognize the nutrient status and soil sustainability under long run (Katyal and Gangwar, 2000).

CHARACTERIZATION AND CLASSIFICATION OF SOILS OF SOHAG-RED SEA ROAD SIDES, EASTERN DESERT, EGYPT

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An investigation was carried out to characterize and classify the soils of area about 204 km² where lies between 26°⁰.75, 26°⁰.65 latitudes (N) and 32°⁰.70, 32°⁰.90 longitudes (E) of Sohag-Red Sea Road-sides, Eastern Desert, Egypt. Twelve representative pedons were chosen based on six mapping units identified from the DEM extracted from the Landsat 8 ETM+ satellite image. All pedons were moderate to deep in depth, well drained, slightly to strongly alkaline in soil reaction (7.6-8.4), slightly to moderately saline (3.5- 16 dS m⁻¹), low in organic matter (0.1-0.4%), CEC is low (1.5-7.0 cmol (p+) kg⁻¹), Calcium Carbonates ranged from (1.2-18.2%). Regarding nutrients, the soils were low in available N (1.5-30 kg ha⁻¹), low in available P 1.0-9.0 kg ha⁻¹, medium to high in available K (100-680 kg ha⁻¹). Further, the soils were low to moderate in available Fe, Mn, Zn and Cu. Soil classification of the investigated area done according to the field survey, morphological description and soil analyses. Two orders of Entisols and Aridisols were recognized representing three subgroups Typic Torriorthents, Typic Torripsamments and Typic Haplocalcids. These results can be used by decision makers to focus on prospective agricultural areas and to achieve land reclamation and better agricultural production.

Keywords: Characterization – Classification – Sohag Red Sea.

VARIATION IN SPECIATION AND AVAILABILITY OF PHOSPHORUS IN PADDY SOIL**AMIT DHUDHWAL***Department of Soil Science and Agricultural Chemistry, SKNCOA (SKNAU)- Jobner, Jaipur Rajasthan (India)*

There is a global concern about the depletion in phosphorus (P) resources in the near future. Some attempts for effective reuse of P, including recovery from municipal wastes, have been conducted. However, a strong sorption of P onto some minerals may result in low P availability for crops. Therefore, it is necessary to understand the speciation of the chemical forms of P and to elucidate the relationships between P availability and chemical forms of P in soil. This study focuses on the variation in P speciation and the chemical forms of available P in a paddy soil. Incubation experiments with/without drainage, simulating the situation in a paddy field, were performed at a laboratory scale to evaluate the variation in speciation and P availability in soil. The speciation of P was analyzed according to Wilson's sequential extraction method and measured using Bray No.2 and Truog methods. Two kinds of chemical forms, i.e., Fe and Mn (oxy)hydroxides (Fe-Mn-P) and organic and biogenic P (Org-P) were predominant in the soil, and they were easily interconverted by changing soil redox conditions. Available P using the Bray No. 2 method was increased in 21 days owing to the anaerobic condition; thereafter, it reached a constant value by the end of both the incubation experiments. However, a drastic decrease was detected in available P, using Truog-P. It occurred owing to the drying of soil, which suggested that some chemical form(s) of P other than Truog-P might be generated. A comparison between the concentrations of available P and that of each chemical form showed that available P included some Org-P, which might be less absorbed by plants compared to the exchangeable and pore water fraction (Ex-P) and Fe-Mn-P. We conclude that anaerobic soil conditions play an important role in the efficient consumption of P.

ROLE OF PLANT HORMONES IN PLANT DEFENCE**ANNU*, AJIT SINGH RATHI, RINKU RANI***Department of Plant Pathology, Chaudhary Charan Singh Haryana Agricultural University, Hisar Haryana, India*

Plant hormones play important roles in regulating developmental processes and signaling networks involved in plant defence to biotic and abiotic stresses. Progress has been made in identifying the key components and understanding the role of salicylic acid (SA), jasmonates (JA) and ethylene (ET) in plant responses to biotic stresses. Other hormones such as abscisic acid (ABA), auxin, gibberellic acid (GA), cytokinin (CK), brassinosteroids (BR) and peptide hormones are also implicated in plant defence signaling pathways but their role in plant defence is less well studied. Plant hormones interact in complex networks to balance the response to developmental and environmental cues and thus limiting defense-associated fitness costs. A complex network of signaling pathways mediates defense responses as well as plant development and abiotic stress adaptation. Hormonal signaling pathways share hubs for crosstalk, which include DELLA, JAZ, and BZR1/BES1 proteins. A significant progress has been made in elucidating the roles of phytohormones in rice immune responses. The negative role of GAs in rice immunity is a breakthrough for the mechanism underlying the virulent strategy of *G. fujikuroi*. In general, growth-promoting hormones such as auxin and GAs are susceptible factors for pathogen infection on rice plants, whereas growth-repressing hormones such as SA and JA are resistant factors. However, there is exception to this generalized concept.

Keywords: Pathogens, abscisic acid, auxin, hormone crosstalk, salicylic acid, trade-off

MANAGEMENT OF ALTERNARIA BLIGHT OF RAPESEED-MUSTARD**ANUPRIYA¹, PRAHLAD²**¹*Dept. of Plant Pathology, College of Agriculture, Rajmata Vijayaraje Sindhiya Krishi Viswavidhalya Gwalior (474002), India*²*Dept. of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner, Rajasthan (334006), India*

Three systemic fungicides: Topsin-M (Thiophanate methyl, 70%WP), Ridomil MZ (Mancozeb, 64% + Metalaxyl, 8%WP), and Bavistin (Carbendazim, 50%WP) alone and in combination with four non-systemic fungicides Captaf (Captan, 50%WP), Indofil M-45 (Mancozeb, 75%WP), Indofil Z-78 (Zineb, 75%WP), and Thiram (Thiram, 75%WP) were evaluated both in vitro and in vivo for their effectiveness to manage Alternaria blight of rapeseed mustard caused by *Alternaria brassicae*. A pure culture of the pathogenic fungus was applied in the field at 2 g colonized sorghum seeds kg⁻¹ soil. All the fungicides were evaluated for their efficacy at various concentrations, 50, 100, 150, 200 and 500 ppm, and were sprayed in the field at 0.2% a.i. l⁻¹. All fungicides significantly reduced the severity of the disease but Ridomil MZ was most effective. Topsin-M at a concentration of 500 ppm was the most effective in reducing radial growth of the pathogenic fungi (74.2%). Ridomil MZ reduced disease severity by 32% and

was followed in effectiveness by the combination Bavistin+Captaf (26.5%). Maximum yield was obtained in plots sprayed with Bavistin+Captaf (1198 kg ha⁻¹) followed by Bavistin+Indofil Z-78 (1172 kg ha⁻¹). It was worth noting that the highest net profit as well as the highest cost-benefit ratio was obtained with Bavistin+Indofil Z-78, followed by Bavistin+Captaf.

Key words: *Alternaria brassicae*, chemicals, systemic fungicides.

MEAN PERFORMANCE & VARIABILITY ANALYSIS IN LONG FRUITED BRINJAL (*SOLANUM MELONGENA* L.) FOR CHHATTISGARH

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17 brinjal genotypes were studied in randomized block design for sixteen quantitative characters. The magnitude of PCV was higher than the concurrent GCV for all the characters. High genetic advance as percent of mean was observed for fruit yield per hectare followed by number of flower per cluster, fruit yield per plant average fruit weight, calyx length, number of primary branches per plant, fruit diameter, pericarp thickness, days to 50% flowering, fruit length, number of fruits per cluster, whereas, moderate genetic advance as percent of mean was observed for plant height, pedicel length, plant spread and days to first marketable fruit maturity and low genetic advance as percent of mean was observed for number of cluster per plant. High heritability coupled with high genetic advance was observed for the characters like number of primary branches per plant, number of flowers per inflorescence, average fruit wt. (g), fruit yield per plant (kg) and fruit yield per hectare (q).

INTEGRATED PEST MANAGEMENT OF CHICKPEA (POD BORER) *HELICOVERPA ARMIGERA* HUBNER (LEPIDOPTERA: NOCTUIDAE)

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Chickpea (*Cicer arietinum* L.) commonly known as Bengal gram. The pod borer (*Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae)) is responsible for causing up to 90% damage in chickpea due to its regular occurrence from the vegetative growth to the pod formation stage. In order to manage this problem, growers are tempted to increase the amounts of pesticides, but indiscriminate or injudicious use of pesticides has resulted in residues in the food chain, pesticide resistance, and pest resurgence, in addition to causing harm to non-targeted beneficial organisms and the environment. Here, we reviewed the sustainable approaches to reduce the incidence of pod borer and achieve sustainability in chickpea production systems through the adoption of an integrated approach involving host plant resistance, good agronomic practices, and judicious use of chemical and biological methods. We found that the following major points have been reported to reduce the survival and damage of pod borer: (1) use of resistant varieties (the cheapest and the best method of gram pod borer management); (2) implementing a number of good agronomic practices, such as early sowing with optimum planting density and fertilizer levels, including inter/trap crops (coriander, mustard, linseed, sunflower, sorghum, and marigold) and installing animated bird perches and T-perches at 2 m distance of predatory zones; and (3) monitoring pod borer through pheromone traps (which is also necessary to understand the major factors influencing pest population and to make the pest control program more effective). Integrating all of these approaches with biological control has shown some encouraging results for sustainable pod borer management and has resulted in high chickpea yields. This review highlights examples of successful management approaches from past studies that were implemented in experimental and farmers' fields. These approaches can be explored as reproducible practices for managing the pest in locations with similar *H. armigera* concerns. We conclude that an integrated approach is most effective for long-term sustainable management programs.

A STUDY OF SOCIO PSYCHOLOGICAL FACTORS ASSOCIATED WITH THE CREDIT BEHAVIOUR OF FARMER IN ETAAH DISTRICT OF U.P.**AUSAN SINGH***S.S. Memorial Mahavidhyalaya, Sutiyan mod, Takha, Etawah*

To Study of Socio Psychological factor associated with the availabilities and utilization Pattern of credit of borrowing farmer. there farmer categories wise small farm medium farm and large farm are associated in agri crop loan, agri crop and term loan and both in this way available under crop loan 71.26 percent and agri term loan about 28.74 and crop loan as well as agri term loan about 12.89 percent and utilization of crop loan as well as agri term loan in small farmer in crop loan about 68.51 percent and medium farmers in crop loan about 21.55 percent and large farmer in crop loan about 9.94 percent. Agri term loan utilized under to fertilizer as well as small farmer about 54.55 percent medium farmer about 58.33 percent and large farmer about 55.56 percent in other things utilized loan for more than one things under small farmers about 77.42 percent, medium farmer about 23.08 percent and large farmer about 50.00 percent. farmer showing of utilization crop loan in different purposes. Maximum respondent have utilized loan for both purpose seed and fertilizer in case small farmer and large farmer of farm size. majority of 75.00 percent respondent have avail loan range of Rs. 50000 to Rs. 100000.

STUDIES ON THE EFFECT OF DIFFERENT LEVELS OF BORON AND BIO FERTILIZERS ON GROWTH AND YIELD OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL)**R.A AWASTHI***Dept. Of Horticulture, K.A.P.G Allahabad (U.P)*

Studies of the effect of different levels of Boron and bio-fertilizers on growth and yield of Tomato (*Lycopersicon esculentum* Mill.) was carried out during 2018-2019 at research field of department of Horticulture ,K.A.P.G , Allahabad. The experiment included 12 treatments. It was concluded that mixed application of Bio-fertilizers, VAM + Azospirillum + 75% Boron (B3F2) was found to be superior over all levels of Bio-fertilizers and Boron for growth and yield of Tomato. The yield was found maximum 15.24 tonnes/ha with B3F2 in comparison with B0F3 which recorded minimum yield of 7.81 tonnes/ha.

Key words: Tomato, biofertilizers, boron, growth, yield.**CONSERVATION OF AGRICULTURAL BIODIVERSITY AND SUSTAINABLE USE IN AGRICULTURE****OM PRAKASH YADAV^{1*}, A. K. RAZDAN¹, RAMESH CHAND BANA², SURBHI KOHLI¹ AND KANHEYA LAL YADAV³**

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Cultural diversity in remote mountain regions is closely linked to biodiversity, as there is a symbiotic relationship between habitats and cultures, and between ecosystems and cultural identity; indeed, religious rules and rituals often strengthen this relationship and are characterized by a conservation ethic. In order to allow the earth to continuously play its mother ship role and to enhance the biodiversity, man developed a body of laws and regulations known as taboos to regulate his relationship with his environment. Furthermore, he developed farming systems and fashioned farm tools, which helped him to sustain the biodiversity. Imposition of legislation to enhance the biodiversity is likely to worsen the predicament of the people. Therefore, contemporary biodiversity conservation needs to take into account alternative economic activities, which will relieve the land from the constant pressure it is being subjected today. The data collected are analyzed within the framework of traditional knowledge-based systems methodology, using the conservation purpose of rules and practices as a means of typifying the information on sacred natural sites (forests/groves, pastures, water bodies), on the phenomenon of dedicating forests to a deity, on the inherent taboos regarding resource exploitation, and on other traditional beliefs and customs, in order to understand the environmental and conservationist implications of these rules and practices. The meaning of the term conservation is itself controversial. We propose that to qualify as conservation, any action or practice must not only prevent or mitigate resource overharvesting or environmental damage, it must also be designed to do so. The conditions under which conservation will be adaptive are stringent, involving temporal discounting,

economic demand, information feedback, and collective action. This knowledge and related conservation rules need to be strengthened in the face of current change.

Keywords: Nature conservation, Culture, Natural Resources and Genetic diversity.

CROP IMPROVEMENT BY CONVENTIONAL BREEDING OR GENETIC ENGINEERING

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Genetic Engineering has offered tremendous scope and potential to conventional Breeding methods of crop Improvement, crop protection, crop quality management and other horticultural traits. Genetic Engineering extends tremendous opportunities in fruit production by providing new genotypes for breeding purpose, supply of healthy and disease free planting material, improvement in fruit quality, enhancing shelf-life, availability of bio-pesticides, bio-fertilizers, etc. Genetic engineering consists of isolation of a gene of interest, ligating that gene with a desirable vector to form the recombinant-DNA molecule and then transferring that gene into the plant genome to create a new function. Horticultural biotechnology has been a leading example in the following mentioned areas for more than two decades, right from the commercialization of the first ever transgenic crop in the form of Flavr-Savr transgenic tomato with enhanced shelf life trait. Currently transgenic maize, soybean, cotton, and other crops, with genetically modified pest resistance, herbicide resistance, and quality-improved crops, have been developed and grown worldwide. The RNAi technology has found its most powerful expression in plant biology these days. The applications of this technology cover a wide range from producing insect, viral and disease resistant plants to developing designer flower colors by knocking down the expression of certain endogenous genes. Biotechnological interventions that could increase the efficiency of horticultural crop improvement are essential to generate plants with several desirable traits.

Key words: Genetic engineering, Horticultural crops, Insect resistance, RNAi.

GENETIC DIVERSITY ASSESSMENT AMONG TEAK (*TECTONA GRANDIS LF*) POPULATIONS THROUGH RAPD MARKER

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Teak is a deciduous forest tree species belongs to the family Lamiaceae. It is one of the world's premier hardwood timbers due to fine grain and durability. The present experiment was carried out to assess the genetic diversity among teak population of South Gujarat through RAPD marker. 20 primers produced clear and reproducible band out of 30 RAPD primers. The 20 random primers amplified a total of 192 loci out of which 150 (78.13 %) loci were polymorphic. The number of loci amplified by these RAPD primers ranged between 4 (OPD 02 and OPF 09) to 15 (OPF 01). The percentage of polymorphism ranged from 25 % for OPD 02 to 100 % for OPF 06. Highest Marker Index (2.99) and resolving power (8.60) observed with OPD 03 and OPF 01, respectively. Maximum Jacards's similarity (0.81) observed between Vansada and Dharampur, indicating a close relationship between these populations. However, the smallest Jacard's similarity values (0.47) were observed between Vyara and Bardipada-B. Dendrograms of the accessions were constructed based on the Jacard's coefficient gave exact similar clustering of the ten populations. Populations from Dang forest division stayed in same cluster except Bardipada-B population, however all the populations from Valsad Forest division fall in same cluster. The PCoA results corresponded well with the cluster analysis obtained through UPGMA. The first three coordinates accounted for 20.53, 14.90 and 13.31 per cent of the total variance, respectively. Thus, the total cumulative variance accounted by these three coordinates was 48.73 per cent. Overall, the Vyara population was distinct than the other population. The information on the genetic variation between populations will be useful for conservation and sustainable management of teak genetic resources in south Gujarat region in each forest divisional circle.

Keywords: *Tectona grandis*, Populations, RAPD, Diversity, PCoA

STUDIES ON INTERACTION OF MELOIDOGYNE INCOGNITA AND FUSARIUM OXYSPORUM IN BLACKGRAM & MANAGE THE DISEASE COMPLEX USING BIO CONTROL AGENTS.**DILIP KUMAR, JAYANT BHATT AND DEVENDRA KUMAR***Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur, MP-482004, India*

The experiment on interaction of *Meloidogyne incognita* and *Fusarium oxysporum* in blackgram & manage the disease complex using bio control agents was conducted under pot conditions at the glass house of Department of Plant Pathology, J.K.V.V. Jabalpur (M.P.) during kharif season of 2014-15. The interaction of nematode and fungus, significant reduced the plant growth parameters in blackgram. Pathogen interaction the plant height i.e. (13.40cm), length of root (11.52cm), fresh shoot weight (0.60g), root weight (0.58g), and the dry shoot reduced up to (0.29g). The use of bio control agents reduced the infection of pathogen which resultant the increase in plant height (19.02cm). In case of *Paecilomyces lilacinus* followed by *Pochonia chlamydosporia* (17.70cm). The root length was reduced (18.38 cm), with *P. lilacinus* and (11.24 cm), *Pochonia chlamydosporia*. The fresh weight of shoot (0.89g) recorded with *P. lilacinus* which remained almost at par with *P. chlamydosporia* (0.87g). The Dry weight of shoot was also significantly increased (0.41g) in *P. lilacinus*. Against the minimum (0.26g) in control increased dry root weight of black gram. Maximum (0.39g) dry root weight was recorded with *P. lilacinus* followed by *P. chlamydosporia* (0.36g), Minimum number (8.20) of galls were recorded in *P. lilacinus* followed by *P. chlamydosporia* (9.80), Maximum (1890.20) nematode recovery was noted in inoculated control.

STUDY ON BIOCONTROL AGENT BASILLUS SUBTILIS APPLICATION FOR THE MANAGEMENT OF BROWN SPOT OF RICE IN MADHYA PRADESH**DINESH ALAWA, YOGESH KUMAR CHELAK, S.K. TRIPATHI, BHRAT KUMAR AND RANI DEVI BANSAL***Department of Plant Pathology, College of Agriculture, Rewa-JNKVV, MP, India-486001*

Rice (*Oryza sativa* L) suffers from number of fungal diseases and many of them occur at times in fairly severe form and cause substantial loss to the crop yield. Among the major fungal diseases of rice, Brown spot caused by *Helminthosporium oryzae* occupies not only important position but also historical interest. The disease is prevalent throughout the rice growing tracts of the country. The disease affects the leaves and glumes of the host plant, seedling, sheaths, stems and grains quality and causes significant yield losses. It is found to be pandemic in heavy rainfall areas viz; Assam, West Bengal, Chhattisgarh and Madhya Pradesh under poor fertilizer and water management. The disease is generally severe in soils of low pH, low available Potassium and also deficient essential and trace elements under upland ecosystem. Keeping these facts in view, the study was carried out to evaluate the different concentrations of various newly evolved fungicides *In vitro* as well as the efficacy of exogenous application of various biocontrol agent *Bacillus subtilis* combinations in different mode of applications in the field against highly susceptible variety PS-4 for controlling rice brown spot disease. It was noted that among the tested fungicides at different concentrations, Hexaconazole 5% EC at 750 ppm was found to be highly effective to check the mycelia growth of *H. oryzae* (11.3 mm) followed by Merger (Tricyclazole 18% + Mancozeb 62% WP (13.6 mm) over untreated check (87 mm) after 5 days of incubation. Spraying of newly evolved fungicides led to a significant reduction in disease severity of brown spot in addition to a significant increase in the grain yield and its component. Of the tested fungicides, ICF-110 (Tricyclazole 45% + Hexaconazole 10% WP) was found to be highly effective in controlling the brown leaf spot 43.01% followed by Hexaconazole 5% EC (33.64%) and increased the grain yield significantly 53.73% over untreated check. In regard to application of Biocontrol agent *Bacillus subtilis* in different mode of application Seedling dip + 2nd at 15 Days after transplanting and 3rd application @ 500g/ha gave optimum percent disease control 4.56% followed by seed treatment + 2nd at 15 Days after transplanting and 3rd application @ 250g/ha (29.57%) over untreated check. Thus, it may be concluded that excessive and improper use of fungicides presents a menace to the health of humans, animals and environment. Many of these chemicals are also too expensive, uneconomical for the poor farmers therefore, biocontrol agent *Bacillus subtilis* as seed dressing and its foliar application may be recommended to the growers for effective management under rain fed and irrigated ecosystem to combat the economic losses.

STATUS OF SEED ASSOCIATED MYCOFLORA OF SOYBEAN IN MADHYA PRADESH**DINESH DHURVEY, VIVEK HAMANE, SHIKHA GAURI AND KUNIKA SILODIA***Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, MP, India-482004*

Soybean (*Glycin max* (L.) Meril) is a worldwide economic crop and the most important cultivated legume with hundred of food, feed and industrial uses. The crop is an excellent source of vegetable oil and protein. In an investigation, seed sample of soybean variety JS 335 were obtained from farmer of 7 district covering 7 agro climatic zones of Madhy Pradesh during 2015-16. The

collected seeds were analysed for associated mycoflora by employing standard Blotter method (ISTA, 1996). Five major mycoflora were detected on incubated soybean seeds. The association of *Macrophomina phaseolina* was in the range of 4.0 to 17.0%. The seeds obtained from farmer of Jabalpur exhibited maximum association. Maximum association (13%) was noticed in the seeds from Betul district while 18% soybean seeds exhibited the association of *Fusarium oxysporum* which were obtained from Betul district. Association of *Aspergillus niger*, *Aspergillus flavus* was in variable proportion. Seed associated mycoflora caused seed rot and seedling decoy and influenced the germination adversely.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTION POTENTIAL OF FRENCHBEAN (*PHASEOLUS VULGARIS* L.) UNDER THE EASTERN HIMALAYA

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Frenchbean (*Phaseolus vulgaris*) is commonly known as kidney bean, common bean or rajmash is highly nutritious crop and used as mostly as green vegetable in Nagaland. It fetches the highest price among pulses, thus economically a remunerative crop. In Nagaland, agriculture is the main source of livelihood for poor tribal people and *jhum cultivation* is most common form of agriculture. Though, climate and other natural resources are favourable, still farmers are not able to take up frenchbean cultivation as vegetables consumption on a large scale for enhancing income generation due to several problems. Among them fertility management is most important attributes to determine crop productivity in the regions. Therefore, keeping these things in view to achieve higher productivity as well as nutritional security of poor tribal's in the states, the present experiment was undertaken at Agricultural Research Farm of Indian Council of Agricultural Research, Research Complex for North Eastern Hilly Region, Nagaland Centre, Jharnapani, Medziphema, during *rabi* season of 2013-2014 and 2014-2015. The experimental site was located at 25°45' N latitude, 93°53' E longitude with mean altitude of 295 m above mean sea level. Soil of the experimental field (0–15 cm) was sandy loam (Inceptisol, sand of 58.2%, silt of 11.8% and clay of 30%) and acidic in reaction (pH 5.7). The fertility status of experimental site was low in oxidizable organic carbon (0.91%), high in minerable N (223.3 kg ha⁻¹) and available K (146 kg ha⁻¹) and moderate in available P (12.8 kg ha⁻¹) as per Indian context. Four fertility levels viz. combining inorganic (NPKS) and organic (farm yard manures) were allotted to main plot [100% RDF (IN), 100% RDF (ON), 75% RDF (IN) +25% RDF (ON), 100% RDF (IN)+ 25% RDF (ON)] and five different combinations of biofertilizers (*Rhizobium*+*Bacillus polymyxa*+*Pseudomonas fluorescence*) and micronutrients (Zn and Mo) were subjected to [control, PGPR+5 kg Zn ha⁻¹, PGPR+1.5 kg Mo ha⁻¹ and PGPR+5 kg Zn ha⁻¹+1.5 kg Mo ha⁻¹] sub-plot in sub-plot in split plot and replicated thrice. Recommended dose of fertilizers (100% RDF) represents 120-60-40-30 kg NPKS ha⁻¹. Results revealed that significantly higher seed (1690 kg ha⁻¹) and green pod yield (5418 kg ha⁻¹) had recorded with 100% RDF (IN) +25% RDF (ON), respectively. Similarly, combined application of bio-fertilizer and micronutrient i.e. PGPR+5 kg Zn ha⁻¹+1.5 kg Mo ha⁻¹ had higher seed (1611 kg ha⁻¹) and green pod yield (5162 kg ha⁻¹). Application of 100% RDF (IN) +25% RDF (ON) had recorded to increase the seed and green pod yield to the tunes of 11, 14%; 29,27% and 14,14% compared to 100% RDF (IN), 100% RDF (ON), 75% RDF (IN) +25% RDF (ON), respectively. Similarly, combined application of PGPR+5 kg Zn ha⁻¹+1.5 kg Mo ha⁻¹ had recorded to increase the seed yield and green pod yield to the tunes of 16, 18%; 10,10% and 6,5; 5,5% compared to control, PGPR+5 kg Zn ha⁻¹, PGPR+1.5 kg Mo ha⁻¹, respectively. Based on the present study, it was concluded that to achieve the maximum higher yields and monetary return, frenchbean can be grown as *rabi* crop with application of 100% RDF (IN) +25% RDF (ON) along with PGPR+5 kg Zn ha⁻¹+1.5 kg Mo ha⁻¹ under the foot hill condition of Nagaland.

EPIDEMIOLOGICAL STUDIES TO CRITICAL ENVIRONMENTAL PARAMETERS FAVOURING INFECTION AND DEVELOPMENT OF DISEASE

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An experiment was laid out on epidemiological studies with five different dates of sowing with replicated four times during 2014-15 and 2015-16 at experimental field, Department of Plant Pathology, RVSKVV, Gwalior (M.P.). The meteorological parameters data was collected at weekly interval during crop season of both years from the Meteorological Department, College of Agriculture

Gwalior. The data revealed that stem rot infection is negatively and significantly influenced by maximum temperature ($r = -0.697^*$) and sunshine hrs ($r = -0.855^{**}$), while, the maximum relative humidity ($r = 0.883^{**}$) and minimum relative humidity ($r = 0.871^{**}$) showed highly significant and positive correlation with the *Sclerotinia sclerotiorum* infection. Further, for predicting the impact of the individual meteorological parameters a regression study was carried out. Further, The regression equation $Y = -40.518 + 0.475 X_3$ indicates that average maximum in relative humidity should be at least 85.3% and thereafter, with 1% increase in relative humidity the stem rot infection may increase by 0.47 cm. Similarly, the disease increases by 0.06 cm per unit in minimum relative humidity for the infection of stem rot of mustard. This study concluded that the data would be helpful for the predictions of stem rot infect and its management.

FOOD SECURITY UNDER CLIMATE CHANGE: SUSTAINABLE FOOD PRODUCTION

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Current trends point to continued human population growth beside climate change increase the pressure on improving the capacity of agricultural system to produce food and fiber without further sacrificing the regional and natural resources. The foremost challenges which agriculture is going to face in coming decades will be to produce sufficient food and fiber for emergent global population by keeping in mind the environmental sustainability. Climate change has immense effects on agriculture and therefore human hunger currently and in the decades ahead. The degradation and scarcity of natural resources, pollution resulting from agricultural production, food losses and wastage, and food safety (both quantitative and qualitative), both in terms of production and post-harvest handling, are critical issues that must needs to concern to attain sustainable agricultural production globally. Recent agricultural practices that have greatly increased global food supply have had inadvertent, detrimental impacts on the environment and on ecosystem services, highlighting the need for more sustainable agricultural production.

Keyword: Food security, Climate change, Sustainable management

EFFECT OF AZOTOBACTER ON SEED GERMINATION OF ONION

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Azotobacter is been studied for nitrogen fixation bacteria is soil and effect positively on growth and yield. But its role as a priming agent is not explored much. Very less literature is available thus present study was carried out to evaluate the response of bio-fertilizer (*Azotobacter*) on germination and seedling growth in case of onion. Doses (T_0 : water, T_1 : 0.33ppm, T_2 : 0.66ppm, T_3 : 0.99ppm, T_4 : 132ppm, T_5 : ppm) were decided on the basis of nitrogen requirement by the germinating seedling re used for investigation. Germination was conducted on 'between paper method' and observation for parameters viz; germination percent, shoot length, root length, seedling vigour indices was recorded on 6th & 12th day. The germination was observed higher in T_5 (85%) treatment in comparison to other treatments. The shoot length T_5 treatment (13cm), root length (1.43%), with increase vigour index was reported higher in T_5 treatment followed by T_4 in comparison to all other treatments. The conclusion of the present study is that *Azotobacter* may play effective role by using as a priming agent in improving seed germination and seedling growth of onion seeds.

EFFECT OF FERTIGATION AND BIO-FERTILIZERS ON GROWTH AND YIELD ATTRIBUTES OF SPROUTING BROCCOLI (BRASSICA OLERACEA VAR. ITALICA)

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Broccoli (*Brassica oleracea*) is an herbaceous annual or biennial grown for its edible flower heads which are used as a vegetable. The broccoli plant has a thick green stalk, or stem, which gives rise to thick, leathery, oblong leaves which are gray-blue to green in color. The plant produces large branching green flower heads covered with numerous white or yellow flowers. Broccoli can be annual or biennial depending on the variety and can grow to 1 m (3.3 ft) in height. Broccoli may also be referred to as sprouting broccoli and likely originates from the Mediterranean although the exact location has not been determined. The field experiment was conducted in clay loam soil of the Horticulture farm, College of Agriculture, Rewa, JNKVV during rabi 2017-18. The

experiment, comprising of 18 treatment combinations replicated four times, was laid out in random block design with three fertigation levels of NPK (F25, F50 and F75) with main plot and two levels of biofertilizers (without and with Azotobacter + PSB) were added in sub plots. The results of the study have clearly shown that application of fertigation levels (F75) significantly increased yield attributes and yield (volume of head, diameter of head, weight of main head and secondary head, total head yield per bed and per hectare and biological yield). While biofertilizers (Azotobacter + PSB) in combination significantly enhanced the growth parameters (plant height, number of leaves, leaf area), yield attributes and yield (volume of head, diameter of head, weight of main head and secondary head, total head yield per bed and per hectare and biological yield).

INTEGRATED MANAGEMENT OF MAJOR DISEASES OF MUNGBEAN

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Major diseases of mungbean, namely, wet root rot (*Rhizoctonia solani*), cercospora leaf spots (*Cercospora canescens*) and yellow mosaic (*Mungbean Yellow Mosaic Virus*) by using different combinations of an insecticide, fungicide, and bio-formulation. A combination of seed treatment with Thiamethoxam (Cruiser™) at 4 g kg⁻¹, Carboxin (Vitavax™) at 2 g kg⁻¹ and Pusa 5SD (*Trichoderma virens*) at 4 g kg⁻¹ followed by simultaneous foliar sprays of Thiamethoxam (Actara™) 0.02% and Thiophanate methyl 15%+COC40WP 0.15% at 21 and 35 days after sowing resulted in the highest seed germination and grain yield in mungbean with the lowest intensities of cercospora leaf spots and mungbean yellow mosaic, and moderate incidence of wet root rot. The lowest whitefly population was also observed in this treatment during all stages of the crop. Use of *T. virens* based bio-formulation Pusa 5SD with insecticide Thiamethoxam has been effectively demonstrated for the first time along with fungicides Thiophanate methyl 15%+COC40WP for the management of the major diseases of mungbean.

Keywords: Integrated, pest, protection and control

IMPACT OF HERBICIDES ON SOIL MICROBIAL DIVERSITY

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Herbicides use is increasing throughout the globe due to increasing labor cost, choice of application of herbicides, quick weed control in crop and non-crop areas. In India, herbicide use has increased up to 30% during the last 10 years in the country. In India out of the total consumption of pesticides, insecticides are 80% followed by herbicides (15%), fungicide (1.46%) and others (3%). Whereas, globally out of the total consumptions of agrochemicals herbicides consumptions is 47.5% followed by insecticides (29.5%), and fungicides 17.5% and others account for 5.5% only. Herbicide application is more common in wheat crop (44%), followed by rice (31%), plantation crops (10%), soybean (4%), and other crops (11%).

Herbicides are synthetic chemical in nature therefore; excessive and repeated use may pose residue problems that have adverse effects on non-target organisms. The issue of the impact of herbicides on the composition of soil microorganisms and the processes they direct has received more attention. Herbicides adversely affect the proliferation of beneficial soil microorganisms and their associated bio-transformation in the soil. The amount of applied pesticides reaching the target organism is about 0.1% while the remaining bulk contaminates the soil environment.

Keyword: Herbicide, Soil health, Microbial diversity, Productivity

IMPORTANCE OF BIODEGRADABLE FILMS FOR FOOD PACKAGING

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Today synthetic polymers are produced from petrochemicals and are not biodegradable. Persistent polymers generate significant sources of environmental pollution, harming wildlife when they are dispersed in nature. Plastic bags are choking our oceans. An estimated 50-80 million end up in our environment each year. Once they enter our precious water they do not go away. Plastic bags remain for centuries posing threats to wildlife by entanglement, suffocation and entering the food chain. Plastic production has increased from 0.5 to 260 million tonnes per year since 1950a. 40% of plastics produced every year is discarded into

Landfill. Every year, more than 500 billion plastic bags are distributed, and less than 3% bags are recycled. They are typically made of polyethylene and can take up to 1,000 years to degrade in landfills that emit harmful greenhouse gases. The use of biodegradable films for food packaging has been strongly limited because of the poor barrier properties and weak mechanical properties shown by natural polymers. The application of nano-composites promises to expand the use of edible and biodegradable films that reduce the packaging waste associated with processed foods this supports the preservation of fresh foods by extending their shelf life. Nanotechnology can be used in plastic food packaging to make it stronger, lighter or perform better. Antimicrobials such as nano particles of silver or titanium dioxide can be used in packaging to prevent spoilage of foods. Introduction of nanoparticles into packaging to block oxygen, carbon dioxide and moisture from reaching the food, and also aids in preventing spoilage.

Key word: Petrochemicals, Nano-composites, Biodegradable films, Food packaging

ECOFRIENDLY MANAGEMENT OF FUSARIUM WILT OF TOMATO CAUSED BY *FUSARIUM OXYSPORUM* F.SP. *LYCOPERSICI*

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Fusarium wilt of tomato is caused by the fungal pathogens, *Fusarium oxysporum* f.sp. *lycopersici*. It is a devastating disease that affects many important food and vegetable crops and a major source of loss to farmers worldwide. Initial strategies developed to combat this devastating plant disease include the use of cultural, physical and chemical control. None of these strategies have been able to give the best results of completely ameliorating the situation except for the cultural method which is mainly preventive. A good knowledge of the nature, behaviour and environmental conditions of growth of the disease agent is very important to controlling the disease development in that case. Biological control has been shown to be an environmentally friendly alternative. It makes use of rhizospheric and endophytic microorganisms that can survive and compete favourably well with the Fusarium wilt pathogen. They include plant growth-promoting rhizobacteria (PGPR) such as *Bacillus* spp. and *Pseudomonas* spp.. For PGPR to control or inhibit the growth of the Fusarium wilt pathogen, they make use of mechanisms such as indole acetic acid production, siderophore production, phosphate solubilization, systemic resistance induction and antifungal volatile production among others.

Keywords:- Biological control, Pathogen, Plant growth-promoting rhizobacteria

ADVERTIZING IMPORTANCE AND GENETIC IMPROVEMENT OF MOTH BEAN FROM A LAND OF SEMI-ARID TRACT- RAJASTHAN

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Moth bean originated in India, chromosome number $2n=2x=22$, Scientific name- *Vigna aconitifolia*, family-fabaceae, Crop is having typical papilionaceous flowers like other leguminous crops. It is considered as most drought resistance crop among *kharif* crops and mainly grown in Rajasthan (Arid and semiarid part of country). Maximum area and production also contributed by Rajasthan. Crop offers several advantages like minimizing wind erosion, Nitrogen fixation, nutritional quality and without much investment starting from land preparation to harvesting. In spite of its great advantage genetic improvement are still at low level. However sincere and deliberate effort of plant breeding made to exploit some improved varieties for farming community i.e Type - 1, Type-3, MG-1, Baleshwar-12 (Late maturing varieties-100-120 days), Jadia, Jwala, Maru Moth, ICPMO-800, ICPMO-912, CAZRI Moth-1 (Medium maturing varieties 90-100 days) and RMO-40, RMO-257, FMM-96, RMO-225 and RMO-435 (early maturing varieties- 75-90 days). However constraint in crop like it is susceptible to terminal drought, yellow mosaic virus, nematode, bean weevil and still there are lot of scope to increase the yield plateau for feeding an increasing population which can be initiated from introduction, screening of germplasm, evaluation, hybridization breeding, Mutation breeding, genetic engineering approaches etc. and the integrated approaches of exploiting traditional methods as well as non conventional method will be more suitable option in fluctuating environment. The content will be helpful in advertizing importance and needed genetic improvement of the crop.

Key word- Moth bean, drought, genetic improvement, improved varieties and Rajasthan

MANAGEMENT OF STEM AND ROOT ROT OF SESAME**RAVIT SAHU¹, PRAHLAD²**¹Dept. of Plant Pathology, College of Agriculture, JawaharLal Nehru KrishiViswavidyalaya Jabalpur(482001), ² Swami Keshwanand Rajasthan Agriculture University, Bikaner , Rajasthan (334006), India

Out of 27 entries evaluated against stem and root rot caused by *Macrophomina phaseolina*, only three entries viz., IC-205477, IC-205506 and Krishna were identified as resistant. Dates of sowing trials revealed that early sowing favored *Macrophomina* stem and root rot. Multiple regression equation between disease index and weather variables exhibited strong relationship among the different components of epiphytotics during 2002-03 and 2003-04 crop seasons ($R^2 = 0.989$ and 0.985). This disease appeared during second week of July in the field. Maximum apparent infection rate of 0.122 unit/day and 0.118 unit/day were calculated at July 25, during both years of experimentations, respectively. The mean temperature 26.86 to 28.93°C, mean relative humidity 77.49 to 79.4 per cent, rainfall 5.54 mm and 13.24 mm and 12 and 14 number of rainy days were favorable for maximum disease development. Seed treatment with a mixture of carbendazim 50 WP (0.1%) and thiram 75 WP (0.15%) recorded minimum PDI of 11.15 per cent and 9.91 per cent and highest seed yield of 637 kg/ha and 646 kg/ha during above mentioned crop seasons. First spray of carbendazim 50 WP (0.05%) + second spray of *T. viride* (107 spore/g) were found to be most economical for the management of the disease.

Keywords : *Sesamum indicum*, Stem and root rot, *Macrophomina phaseolina*, Management

EVALUATION OF URDBEAN CULTIVARS FOR RESISTANCE OR TOLERANCE AGAINST WHITE FLY (*BEMISIA TABACI* GENNADIUS) AND BIHAR HAIRY CATERPILLAR (*SPILOSOMA OBLIQUE* WALKER)**KRISHNA PATEL¹, M.A. ALAM¹, SACHIN KUMAR JAISWAL¹, INDRAJEET SINGH RAJAWAT¹ AND ANKITA SINGH²**¹Department of Entomology, College of Agriculture, Rewa, JNKVV, Jabalpur, MP, India-486001²Department of Extension Education, College of Agriculture, Tikamgarh, JNKVV-Jabalpur, MP, India-472001

Field experiment were carried out during Kharif, 2017 at instructional unit of JNKVV, college of Agriculture Rewa (M.P) studies include the evaluation of urdbean cultivars for resistance or tolerance interaction against White fly (*Bemisia tabaci* Gennadius) and Bihar hairy caterpillar (*Spilosoma oblique* walker) and Exploration of physical characters of the genotypes, responsible for the low infestation of the mentioned insects. The study concerning with the evaluation of urdbean cultivars for resistance or tolerance interaction against White fly had indicated that whitefly infestation on different cultivars started in the 2nd week of August 2017. In the fourth week after germination (35th SW); the highest population of 37.82 N&A /plant was recorded in check T-9 while minimum; 13.46 N&A /plant in TU 94-2. The check T-9 was found susceptible to whitefly while TU 94-2 appeared to be least infested genotype. The population of Nymph and Adult of whitefly was least 14.07/plant in TU 94-2 which was at par with Mash-1008, LBG-623, SHEKHAR-3, JU-3, SHEKAR-2, IPU 54-2, While check T-9 had indicated highest infestation of whitefly (42.96 N&A /plant). While Bihar hairy caterpillar infestation started in the third week after germination (34th SW); The highest population (8.36 larva / 10 plants) of Bihar hairy caterpillar was recorded in the eighth week after germination in genotype KPU 564-24 and the lowest (4.83 /10 plants) on Mash-1008. On the basis of overall response of different genotypes of urdbean: Mash-1008 appeared to be the least susceptible (4.83 larva /10 plants) genotype. Of course, it was at par with TU 94-2, PU-30 SHEKAR-2, IPU 54-2 and SHEKHAR-3. The genotype KPU 564-24 appeared as a susceptible genotype with infestation level of (8.33 larva /10 plants).

INTEGRATED FARMING SYSTEM FOR SUSTAINABLE PRODUCTION AND LIVELIHOOD IMPROVEMENT OF SMALL AND MARGINAL FARMERS OF WPZ OF UP**L.R.MEENA*, RAVI MALIK, ANUJ KUMAR AND AJIT KUMAR**

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Farming systems research is considered a powerful tool for natural and human resource management in developing countries like India. This is a multidisciplinary whole –farm approach and effective in solving the constraints of small and marginal farmers. The approach aims at increasing income and employment from smallholdings by integrating various farm enterprises and recycling of crop residues and by-products within the farm itself. It is characterized by small and fragmented land holdings, the whole family works on the farm, most of the work is done manually and most of the farm produce is consumed by the family. The interaction of biophysical, technological, institutional and socio-economic conditions leading to temporal and spatial variability among the

farming systems. It helps to capture the extent of productivity and profitability enhancement in the farming system contributing to augment spending by the household towards balanced diet. It is evident that value addition with intervention at small scale of the produce realized in the Integrated Farming Systems model has great potential. Keeping in view a farming system model was designed in the year of 2012 on 1.15 ha integrated farming system (IFS) model comprising of cropping systems; Sugarcane + cowpea (2:1) - Ratoon + cowpea (2:1)- Wheat; Rice-Wheat-Dhaincha (GM); Pigeonpea + Maize (1:2)-Chickpea-Okra; Maize-Berseem-Urdbean; Sorghum(F)-Mustard-Moong bean; round the year fodder production (Napier+cowpea/Napier+berseem+Subabool); horticulture (Guava, peach, pear and mango) in 0.26 ha, dairy (2 buffaloes+1cow) in 0.001ha including 2m³ bio gas and vermicompost unit in 0.001ha, fish cum poultry in 0.1ha, mushroom (button, milky and dhingri) in 0.001 ha developed for small and medium farmers of western plain zone of Uttar Pradesh provides round the year average production (28.70 t REY/year) from all the components when values of the other components converted into rice equivalent yield, gross profit (4.02lakhs/year) and net profit was (2.68lakhs/ha) and employment (341 man days/year). The model also meets around 85% of inputs requirement for different components within the farm, besides, providing all the commodities (cereals, pulses, oilseeds, vegetables, fruit, eggs, mushroom, milk and fish) required the farm family. Kitchen gardening and biogas units were also found to enable meeting household vegetable and fuel need to a great extent. The approach because of its diversified nature also safeguard farmers against climate hazards and cut down in production costs through adding recycled products and saving in cost of market inputs by 30-40% or more. Thus, it can be concluded that IFS model with cropping, dairy, horticulture, poultry, fishery, mushroom, vermicompost, boundary plantation and kitchen gardening was found highly productive and profitable as compared to existing farming systems which are presently being adopted by the farmers. Therefore, farmers need to switchover on the newly developed IFS models.

INTEGRATED FARMING SYSTEM MODEL FOR SUSTAINING PRODUCTIVITY AND LIVELIHOOD IMPROVEMENT OF SMALL FARM HOLDERS IN WESTERN PLAIN ZONE OF UTTAR PRADESH

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The economy of the India is very much linked with the advancement in agriculture and livestock sectors. The resource crunch small farm holders who constituted about 82% of more than 121 million farm families in India cultivating about 29 % or even less of the total consolidated and scattered arable land having an average holding size of 1.2 hectare with small and 0.4 hectare with marginal farmers. Undoubtedly, majority of the farmers are engaged in farming since long back but their main focus was on individual component rather than in an integrated manner. In past independence era a lot of efforts have been made aiming to increase the productivity of different components of farming system but lacking in their integration is not producing adequate dividends. Agricultural research emphasized mainly component and commodity based research involving development of animal breed, crop varieties, farm implements and machinery, fertilizer use and other production and protection technologies which enabled the farmers to grow more but at the same time over exploited the resources resulted in decreasing factor productivity, declining resource use efficiency and ultimately less farm productivity and profitability. It further poses the national problems like environmental degradation, ground water depletion and entry of toxic substances in to the food chain which has created alarming situation. To fulfill the basic needs of household including food, feed, fodder, fuel and fiber, etc. warrant an urgent attention to adopt the IFS models. The integration is made in such a way that product of one component should be the input for other enterprises with high degree of complimentary effects on each other. Cow dung mixed with crop residues and farm wastes may be converted in to nutrient rich and termite free vermicompost. The fishpond dykes comprising 20-30% can be used for growing cucurbits and fruit trees and also provide effective soil cover to check the soil erosion and also make the system economically viable. The silt (nutrient rich soil) of fishpond is utilized as manure to the crops. The fishpond water can be recycled by gravity and/or lift method as supplemental irrigation at critical growth stages while there is breakdown in electricity supply or long dry spell prevails. Oilseeds provide nectar for honeybee, edible oils for human being and oilseed cake for animal feed. INM can enhance the productivity of cereals by 0.5 to 1.0 t/ha. Processing of different products enhances the value addition to the extent of 25 to 50% besides generating 50-75 man days/family/year of employment. The preliminary research investigations under IFS approach advocated the benefits of productivity improvement by 30-50% and significantly more (200-300%) employment than arable farming depending upon the number and kind of enterprises and their management. Integrated farming system model has been developed to realize better productivity, profitability and sustainable production system which would help to solve the food, fuel, feed and energy crisis creating more employment avenues, ensure regular income and encourage agricultural oriented industry through significantly participation and involvement of small and marginal farmers.

PRODUCTIVITY AND ECONOMICS OF BER (*ZIZIPHUS MAURITIANA*) BASED HORTIPASTURE SYSTEM AS INFLUENCED BY INTEGRATED NUTRIENT MANAGEMENT

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Awareness of food quality has shifted our focus on nutrient management system in crop production. Integrated nutrient management system resulted in good yield improvement and maintenance of soil health having least impact on food quality and environment. In order to assess the impact of different nutrient management systems, an experiment was conducted for two consecutive years during *kharif* seasons 2012-13 and 2013-14 on sandy loam soil to ascertain the response of grasses and ber plants against integrated nutrient management system (no fertilizers, no organic manure (control), 100% RDF of NPK through sheep manure, 100% RDF of NPK through fertilizers and 50% RDF of NPK through fertilizers+ 50% through sheep manure) under horti-pasture system. The results of study revealed that grass species had significant effect on yield and yield attributes. Yield and all the yield attributes were noticed higher in *Cenchrus setigerus* species than *Cenchrus ciliaris* except spike length. The highest green fodder (19.87tonnes/ha), dry matter (4.48 tonnes/ha), grass seed (120.18kg/ha) and protein content (7.36%) were found in *Cenchrus setigerus* species. While, Ber (*Ziziphus mauritiana*) leaf (3.93kg/plant), fruit (36.84 kg/plant) and fuel (23.31kg/plant) were higher in association of *Cenchrus setigerus* than *Cenchrus ciliaris*. The maximum gross return of ₹ 104429/ha, net returns of ₹ 72029/ha and benefit: cost ratio (2.21) were registered in combination of *Cenchrus setigerus* and ber plants under hortipasture system. In integrated nutrients management system where 50% RDF of NPK through fertilizers +50% sheep manure enhanced growth and development of grasses as well as ber plants resulted significant increase in green fodder (80.71%), dry matter (35.07%), seed yield (36.14%), protein (26.62%), ber leaf (42.67%), fruit(47.34%) and fuel wood (90.31%) over control treatment. The maximum gross return (₹ 1, 22,374/ha) and net return (₹ 79,652/ha) were realized where combined use of organic and inorganic sources of plant nutrients in grasses as well as in ber plants under ber based hortipasture system. The higher benefit: cost ratio was noticed with 100% RDF of NPK through fertilizers (2.19).

EVALUATION OF DIFFERENT FUNGICIDES, PLANT EXTRACTS AND BIOAGENTS AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID THE CAUSAL AGENT OF DRY ROOT ROT OF CHICKPEAIN-VITRO CONDITION

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In recent years cultivation of chickpea has been decreases due to major constraint of root rot disease.Chickpea (*Cicer arietinum* L.) also known as Bengal gram is one of the most important winter season pulse crop grown in India. The efficacy of various plant extracts and fungicides were evaluated against *Macrophomina phaseolina* (Tassi.) Goid causing dry root rot of chickpea. Six phyto extracts were evaluated *in vitro* by poisoned food technique against *M. phaseolina*.The extract of garlic cloves (*Allium sativum* L.) was proved excellent with maximum inhibiting (70.15 and 100 %) mycelia growth followed by Neem leaf extract (*Azadiracta indica*) (68.35 and 82.35 %) at 5 and 10% respectively. The fungicides were tested against *M. phaseolina* by poisoned food technique *in vitro*. Significantly maximum mycelium inhibition was recorded in Carbendazim(100%) followed by Carbendazim+ Mancozeb. Among bioagents tested, maximum inhibition was recorded in (*T. viride*) (80.20%) followed by *Trichoderma harzianum* (65.10%) compared to control.

Keywords: Bio- agents , fungicides, *Macrophomina Phaseolina*, plant extract, Root rot,

EFFECTS OF INTERCROPPING ON RHIZOSPHERE SOIL BACTERIAL COMMUNITIES INAMORPHOPHALLUS KONJAC.

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Soft rot disease causes heavy loss in konjac production every year, which caused by the genus *Pectobacterium* has been recognized as a major reason why konjac industry has not boomed in worldwide. However, intercropping with economically important trees can effectively control affect soft rot disease epidemics. Consequently, we conducted a rhizosphere bacterial diversity study to assess how intercropping affects soft rot disease using next-generation DNA sequencing. The results

demonstrate the Shannon diversity index and Chao 1 index for soil bacteria were relatively steady under intercropping conditions, but changed greatly for the konjac monocrop with the increase in the number of cropping years. Of the 44 bacterial genera with relative abundance ratios of >0.3%, 11 were significantly affected by the duration of continuous cropping and the cultivation mode. *Luteolibacter* and *Bacteroides* showed highly significant differences between the monocrop and the intercrop for three continuous years. *Pseudomonas* was significantly affected by the different cultivation modes, while *Myroides* was significantly affected by planting age. Intercropping altered the structure and composition of the soil bacterial community, which led to a relative balance of beneficial bacteria, and the relative balance of beneficial bacteria is helpful to reduce the incidence of soft rot.

SEED MYCOFLORA OF MUSTARD (*BRASSICA JUNCEA* L.), AND THEIR PHYTOPATHOGENIC EFFECTS

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Seed is the basic and most critical input for substantial agriculture. Several fungal pathogens have been recorded from surface sterilized seeds by Agar Plate and Blotter Methods respectively a composite of 10 seed samples of mustard (*Brassica campestris* L.) obtained from major growing areas of Rajasthan. Members of Deuteromycota are most predominant followed by Ascomycota, Zygomycota and Oomycota. Basidiomycota did not persist on seeds. Some fungal genera have been reported from composite seed lots as both external and internal seed borne. Ascomycota contributed nearly half of a total incidence followed by Deuteromycota, contributing one-third of total incidence. Zygomycota contributed moderate while Oomycota had least incidence. Among the predominant isolates, *Aspergillus* dominated with highest count of species followed by *Alternaria*, *Curvularia*, *Fusarium*, *Penicillium*, *Mucor*, *Rhizopus* and *Helminthosporium* while remaining were reported with single species. *Aspergillus amstelodomi*, *A. sulphureus*, *A. versicolor*, *A. ochraceus*, *Paecilomyces varioti* and *Cunninghamella elegans* were also reported on mustard seeds in India. It was noted from the result that the percentage of seed germination declined with the extension of storage period. The pathological symptoms such as weak root, yellowing of leaf, stunted growth, blackening of radical, seedling rot, no primary root etc. were observed a distinct symptoms of disease due to effect of storage fungi.

Key Words: Seed mycoflora, *Brassica campestris* L., *Aspergillus*, incidence, susceptible

EFFECT OF SINGLE SUPER PHOSPHATE ON QUALITY AND FORAGE YIELD OF COWPEA (*VIGNA UNGUICULATA* L. WALP.) ENTRIES

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The field experiment was conducted at GPB Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, Faizabad (U.P.) during Kharif season of 2015 to evaluate the effect of Single Super Phosphate doses on quality and forage yield of cowpea (*Vigna unguiculata* L.) entries. Twelve treatments comprised of three SSP doses- F₁: 190 kg SSP ha⁻¹, F₂: 375 kg SSP ha⁻¹ and F₃: 560 kg SSP ha⁻¹ and four entries- E₁: TNFC- 0926, E₂: Bundel Lobia-1, E₃: UPC- 5286 and E₄: UPC- 622 were replicated thrice in Randomized Block Design (Factorial). The experimental soil having pH (1:2.5) 8.62, EC dSm⁻¹ 0.39, Organic Carbon 2.9 g kg⁻¹, B.D. 1.45 Mg m⁻³. Available N 166.73, P 13.20, K 207.55 and S 12.73 kg ha⁻¹. The maximum quality (crude protein content 11.37 % and chlorophyll content 1.98 %) were recorded with application of F₃: 560 kg SSP ha⁻¹ which was significantly superior over F₁ and statistically at par with F₂ among the entries maximum crude protein content (crude protein content 10.81 % and chlorophyll content 1.98 %) were recorded with F₃: UPC-5286 entry which was significantly superior over E₁ and E₂ and Statistically at par with E₄. Same trend were also recorded in nutrients content, uptake, yield and yield attributes of forage crop of cowpea. The maximum gross income was calculated with E₃F₃: 28065 and net income with E₃F₂: 13289. However, highest benefit cost ratio (0.84) was obtained with treatment combinations E₃F₂: UPC- 5286+ 375kg SSP ha⁻¹. Thus the recommendation of F₂ (375 kg SSP ha⁻¹) and E₃(UPC-5286) be made to the farmers of eastern (U.P.) for successful cultivation of forage crop cowpea in kharif season.

ALLEY CROPPING IS DIVERSIFY AGROFORESTRY SYSTEM***VISHNU K SOLANKI¹ AND J.S.RANAWAT²**¹College of Agriculture, Ganjbasoda, JNKVV, Jabalpur (MP), ²College of Horticulture & Forestry, Jhalawar, KAU, Kota (Raj)

Alley cropping is an agroforestry practice in which fast-growing trees and shrubs are established in hedgerows on arable cropland and annual food crops cultivated in the alleys between the hedgerows. Alley cropping practice is especially attractive to land owners wishing to add economic stability to their farming system while protecting soil from erosion, water from contamination and improving wildlife habitat. Alley Cropping can diversify farm profits, enhance crop production, develop landscape aesthetics, improve wildlife habitat and give protection and conservation profits to crops. Alley cropping impacts water management by altering the hydrologic cycle through increased water infiltration, disruption of overland flow by the tree/grass strip. Nutrient cycling and soil quality are impacted as deeply rooted trees exploit lower soil horizons and cycle the nutrients to the surface through litter fall. Additional moisture is added to the site through interception of rainfall by the tree canopy. Microclimates are modified due to reductions in wind velocity which reduces air temperatures and evapotranspiration of intercropped plants and soil. Pest management can be strengthened through the structural diversity of trees and crops. Alley cropping creates habitat to build up biodiversity and associated populations of natural enemies of insects, diseases or weed pests and can interrupt pest cycles. Incorporation of trees and shrubs add opportunity for additional products which are derived from the tree/shrub component such as wood, nuts, fruit, foliage etc. as well as the option to plant sensitive crops which can be grown due to the protection from the trees.

Key words- Agroforestry, Alley cropping, Wildlife habitat, Nutrient cycling, Hedgerows

EFFECT OF STCR BASED FERTILIZERS AND MANURE APPLICATION ON AZOSPIRILLUM POPULATION IN RICE FIELD IN VERTISOL OF JABALPUR, MADHYA PRADESH**SAROJ CHOUDHARY¹, S.S.BAGHEL², A.K.UPADHYAY²**¹Department of Soil Science and Agricultural Chemistry, Banaras Hindu University Varanasi (U.P.) - 221005, India, ²Department of Soil Science and Agricultural Chemistry, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) - 482004, India

Rice (*Oryza sativa* L.) is one of the most staple food crop, which supplies major source of calories for about 45% of world population particularly the people of Asian countries. At global level, rice is grown on about 155.2 mha with production and productivity of 461 mt and 4.09 t ha⁻¹, respectively. Continuous use of chemical fertilizer in the absence of adequate organic manures poses problems like toxicity, deterioration of physical properties of soil and microbial activity, poor aeration resulting in decreased productivity. Integrated nutrient management, which includes potential source of nutrient like chemical fertilizer, bulky manures could help in mitigating these problems to some extent. Addition of organic manure is the prime necessity for maintenance of soil fertility and sustained productivity. Among different methods of formulating fertilizer recommendations the concept of soil test crop response correlation (STCR) has been found quantitative, precise and meaningful which consider the soil test values for the targeted yields. A field experiment is carried out at Agricultural Research Farm, JNKVV, Jabalpur (M.P.) in vertisol during Kharif crop 2016-2017 with rice cv. Kranti. The field experiment was laid out in four replications and six treatments viz., T₁: Control, T₂: GRD (120:60:40 kg N, P₂O₅ and K₂O ha⁻¹), T₃: TY 50 qha⁻¹ (115:90:49 kg N, P₂O₅ and K₂O ha⁻¹), T₄: T.Y. qha⁻¹ (157:125:70 kg N, P₂O₅ and K₂O ha⁻¹), T₅: T.Y. 50 qha⁻¹ (115:90:49 kg N, P₂O₅ and K₂O + 5 t FYM ha⁻¹) and T₆: T.Y. 60 qha⁻¹ (157:125:70 kg N, P₂O₅ and K₂O + 5 t FYM ha⁻¹) in Randomized Block Design. Statistically higher *Azospirillum* population (85.1 × 10³ CFU/g of soil) was recorded in the treatment T₆ having 5 t FYM ha⁻¹ along with inorganic fertilizers which was followed by treatments T₅ (having *Azospirillum* population of 81.8 × 10³ cfu g⁻¹ of soil. The population of *Azospirillum* 51.1 × 10³ cfu g⁻¹ of soil were observed in treatment T₂ followed by treatment T₃ (43.0 × 10³ cfu g⁻¹) and T₄ having *Azospirillum* population of 33.3 × 10³ cfu g⁻¹ of soil and the minimum found in control. The data revealed that the *Azospirillum* population was significantly increased using the combination of inorganic fertilizers and manure application. The population of *Azospirillum* were decreased at harvest from the 60 DAS. This may be due to insufficient availability of root exudates in rhizospheric soil of crop. The increase in mineral nitrogen availability results in slight increment in *Azospirillum* count without fixing nitrogen in soil. It is observed that the use of fertilizers with manure based on STCR recommendation gave considerable result in contrast to inorganic fertilizer applied alone.

Key words- Rice, manure, fertilizer, STCR, *Azospirillum*

SCREENING OF SELECTED SPINACH CULTIVARS FOR THEIR RESPONSE TO THE ROOT-KNOT NEMATODE, MELOIDOGYNE INCOGNITA**MOHAMMAD SHARIQ*, MOHD.ASIF, AMIR KHAN, FARYAD KHAN, MOH. TARIQ, TARUBA ANSARI AND MANSOOR A. SIDDIQUI***Section of Plant Pathology and Nematology, Department of Botany, Aligarh Muslim University, Aligarh, India.*

The Root-knot nematode, (*Meloidogyneincognita*) is the most damaging pathogens of vegetables, especially in the tropical and subtropical regions. Increasing restrictions of chemical nematicides have given rise to growing attention and interest in alternative nematodes management. Among the non-chemical methods available to nematodes control, the use of resistant cultivars can be one of the most effective and environmentally safe alternatives over chemical control. An investigation was carried out to assess the level of resistance in five selected spinach cultivars viz., All green, Green Flavour, Kantedar, Pure green and Super green against *M. Incognita* under greenhouse condition. The nematode development and host damage were evaluated by recording the nematode infestation parameters and percentage reduction of plant growth. All the tested cultivars varied significantly in causing reductions in growth parameters over their controls. Similarly, all the cultivars behaved differently regarding the formation of galls and egg masses and the nematode development. It was observed that none of the tested cultivars was immune or highly resistant. The cultivar Kantedar was found moderately resistant against *M. Incognita* as it showed minimum root gall index and reduction in growth parameters while cultivar All green was found highly susceptible showing the highest root-knot index and reduction in growth parameters. Similarly, the cultivar Green flavour and Pure green were susceptible; the cultivar Super green was moderately susceptible against the nematode damage. A significantly negative correlation was found between the number of galls and plant growth parameters.

Keywords: *Meloidogyneincognita*, Screening, Spinach, Resistance.**BIOLOGICAL CONTROL OF PLANT PARASITIC NEMATODES****NARESH KUMAR, SATYADEV PRAJAPATI AND LALITA LAKHRAN***Department of Plant Pathology, SKNCOA (SKNAU)- Jobner, Jaipur Rajasthan (India)*

In biological control of plant parasitic nematodes can be accomplished either by application of antagonistic organisms, conservation and enhancement of indigenous, or a combination of both strategies. Several nematicides have been withdrawn from the market because of health and environmental problems associated with their production and use. Second, it has been demonstrated in several soils that nematophagous fungi and bacteria increase under some perennial crops, and under those grown in monocultures and so may control some nematode pests, including cyst and root nematodes. The most studied example of natural control of a plant parasitic nematode concerns the decline of populations of the cereal cyst nematode, *Heterodera avenae*, and root knot under monocultures of susceptible cereals vegetables and pulses in many soil throughout northern Europe. The biological agents are applied in high concentrations as inundative treatments to a readily accessible site of action and protection from the diseases for a relatively short period provides long term control. The initial exploitation of biological control agents for nematodes may be developing countries. A range of control measures, including crop rotation, partial soil sterilization, soil amendments, and nematicides, that could be combined to increase the activity of naturally occurring biological control agents. In this method different types of organic and biological inputs like various manures, compost, botanicals and microbes like fungi, bacteria nematode etc. Are presently used at commercial scale to keep the plant parasitic nematode population below the damaging level for enhancing the crop yield.

Keyword: Biological, Control, Plant Parasitic Nematodes**DEVELOPMENT AND CHARACTERIZATION OF TRANSGENIC PIGEON PEA (CAJNUS CAJAN L.) PLANTS WITH MARKER FREE PSP68 GENE FOR SALINITY TOLERANCE****NEHA AND PUSHPA KHARB****Department of Molecular Biology, Biotechnology and Bioinformatics, CCS Haryana Agricultural University, Hisar-125004*

Pigeon pea (*Cajanuscajan*L.), is an important multiuse shrub legume of the tropics and sub tropics and recognised as the second most important pulse crop in India. Pigeon pea faces various abiotic stresses during its life cycle such as drought, cold, terminal heat and salinity and it also encounters water logging, acidity and metal toxicity stresses. Pigeon pea production is adversely affected due to salinity in arid and semi-arid regions of world. Salt stress reduces water potential, creates imbalance in ion concentration and causes toxicity. Helicases have been shown to play an important role in plants against salt stress. *p68* which is a prototype

member of DEAD-box helicase interacts with Ca²⁺-CaM thus regulating diverse signalling pathways against salt stress in plants. In the present study, we have developed transgenic pigeonpea plants with marker free gene *Psp68* for salinity tolerance. Since regeneration is prerequisite for transgenic development and pigeon pea is considered to be recalcitrant, the transgenic pigeon pea plants containing *Psp68* gene have been developed using the tissue culture independent transformation method (Patent Application No. 252590). The putative T₀ plants were screened by PCR analysis and the PCR positive plants with transformation efficiency of 16% were observed. The plants were further being characterized for integration, and transgene copy number using Southern Hybridization and Real time PCR. Transgenic lines in T₁ generation under salt stress condition showed enhanced tolerance to salt stress in terms of relative water content, membrane injury index, MDA content, chlorophyll content, proline and total soluble sugar content, catalase activity and peroxidase activity.

A SUSTAINABLE MANAGEMENT OF SOIL-BORNE PLANT DISEASES USING BIO AGENTS

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Soil-borne diseases result from a reduction of biodiversity of soil organisms. Restoring beneficial organisms that attack, repel, or otherwise antagonize disease-causing pathogens will render a soil disease-suppressive. Plants growing in disease-suppressive soil resist diseases much better than in soils low in biological diversity. Beneficial organisms can be added directly, or the soil environment can be made more favorable for them through use of compost and other organic amendments. Compost quality determines its effectiveness at suppressing soil-borne plant diseases. Compost quality can be determined through laboratory testing. Some of the beneficial microorganisms that re-inhabit compost from the outside edges after heating has subsided include several bacteria (*Bacillus* species, *Flavobacterium balustinum*, and various *Pseudomonas* species) and several fungi (*Streptomyces*, *Penicillium*, *Trichoderma*, and *Gliocladium verens*). The key to disease suppression in compost is the level of decomposition. As the compost matures, it becomes more suppressive. Readily available carbon compounds found in low-quality, immature compost can support *Pythium* and *Rhizoctonia*. As these compounds are reduced during the complete composting process, saprophytic growth of these pathogens is dramatically slowed

Keywords: antagonize, beneficial, Compost, laboratory testing and soil-borne

PLANT GENETIC RESOURCES AND ITS IMPORTANCE

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Plants have always been the most important resource as food for humankind and feed for animals. Plant genetic resources collection and utilization had made a huge impact in balancing the genetic diversity of the existing crop plant species and their application in genome based studies had also increased widely. Plant genetic resources are the most important components of agro biodiversity. They include primitive forms of cultivated crop species and land-races, modern cultivars, obsolete cultivars, breeding lines and genetic stocks and related wild species. The introgression of genes that reduced plant height and increased disease and viral resistance in wheat provided the foundation for the "Green Revolution" and demonstrated the tremendous impact that genetic resources can have on crop production. Food production and security depend on the wise use and conservation of agricultural biodiversity and genetic resources. It is particularly important that their genetic diversity is conserved effectively and managed wisely. The future of crop improvement will be centred on comparisons of individual crop plant genomes, and some of the best opportunities may lie in using combinations of new genetic mapping strategies and evolutionary analyses to direct and optimize the discovery and use of genetic variation.

Keywords: Plant genetic resources, genetic diversity, genome, crop improvement.

STATUS OF AGRICLINICS AND AGRIBUSINESS CLINICS IN INDIA**NISHANT CHOUDHARY^{1*}, NILOTPAL BORTHAKUR², MANASHI GOGOI³ AND ASHOK KUMAR MEENA⁴**¹MBA(Agri-business) Scholar, Department of Agricultural Economics and Farm Management, Assam Agricultural University, Jorhat-785013, ^{2,3}Department of Agricultural Economics and Farm Management, Assam Agricultural University, Jorhat-785013,⁴Department of Horticulture, Assam Agricultural University, Jorhat-785013

The Agri clinics and Agribusiness Centres (AC &ABC) Scheme playing an important role to supplement the public extension services in agriculture in India and has become very popular among agriculture graduates. The Scheme has been implemented across the country since 2002. The study was conducted on the status of the Agri clinics and Agribusiness Centres (AC &ABC) Scheme in India from the year 2002 to 2017. Assistance under the scheme is purely credit linked and subject to sanction of the projects by banks based on economic viability and commercial considerations. The eligible financial institutions under the scheme are Commercial Banks, Regional Rural Banks, State Cooperative Banks, State Cooperative Agriculture and Rural Development Banks and Such other institutions eligible for refinance from NABARD. Ceiling of project cost for subsidy has been enhanced to Rs.20 lakhs for an individual project (25 lakhs in case of extremely successful individual projects) and to Rs.100 lakhs for a group project. Depending on the type of venture with a moratorium of up to 2 years, Agriclincs and Agribusiness Centre Loans can be repaid within 5 to 10 years as per easy installment plans. However, since the inception of the AC&ABC Scheme, the bank sanction rate is only 11.60 per cent. As on 2017, the number of trained peoples accounts for 54,496 under the scheme. The number of agri venture established during this period was estimated to be 23501 depicting a success rate of almost 43 per cent. There are 132 Nodal Training Institution (NTIs) identified by MANAGE all over the country for training purpose, whereas Maharashtra has maximum number of Nodal Training Institutes (26). It was observed that various states have different success rates in implementing the scheme. States in the Northern and Southern region have very encouraging record, while states of North Eastern region have shown poor performance in terms of setting up of agriventures. Although, agriclincs and agribusiness centres scheme provides specialized training, credit facility, subsidy and handholding support for the establishment of agribusiness/agriventure, but the success rate of total agriventure establishment was found low against total trained candidates in the country. There is a need to rethinking on the whole gamut of components of scheme such as training programme, nodal training institutes, credit assistance, subsidy and monitoring of scheme for successful implementation of the scheme. The objectives of scheme such as technology transfer, employment generation and strengthen the extension service system, has been met to some extent, yet there is a need to involve private extension staff and agribusiness experts to improve the performance of the scheme.

Key Words: Agri clinics, Agribusiness, Agriventure, Subsidy

SIGNIFICANT ROLE OF CELLOLASE PRODUCING MICROORGANISM IN INDUSTRIAL BIOTECHNOLOGY**PANKAJ CHAUHAN, RICHASONI, NISHI CHANDRA, NIKKI KUMARI, MAHENDRA KR. SINGH, ABDUL KALAM, FAKRULHASAN***College of Biotechnology & College of Veterinary, SVPUAT, Meerut*

Cellulolytic microbes are primarily carbohydrate degraders and are generally unable to use proteins or lipids as energy sources for growth. Cellulolytic microbes notably the bacteria *Cellulomonas* and *Cytophaga* and most fungi can utilize a variety of other carbohydrates in addition to cellulose, while the anaerobic cellulolytic species have a restricted carbohydrate range, limited to cellulose and or its hydrolytic products. The ability to secrete large amounts of extracellular proteins is characteristic of certain fungi and such strains are most suited for production of higher levels of extracellular cellulases. One of the most extensively studied fungi is *Trichoderma viride*, which converts native as well as derived cellulose to glucose. Most commonly studied cellulolytic organisms include: Fungi-*Trichoderma*, *Humicola*, *Penicillium*, *Aspergillus*; Bacteria-*Bacilli*, *Pseudomonas*, *Cellulomonas*; and Actinomycetes- *Streptomyces*, *Actinomucor* and *Streptomyces*. Cellulases have become the third largest group of enzymes used in the industry since their introduction only since a decade. They are used in the bio-stoning of denim garments for producing softness and the faded look of denim garments replacing the use of pumice stones which were traditionally employed in the industry. Cellulases, in particular EGIII and CBHI, are commonly used in detergents for cleaning textiles. Several reports disclose that EG III variants, in particular from *T. reesei*, are suitable for use in detergents.

Keywords: Cellulolytic species, Biostoning, EGIII, CBHI.

BIOEFFICACY OF NEW FUNGICIDE MOLECULES AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID**P N MEENA^{1,2†}, HANSRAJ DHAKAR¹, PRAHLAD¹, S SATPATHY² AND S MITRA²**¹College of Agriculture, Department of Plant Pathology, Swami Keshwanand Rajasthan Agricultural University, Bikaner- 334 006, Rajasthan, India. ²ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata, 700 120, India

Stem rot and root rot diseases of jute caused by *Macrophominaphaseolina* (Tassi) Goid persists throughout the crop growth period which incurs substantial yield losses. Systemic fungicides with prolonged activity are ideal for management of such diseases. The main aim of this study was to evaluate the efficacy of eight systemic and broad spectrum fungicides used as seed treatment and foliar application for management of *Macrophominaphaseolina* in jute. The fungicides viz., azoxystrobin (strobilurin), carbendazim (benzimidazole), difenoconazole, tebuconazole, propiconazole, cyproconazole, tricyclazole (triazole) and propineb (propylene bis-dithiocarbamate), were used singly and with combinations as seed treatment (ST) and foliar sprays (FS) at recommended doses. Duncan's multiple range test was used to determine significant difference ($p < 0.05$) between the treatments. The treatment consisting with azoxystrobin 18.2% SC + difenoconazole 11.4% SC @ 1.0 ml kg⁻¹ seed (ST) + azoxystrobin + difenoconazole @ 0.075% (FS) at 45 days of crop age followed by treatment with tebuconazole 2DS (ST) @ 1.5 ml kg⁻¹ seed + tebuconazole @ 0.15% (FS) at 45 days of crop age proved very effective in management of stem rot and root rot diseases of jute and resulted in better fiber yield over untreated control.

MANAGEMENT OF DISEASES OF ONIONS AND GARLIC**PARHLAD, HANSRAJ DHAKAR¹, AND P N MEENA¹**

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Onions and garlic are the most popular cultivated forms of the family Alliaceae and consumed by almost every culture on earth. According to the 2001 statistics of the FAO, onions are second only to tomatoes in value of vegetable crops cultivated world wide. There are a number of pathogens attack onions and garlic throughout their developmental stages since the developmental process is important in the progression of diseases. Onions are normally propagated from seed, planted directly into the field, although onion sets and transplants are also used. Garlic has been vegetatively propagated for millennia, by planting cloves. Vegetative propagation results in additional disease management problems. This chapter covers disease management of many of the major bacterial, fungal and viral diseases of onions and garlic, with an emphasis on those diseases that have been the topic of disease management research or for which effective disease management systems have been put into practice. Short descriptions of the pathogens and symptoms are included to assist in identification of the specific diseases.

STUDIES ON VALUE ADDITION OF GUAVA CHEESE**PREETI TOPPO, SHATIS XAXA, DEVI SINGH AND V. M. PRASAD**

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The present investigation was conducted during 2014-2015 in Processing Lab, Department of Horticulture, SHIATS, Allahabad. The experiment was conducted in Completely Randomised Design (CRD) with nine treatments, replicated thrice. The value added product was evaluated for its physico-chemical properties during storage. Nine treatments were included in the trial viz; T₁ Ginger powder (1.25%), T₂ Ginger powder (1.50%), T₃ Ginger powder (1.75%), T₄ Cardamom powder (1.25%), T₅ Cardamom powder (1.50%), T₆ Cardamom powder (1.75%), T₇ Lemon grass (1.25%), T₈ (Lemon grass (1.50%) and T₉ Lemon grass (1.75%) were tested in three replication. On the basis of evaluation of Guava cheese the T₅ Guava cheese + Cardamom powder (1.50%) was found superior in respect of all the parameters T.S.S (10.44°Brix), Total sugar (%) 8.52, pH (4.70) and overall acceptability score (8.37) after 90 days storage. The highest net returns (Rs. 132.96) and higher benefit cost ratio (2.08:1) was also found superior in T₅ Guava cheese + Cardamom powder (1.50%).

SUSTAINABLE AGRICULTURE TO USE OF VERMI-COMPOSTING FOR IMPROVEMENT OF PLANT GROWTH AND SOIL FERTILITY**RADHA MORYA¹ GIRJESH SINGHYADAV² AND NITIN KUMAR PANDEY³**

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Vermicompost is a low-technology, environmentally-friendly process used to treat organic waste. Vermicomposting is a process in which earthworms are used to convert organic materials like humus known as a vermicompost. Composting are *reduce* the degradability of waste organic matter and generate organic matter and nutrients rich, soil amendments and soil conditioner. The resulting of vermicompost has been shown to have several positive impacts on plant growth, soil health and to improves cation exchange capacity of soils and growing media, thus improving their ability to hold nutrients for plant use and supplies beneficial microorganism to soils and growing media. Nutrient status generally as higher as compared to traditional compost. Vermicompost through enhance soil physically, chemically and biologically of soils and properties was vermicomposting impact in the soil humic content, good aeration, soil porosity, bulk density and water holding capacity, control and suppress soil born plant pathogens. The chemical properties such as pH, electrical conductivity, and organic matter are also improved the soil structure, density thus creating a better plant root environment, soil fertility and plant growth. Vermicompost at high concentration of soluble salts are available to increase plant growth and soil health quality and supplies a crop plant macro and micro nutrients. Than farmers cost of cultivation their was reduce also uses of vermicompost and biofertilizers. Future prospects and economy on the use of organic fertilizers in agriculture field and environmentally save to be also examined.

A REVIEW ON MODELING THE EFFECTS OF CLIMATE ON DATE PALM SCALE (*PARLATORIABLANCHARDI*) POPULATION DYNAMICS DURING DIFFERENT PHONOLOGICAL STAGES OF LIFE HISTORY UNDER HOT ARID CONDITIONS***RAJENDRA KUMAR, **DR. A.R. NAQVI**

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The date palm scale (DPS) *Parlatoriablanchardi* is a serious pest due to the damage it inflicts on its host tree (*Phoenix dactylifera*). To develop an effective control against DPS in arid regions, it is essential to know its bio-ecology including population dynamics and climatic factors influencing the duration and timing of life history and also the densities of different phenological stages (crawlers, first and second instars nymphs, adult males, and adult females). Monitoring of biological cycle and population dynamics of the pest were achieved through weekly counts of DPS densities on leaflets sampled at different position of date palm trees in an oasis of Ouargla region (Algerian Sahara Desert). Within this hyperarid region, DPS established four generations per year, the most important was the spring generation. Two overlapping generations occurred in spring–early summer and two in autumn–early winter; these two pairs of generations were interspersed by two phases of high-mortality rates, the first corresponds to winter cold and the second refers to the extreme heat of summer. Statistical analysis of the effects of the studied climatic conditions (minimum, maximum and mean temperatures, precipitation, humidity, wind, rain days, and climatic indices) on the DPS densities at different phenological stages showed great variability from one stage to another. Among these, adult females were the most affected by climate factors. For the total DPS population, high values of minimum temperatures negatively affected population density, while high maximum temperatures, hygrometry, and De Martonne aridity index showed a positive influence.

Keywords: Date palmscale, *Parlatoriablanchardi* .Date palm pests, Climate variability in drylands, Modeling population dynamics, Biological cycle, Arid agriculture

EFFECT OF FOLIAR SPRAY OF UREA AND ZINC SULPHATE ON PHYSICAL AND CHEMICAL PARAMETERS OF GUAVA (*PSIDIUM GUAJAVA* L.)**JATAV, R.* , KANPURE R. N.** PRAJAPATI, O. P. *** AND GUMASTA, V.******

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The present study was conducted on seven year old tree of guava cv. Apple Colour at Instructional cum Research Fruit Orchard, Department of Fruit Science, College of Horticulture, Mandsaur, Rajmata Vijayaraje Scindia Agricultural University, Gwalior, Madhya Pradesh, 474002. The experiment was laid out in Randomized Block Design (RBD). There were forty eight uniform and healthy guava trees, planted at 6 x 6 m distance were selected under the present study. The experiment consisted of sixteen treatment combinations of nutrients (urea 1.0, 1.5 & 2.0% and zinc sulphate 0.3, 0.6 and 0.8%) with control. In this manuscript various physical and chemical parameters such as pulp thickness (cm), seed weight (gm), pulp weight (gm), seed/pulp ratio, pulp percentage, seed percentage and chlorophyll content in leaves (spad value) have discussed here in respect of foliar application of nutrients on guava.

Keywords: Guava, Foliar spray, Urea, Zinc sulphate, physical and Chemical.

PERFORMANCE OF BARLEY (*HORDEUM VULGARE* L.) VARIETIES UNDER VARIOUS NITROGEN LEVELS IN SODIC SOIL**RAJESH KUMAR, SHIPRAYADAV, V.NAND, R. K. DOHAREY AND NEERAJYADAV**

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A field experiment was carried out at Main Experimental Station (MES), Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during Rabi season 2016-17 to study the performance of barley varieties under various nitrogen levels in sodic soil. The trial was laid out in Split Plot Design. Nitrogen levels (60, 75 and 90 kg N ha⁻¹) were kept in main-plots and varieties (RD-2907, RD-2552, NDB-1173 and RD-2794) in sub-plots with three replications on sodic soils having low organic carbon (0.38 g kg⁻¹), available nitrogen (185.0 kg ha⁻¹), phosphorus (15.25 kg ha⁻¹) and potassium (265 kg ha⁻¹). All the growth parameters, yield attributes and yield increased significantly with increasing levels of nitrogen up to 90 kg ha⁻¹. Maximum Plant height, no. of tillers, dry matter accumulation, number of spike m⁻¹, spike length, number of grain spike⁻¹, 1000 grain weight, straw yield and grain yield were recorded under 90 kg N ha⁻¹ then 75 and 60 kg N ha⁻¹. Which was significantly higher. Variety RD-2907 recorded significantly higher Plant height, number of tillers, dry matter accumulation, LAI, yield attributes, grain and straw yields over variety RD-2794 and NDB-1173 while at par with RD-2552. The maximum net return (Rs.45511ha⁻¹) and B-C ratio (1.74) were obtained under variety RD-2552 at 90 kg N ha⁻¹.

MANAGEMENT OF AMERICAN SERPENTINE LEAF MINER THROUGH NEWER COMBINATION OF INSECTICIDES ON TOMATO CROP**RAJMAL JAT*, M. RAGHURAMAN* AND VIJAY KUMAR MISHRA**

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The tomato (*Solanum lycopersicum* Miller) is an important crop grown almost throughout the year in the country. Among the major biotic factors, the insects which damage the tomato crop substantially is the American Serpentine leaf miner (*Liriomyza trifolii*), a notorious polyphagous pest has recently attained a serious pest status on tomato. Reported that among all the insecticides alone and their mixtures after first spraying of Propargite + Bifenthrin 50 + 5 SE @ 621 + 62.1 a.i./ha was found to be the most effective in both the sprays with a maximum reduction in maggots population (69.26/ 10 leaves), and Propargite 57 EC @ 627 a.i./ha was minimum reduction in maggots population (9.43) than the maggot population in untreated control (26.30/ 10 leaves) while after second spraying of Propargite + Bifenthrin 50 + 5 SE @ 621 + 62.1 a.i./ha was found to be the most effective one with a maximum reduction in maggots population of *Liriomyza trifolii* (3.25/10 leaves), and Propargite 57 EC @ 627 a.i./ha was minimum reduction in maggots population of *Liriomyza trifolii* population (15.87/10 leaves), than the control (29.86/10 leaves). The results reflected in terms of increase average means over control than after Propargite 50 + Bifenthrin 5 SE @ 594 + 59.4 a.i./ha plot gave maximum increased fruit yield 72.56% while lambda cyhalothrin - 5 EC @ 25 ml a.i./ha showed 41.17% with

minimum increase in fruit yield over the control. The highest cost benefit ratio was obtained from Propargite 50 + Bifenthrin 5 SE @ 594 + 59.4 g a.i./ha (1:21.24) by novel combination of insecticide.

POLLINATOR “FRIENDLY” AGRICULTURE

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Pollinator animals –a wide variety of insects, birds, and mammals– are key elements for the conservation of natural ecosystems and the stability and enhancement of agricultural production. Around 90% of flowering plants depend, directly or indirectly, on animal pollination. Pollination-dependent crops contribute to 35% of the global crop production volume, and more than three-quarters of the leading types of global food crops rely to some extent on animal pollinators to guarantee good yields and product quality. It is estimated that around 5% to 8% of crop production can be directly attributed to animal pollinators, with an annual market value ranging from US\$235 billion to US\$577 billion. Protecting and increasing wild pollinators is not only economically important, but also contributes to food safety, better livelihoods and environmental conservation. Our approach is based on offering solutions for production systems that reduce the pressure of agriculture on the natural populations of pollinators, while favoring their recovery. Reduce ecosystem degradation, pollution, destruction or fragmentation. Avoid the potential negative effects of agriculture and livestock-related activities on local wildlife. Prioritize the use of integrated pest management approaches as a way to protect crop health and reduce the toxic footprint of agrochemicals. Manage synthetic pesticides responsibly on operations where they are used as a last resort, without using highly toxic substances, and implementing risk mitigation measures. Manage pollination services to prevent any negative effects of farmed pollinator communities over wild pollinators.

IN VITRO EVALUATION OF DIFFERENT FUNGICIDES AGAINST CROWN ROT OF GUAVA INCITED BY *FUSARIUM VERTICILLIOIDES*

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Guava (*Psidium guajava* L.), an arboreal shrub or a small tree, is one of the very productive, highly profitable and popular fruit crop of tropics and subtropics. It is commercially cultivated in more than 60 countries and regarded as one of the most gregarious fruit trees belonging to the family Myrtaceae. Crown rot of guava caused by *Fusarium verticillioides* is gaining importance in Madhya Pradesh state of India owing to introduction of Thai variety of guava. Infection results in the appearance of discolored, malformed, or necrotic areas on the fruits. Therefore, the present study was conducted to assess the ability of seven fungicide viz., Blue copper (0.3g), Carbendazim (0.1g), Carbendazim + Mancozeb (0.25g), Mancozeb (0.25g), Thiophanate Methyl (0.1g), Thiram + Carboxin (0.20g) and Pyraclostrobin (0.02g) along with control against *Fusarium verticillioides* by following the poisoned food technique under *in vitro* condition. All the fungicides inhibited the radial growth of *Fusarium verticillioides* *in vitro* after 168 hrs of incubation. Thiram + Carboxin, Carbendazim + Mancozeb and Carbendazim were found best fungicides which completely inhibited the radial growth of *Fusarium verticillioides*. Thiophanate Methyl, Blue copper and Pyraclostrobin were second next in order of toxicity resulting, respectively 75.88, 73.68 mm and 37.82 per cent inhibition of radial growth. Least inhibition was recorded in Mancozeb (31.57%).

IN VITRO AND IN VIVO STUDIES OF SYRIAN NATIVE ISOLATES OF *TRICHODERMA* SPP. AGAINST ROOT KNOT NEMATODE *MELOIDOGYNE INCOGNITA* INFECTING TOMATO

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Seven isolates of three *Trichoderma* species, *T. viride*, *T. longibrachiatum* and *T. harzianum* were isolated and evaluated to identify the most promising native strain/s to control root knot nematode (RKN), *Meloidogyne incognita* under laboratory and pot culture conditions in comparison with a commercial product of *Trichoderma*. Results showed that all the native isolates

exhibited high virulence to parasitize some stages of RKN. *T. harzianum* isolate showed parasitism of 95, 43.7 and 90.6% on egg masses, eggs and female stages respectively compared to the commercial product that gave 39.8, 26.2 and 63.2% respectively. Further, there was only 5.75% egg hatching in this isolate compared to the commercial product and control that gave 41.50 & 51% respectively. The three isolates which showed promising performance under *in vitro* conditions were further evaluated against *M. Incognita* in infecting tomato under greenhouse conditions. 30 days after infection, *T. harzianum* isolate negatively affected the number of galls and egg masses per root. However, at 90 days, the plants treated with Syrian isolate of *T. longibrachiatum* developed 181.30 and 166.50 galls and egg masses per plant respectively compared to the 332.26 and 305.76 in case of commercial product treatment while control plants showed 493.61 and 488.94 respectively. In addition, *T. longibrachiatum* isolate significantly improved plant growth parameters especially the shoot weight compared to the commercial product and control plants.

EFFECT OF SOIL MICROBES ON IMPROVING PHYSICAL PROPERTY OF SOIL

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Soil physical conditions play an important role in retention of water and nutrients in the soil and eventual availability to plants. Soil micro-organisms like bacteria, fungi and mycorrhiza play an important role in improving soil structure by promoting the formation of soil aggregates and pores within. Not only are the soil physical conditions influenced by soil microorganisms, but the demography of soil microorganisms is also influenced by soil physical conditions. Soil aggregate stability is a multifaceted process and is an indicator of many aspects of soil structure including soil water regimes and nutrient availability. The stability of aggregates is controlled by soil physical and microbial community properties and plant roots. Fungal cells release mucilaginous exudates which are mainly composed of extracellular surface polysaccharides; cell wall polysaccharides and somatic or intracellular polysaccharides located inside the cytoplasmic membrane. Extracellular polysaccharides are mainly responsible for the formation of aggregates, which are beneficial for improving porosity and aeration in soil. Bacteria release exo-polysaccharides that form organo-mineral complexes which help in binding soil particles into aggregates. During bacterial growth, extracellular polymeric substances are produced in the form of peripheral slime polymers into the soil solution. These are negatively charged polysaccharides, polyuronic and amino acids with adhesive properties capable of making bond between clay particles in order to form aggregates. These aggregates adhere together to form macro aggregates and thus increase inter-particle cohesion. Additionally, AM Fungi can also alter soil microbes in its surrounding environment as well as the rhizosphere of host plant which are probably involved in soil aggregation. These contributions of AM fungi are often entangled together developed a model for soil aggregation where their simulated results indicate that AM fungi, organic matter and plant roots are key contributors to aggregate formation in soil. They also observed that this group of fungi plays an important role in stabilization of soil aggregates. Thus the soil microbes do improve the physical properties of soils as well as the fact that soil physical conditions influence the soil microbial population in native ecosystems.

REMOTE SENSING: ASSESSING THE FRUIT PLANT STRESS EARLIER FOR BETTER MANAGEMENT PRACTICES AND YIELD

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Remote sensing techniques offer a unique solution for mapping stress and monitoring its time course. Remote-sensing techniques are capable of measuring that radiation and therefore offer the possibility of quantitatively assessing plant stress caused by biotic and abiotic factors. Remote sensing of plant canopies involves the detection of electromagnetic radiation coming from a complex matrix of plant leaves and stems above a background of soil and plant litter. The objective of many remote-sensing measurements is to extract information concerning plant condition from the composite scene. To complicate the situation, part of the plant-soil framework is exposed to the direct solar beam, while the remaining part is exposed to diffuse skylight and radiation that may have been transmitted through upper plant parts. Thus, illumination of the different plant and soil surfaces changes as the sun zenith changes, yielding a composite scene reflectance that may change throughout the day. Add to this complexity the fact that plant morphology may change because of stress, and it becomes readily apparent that extraction of information from plant canopies concerning plant stress is not simple. However, it is the intriguing complexity of the problem that will motivate the research needed for its solution. By addressing this challenging problem, we will increase our understanding of the basic physics and biology of plant canopies. Thus, techniques will evolve that combine the complex factors into a system that quantitatively evaluates plant stress and identifies its cause, and does so in a time frame that allows management practices to be initiated, and yield maximized.

ADVANCES IN MODIFIED ATMOSPHERE PACKAGING TO ENHANCING THE SHELF LIFE OF FRUITS**RINKU RANI, JEET RAM SHARMA AND ANNU***Department of Horticulture, CCS Haryana Agricultural University, Hisar-125 004*

Modified atmosphere (MA) means an atmospheric composition around the fruit that is different from that of normal air i.e., 78.08% N₂, 20.95% O₂ and 0.03% CO₂ that MA can interplay with the physiological processes of commodity resulting in reduced rate of respiration, transpiration and other metabolic processes of fruits. Modified atmosphere packaging (MAP) is defined as packaging of fruits in polymeric films that creates modified atmospheric conditions around the produce inside the package. MAP can be achieved either actively or passively. The most common polymers used for MAP are polypropylene, polyethylene, low density polyethylene, linear low density polyethylene, polyethylene terephthalate, ethylene vinyl alcohol and polyvinylchloride. Water loss after harvest leads to weight loss and quality reduction of the produce while an accumulation of water at the product surface will help the growth of spoilage microorganisms. Nowadays antifog compounds and microperforations are used to diminish the impact of this problem. Nanomaterials are a new class of materials that have been proven to be a promising option for packaging materials. The packaging industry is actively exploring the potential of nanotechnology to obtain new packaging materials with improved properties (mechanical, barrier) and new functionalities such as antimicrobial activity and monitoring the quality of produces and conditions within package.

Key words: Modified atmosphere, packaging, polymers and nanotechnology

UTILIZATION PATTERN OF MOBILE PHONE TECHNOLOGY (SMART PHONE) AMONG THE FARMERS OF NAGOUR DISTRICT IN RAJASTHAN**ROHTASH KUMAR AND SIKANDER CHOUDHARY***Deptt. of Extension Education, College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner , Rajasthan (334006), India*

Now a days, one of the most important emerging tools of ICT is the mobile phones with a remarkable growth during last decade. Mobile phone technologies have provided a good platform for farmers to share their knowledge and information among each other in time such as weather information, crop and variety selection, fertilizer and irrigation management, disease and pest management market prices of the product and on-going government programmes. Keeping this in view, a study was conducted to assess the utilization pattern of mobile phones for sharing agricultural information among farmers in Merta block of Nagaur district of Rajasthan. A total of 110 respondents were selected for the study. This study has shown that a majority (83.63%) of the farmer used call to retail rather than call to relative farmer (80%), internet user (29.09%) and perceived as most information on weedicide, pesticide & disease control (89.9%) through mobile phones. The correlation studies indicate a significant association between education, with extension agency contact and mass media of the farmer. The analysis of the poor connectivity, economic problem, high cost internet services and lack of updated information were some of the problems reported by the respondents. Key word: m-Learning; ICT; Mobile enabled information; Problems;

THE TOTAL CAROTENOID CONTENT IN TAGETES SPECIES**ROOPALI PATEL¹, PRAHLAD²***¹Dept. of Horticulture, College of Agriculture, Jawahar Lal Nehru Krishi Viswavidyalaya Jabalpur(482001), ²Dept. of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner , Rajasthan (334006), India*

Carotenoids are pigments found in fruits and vegetables with important antioxidant properties. Marigold flowers (*Tagetes* spp.) are a very rich source of carotenoids for application in the food industry. The aim of this work was to study the total carotenoid content in fresh and dried flowers of *Tagetes patula* and *T. erecta*. We analyzed 7 Romanian varieties of *T. patula* and 2 Romanian varieties of *T. erecta*. We determined the total carotenoid content of the 9 samples by a spectrophotometric method. The different varieties of marigold showed considerable variations in their carotenoids concentrations, ranging from 5.44 to 55.05 mg/100 g fresh flowers of *T. patula*, and from 52.8 to 372.08 mg/100 g dried flowers of *T. patula*, and from 7.49 to 25.71 mg/100 g fresh flowers of *T. erecta*, and from 36.2 to 240.25 mg/100 g dried flowers of *T. erecta*. These variations can be due to the differences in aspect of plants (the stem size, the inflorescence type, the colour of petals) and culture conditions.

Keywords : *Tagetes* species; carotenoids; spectrophotometric method; B-carotene

RELATIONSHIP BETWEEN CONCENTRATION AND EXPOSURE PERIOD IN THE TOXICITY OF PHOSPHINE TO TROGODERMA GRANARIUM EVERTS**S. K. YADAV* AND C. SRIVASTAVA***Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi-110012, India*

The experiments were conducted to determine the effects of phosphine concentration and exposure period on susceptible and resistant strains of *Trogoderma granarium* by the equation $C^n t = k$. *T. granarium* is one of the major insect pests of stored products causing considerable loss in India. Fourth instar larvae were exposed to a range of concentrations for fixed exposure periods of 6, 12, 24, 48, 72 and 96 h for the susceptible strain and 12, 24, 48, 72, 96, 120 and 144 h for resistant strains, and to a range of exposure periods for fixed concentrations range from 0.01 to 4.5 mg/l for susceptible strain and 0.10 to 9.0 mg/l for resistant strain at 35°C. $C^n t = k$ relationships of the form $C^n t = k$ showed that the toxicity index, n was less than one in all cases indicating that time was more important variable in the toxicity of phosphine in these ranges of exposure periods and concentrations for both susceptible and resistant strains.

Key words: probit analysis, aluminium phosphide, fumigation, resistance, mortality

EFFICACY OF SOME ECO-FRIENDLY INSECTICIDES AGAINST BRINJAL SHOOT AND FRUIT BORER UNDER THE CLIMATIC CONDITION OF REWA DISTRICT, MADHYA PRADESH**SACHIN KUMAR JAISWAL*, M. R. DHINGRA, M. A. ALAM AND AKHILESH KUMAR***Department of Entomology, College of Agriculture, Rewa, JNKVV, Jabalpur, MP, India-486001*

Vegetables are an important dietary component, because of this reason its extensively cultivated in the world, including India. Amongst the various vegetables, Brinjal (*Solanum melongena* L; family- Solanaceae), commonly known as egg plant, is cultivated throughout the year in the country. Brinjal cultivation in the nation is done in about 680 thousand hectare area with an annual production of 12,706 thousand tonnes and productivity of 18.7 tonnes per hectare. In Madhya Pradesh, it is cultivated in 46.12 thousand hectare area with a productivity of 25.02 tonnes per hectare. No doubt among the insect pests brinjal shoot and fruit borer alone causes more than 90% loss to the crop either quantitative or qualitative. The pest when infested the young plant, the damage is seen in the growing shoots of the plants as drooping down of the shoots and the infested plant at this stage shows retarded development. But, at flowering and fruiting stage of the crop, damage is done by the larvae of the pest by boring and feeding inside the fruit and deteriorating them to the extent of unfit for human consumption and marketing. The damage may reach to the extent of 100 percent. Keeping this fact in view the field experiment were carried out during *Kharif & Rabi*, 2016-17 to evaluate the efficacy of Profenophos @ 800 ml/ha, Fenpyroximate @ 500 ml/ha, Fenpropathrin @ 250 ml/ha, NSKE @ 2500 ml/ha, Emamectin benzoate @ 250 g/ha and Chlorantraniliprole @ 162 ml/ha against the *Leucinodes orbonalis* (Guenn.). Chlorantraniliprole @ 162 ml/ha was found significantly most effective against Brinjal shoot and fruit borer (BSFB) followed by Emamectin benzoate @ 250 g/ha whereas, NSKE @ 2500 ml/ha was found least effective.

EFFECT OF DIFFERENT MICRONUTRIENTS ON PLANT GROWTH YIELD AND FLOWER HEAD QUALITY OF BROCCOLI (BRASSICA OLERACEA VAR.) CV. PALAM SMARIDHI**SHATIS XAXA*, PREETI TOPPO, RADHELAL DEWANGAN AND PRAVEEN CHOYAL***Department of Horticulture Vegetable Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, India.*

A field experiment was conducted to study the "Effect of different micronutrients on plant growth yield and flower head quality of broccoli (*Brassica oleracea* var.) cv. Palam smaridhi" during *rabiseason* of 2016-17 Central Research field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences Allahabad. The experiment consists of 10 treatment viz., T_0 (control), T_1 (B), T_2 (Mo), T_3 (Mn), T_4 (B + Mo), T_5 (B + Mn + Zn), T_6 (Mo + Mn), T_7 (B + Mo + Mn + Zn), T_8 (B + Zn), T_9 (Zn) laid out in Randomized Block Design (RBD) with three replications. The micronutrients (B, Mn and Zn) were applied at the rate of 2.5 kg (B), 3 kg (Mn), 2 kg (Zn) per hectare significantly increased the plant height (53.61 cm), number of leaves (25.23), Plant spread (54.51 cm), diameter of head or head (17.81 cm), average head weight of per plant (571.83 gm), yield ha^{-1} (134.05 q), vitamin 'C' (92.34 mg), TSS ($^{\circ}$ Brix) (8.23) content, Plant fresh weight (897.00 gm), dry plant matter (96.48 gm), root weight (46.63 gm) and dry weight (12.63 gm) were maximum in treatment T_5 and lowest in T_0 (control). It is also concluded that treatment T_5 (B + Mn + Zn) was found economically best in treatment of cost benefit ratio i.e. (1:3.47) followed by (1:2.99) with T_7 (B + Mo + Mn + Zn).

ERUCIC ACID PROFILING IN INDIAN MUSTARD (*BRASSICA JUNCEA* L.) GENOTYPES**SUBHA LAKSHMI SAIKIA AND GYANENDRA KUMAR RAI***School of Biotechnology, SKUAST-Jammu*

Erucic acid is one of the most important fatty acids in mostly found within *Brassica* genus. This 22-carbon fatty acid is undesirable for human consumption when present in higher amounts in edible oil. Higher erucic acid in cooking oil hampers the myocardial conductance in humans and leads to increased blood cholesterol levels. Earlier studies has been reported to cause lipidosis in children and myocardial fibrosis in monkeys. The improvement of seed quality is one of the most important objectives in *Brassica* breeding for satisfying future quality edible oil requirements. In this present study 15 *Brassica juncea* genotypes was use for the erucic acid profiling. The erucic acid content in *Brassica juncea* genotypes varied from 0.90 to 51.83 %. Minimum erucic acid content (as per international oil quality norms $\geq 2.0\%$) was observed in PM 24 (1.56%), PM 21 (0.96%) and PusaKarishma(0.90%). However, highest erucic acid content was noted in SKJM-5(51.83%).Among the genotypes studied, Maximum genotypes showed higher levels of erucic acid. Therefore there is an urgent need to develop new varieties, containing low levels of erucic acid. Hence there is great need to screen out breeding lines for lower levels of erucic acid ($<2\%$) and higher yield potential.

PHYSIOLOGY OF DROUGHT TOLERANCE IN MUSTARD GENOTYPES**SUMITRA BURANIYA*, BASANT KUMAR DADRWAL AND PINKI DADARWAL***Department of Plant Physiology, S. K. N. College of Agriculture, Jobner (Jaipur), Rajasthan-303329, Department of Agronomy, College of Agriculture & Research, MJRP-University, Jaipur, Rajasthan- 302019*

The study entitled physiology of drought in mustard genotypes was conducted during *Rabi* 2017 at Seed Technology Research, RARI Durgapura Jaipur. Ten genotypes of mustard were taken for study which includes RB 50, RGN 48, Urvashi, Geeta, RH 819, RGN 229, RH 406, RH 749, NRCHB 101 and NRCDR 02. It was observed that PEG induced drought conditions reduced the seedling length, weight, and seedling vigour index significantly in all the genotypes. The genotypic difference was also found significant. RGN 229 perform best both under control and PEG induced water stress. The chlorophyll content, RWC, MSI decreased significantly with PEG induced water stress and a concomitant increase in MDA content was observed. The CAT and SOD two antioxidant defense enzymes also show increased activity in all the genotypes under PEG induced water stress.

BIOCHEMICAL STUDIES AND MANAGEMENT OF ALTERNARIA BLIGHT OF CLUSTER BEAN**SURESH KUMAR¹, PRAHLAD²***¹Dept. of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner , Rajasthan (334006), India*

There was significant increase in peroxidase (PO), polyphenol oxidase (PPO) and phenylalanine ammonia lyase (PAL) activities in diseased leaves of all three varieties-RGC-936 (susceptible), RGC-1003 (moderately resistant) and RGC-986 (resistant) of clusterbean. Significant decrease in catalase activity was observed in diseased leaves than healthy ones and this decrease was more pronounced in susceptible variety RGC-936. The pathogen related enzymes polygalacturonase trans-eliminase (PGTE), pectin trans-eliminase (PME), polygalacturonase (PG) and cellulolytic (Cx) enzymes activities were found lower at initial stages of observations. The soluble protein content in healthy leaves of RGC-986 was highest followed by RGC-1003 while, it was lowest in RGC-936. It was significantly decreased in diseased leaves of all three varieties. Maximum decrease in soluble protein "due to infection" was observed in RGC-936 followed by RGC- 986 and RGC-1003. Total phenolic contents were higher in healthy leaves of RGC-986 followed by RGC-1003 and RGC-936.

Keywords: Alternaria blight, cluster bean, fungicides and plant extracts, Alternaria cucumerina var. cyamopsidis

SCREENING OF ENDOPHYTIC BACTERIA FROM DIFFERENT CROP SAMPLES**SURYA PRAKASH REDDY AND BALKISHAN CHAUDHARY***Department of Plant Pathology, College of Agriculture, JNKVV, Jabalpur-482004*

In the present study, we demonstrated the in vitro activity of endophytic phosphate-solubilizing bacteria. Total twenty five endophytic organisms that were isolated pseudomonas spp from sap, leaves, and roots of soybean, Rice, wheat, maize, zinger, garlic, seasmum, were tested for their ability to Phosphate solubilizers and showing zone of phosphate solubilization on solid

Pikovskiyaya's medium after 3 days of incubation at 30 ± 2 . All crop isolates were significant solubilization activity but maize and zinger isolates were showing maximum solubilizing activity.

VOLATILE DIMETHYL DISULFIDE MODULATES ROOT SYSTEM ARCHITECTURE OF ARABIDOPSIS VIA CANONICAL AUXIN SIGNALING

SWATI TYAGI^A, KANGMIN KIM^{A*}, KUI-JAE LEE^A AND MADHURI GUPTA

Bacterial originated volatile organic compounds (VOCs) play a significant role in plant development and growth by interfering with the synthesis, metabolism, or signaling of phytohormones. Here, we demonstrated dimethyl disulfide (DMDS), a VOC known to be produced from rhizobacteria, modulated growth and root system architecture of *Arabidopsis thaliana*. According to DMDS treatment, Arabidopsis seedlings exhibited increases in biomass, leaf area, and chlorophyll contents. Interestingly, DMDS also enhanced lateral root, root hair emergence while a decrease in primary root length. Such changes in root system architecture (RSA) were correlated with enhanced auxin signalling intensities assessed by expression of auxin responsive *DR5::GUS* transgenic plants and early auxin responsive genes (*SAUR*, *GH3.1*, *TIR-14*). Ultimately, *tir1-1* and *arf7arf19*, Arabidopsis mutants aborted auxin signalling, induced no changes in RSA. Collectively, our results suggest that DMDS can contribute to plant growth and development by modifying the root system architecture mediated through canonical auxin signalling pathways in Arabidopsis.

Keywords: auxin signalling, dimethyl disulfide (DMDS), root system architecture, volatile organic compound

INTEGRATED MANAGEMENT OF ALTERNARIA LEAF AND FRUIT SPOTS OF POMEGRANATE

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Pomegranate is high value commercial horticultural crop grown extensively throughout Maharashtra. Among the different diseases on Pomegranate *Alternaria* leaf and fruit spots caused by *Alternaria alternata* is being serious and emerging problem to growers in Maharashtra. Studies on integrated field evaluation different fungicides, bioagents and botanicals against *Alternaria* leaf and fruit spot of pomegranate during *Mrigbahar*, 2015 and *Ambiabahar*, 2016. Results of the studies indicated that among the fungicides, bioagent and botanical tested the fungicide Propiconazole recorded significantly least average disease intensity (12.47%) and highest average reduction (59.74%). This was followed by the treatments viz., Carbendazim + Mancozeb (13.53% and 56.33%), Hexaconazole (14.47% and 53.28%) and Mancozeb (14.78% and 52.29%). However, *T. viride* and *A. sativum* found least significant with highest average disease intensity (22.12 and 24.89 %) as against 30.98 per cent in unsprayed control and lowest average reduction (28.59 and 19.66 %) respectively. Average yield over the seasons due to *Alternaria* leaf and fruit spot control by the treatment with fungicides, bioagent and botanical revealed that, highest average yield of 8.26 t/ha was obtained with Propiconazole. The second and third best fungicides found effective Carbendazim + Mancozeb (7.22 t/ha) and Hexaconazole (6.39 t/ha) followed by Mancozeb (5.86 t/ha) and Penconazole (5.58 t/ha). Thus Spraying of Propiconazole, Carbendazim + Mancozeb, Hexaconazole, bioagent *T. viride* and botanical *A. sativum* were most effective and economical for the management of *Alternaria* leaf and fruit spot of pomegranate.

Key words: Pomegranate, *Alternaria* leaf and Fruit spot, Integrated management Fungicide, Bioagent

MANAGEMENT OF COLLAR ROT OF GROUNDNUT THROUGH SEED TREATMENT

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Groundnut is an economic important edible oilseed crop. Groundnut suffers seed, soil and foliar diseases. Among the groundnut diseases, collar rot is one of the economic important disease. Collar rot damaged regularly due to its seeds and soil borne nature. This disease has prevalent in almost all groundnut growing states. This disease is extensive in kharif than rabi/summer season. Field experiment was conducted for two years to find out effective fungicides for control of collar rot of groundnut. Nine treatments including five fungicides along with check were laid in randomized block design with three replications. Fungicides viz. vitavax 200 wp (carboxin 37.5% + thiram 37.5%), carboxin, ipconazole, kodiak, thiram, and mancozeb were tested in field conditions. Minimum disease incidence (5.16%) and maximum pod yield (1232 kg/ha) were recorded in the treatment of vitavax 200 wp 4.0g/kg seed followed by ipconazole 3.8 FS (0.1ml) + thiram 75wp (2.5g/kg seed) and vitavax 200 wp 3.0g/kg seed.

Key words: Groundnut, *Aspergillus niger*, vitavax 200 wp, ipconazole, kodiak, collar rot and fungicide

CONTRACT FARMING-PROSPECTS AND CHALLENGES IN INDIA**Y. VINAY KUMAR^{1*}, SWATI SHARMA², BHAVESH D. CHAUDHARI³***Dept. of Agribusiness management, ASPEE Agribusiness Management Institute, Navsari Agricultural University, Navsari, Gujarat-396450.*

India is a country where agriculture is an age old practice and back bone of the country. Nearly agriculture contributes 17-18 percent to the country's GDP. In India most of the farmer's are small and marginal farmer's and get lots of troubles at the time of capital requirement. Contract farming has been existing in India since many years. It is the agreement between the farmer's and the company for the production of quality agriculture produces. It also helps the farmer's in increasing their income levels, produce high quality products, gain high price than normal price. Increase in agriculture standards also indirectly helpful for the country's GDP. Contract farming is being done in agriculture sector and its allied sectors like dairy, aquaculture etc. Thus contract farming is the viable option for the development of agriculture in India and raises the standards of farmer's also. Different models and problems of the contract farming from both sides that is farmer as well as company will be discussed in this paper.

Keywords:- Contract farming, Pre-Arrangements, Objectives, Models, Advantages and Problems.

ORGANIC FARMING: THE FUTURE DEMAND FOR INDIAN AGRICULTURE SUSTAINABILITY**BHAGWAT SARAN^{1*}, ANIL KUMAR¹, SHREYA NIVESH¹ AND BHASKAR PRATAP SINGH²**

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The economy of India is one of the fastest growing economies among the developing countries and agriculture plays a vital role in it. For the accomplishment of more and more yield to feed huge population, indiscriminate and excessive use of chemicals during the recent period has put forth a question mark on the sustainability of agriculture, in the long run, calling attention for sustainable agricultural production. Hence, excessive use of these chemicals must have some adverse effect on social and ecological balance. To fulfil and address social, ecological and economic issues together organic farming plays a vital role. Organic farming, is a method of farming system which primarily aims at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment. The entire system is based on the intimate understanding of nature's ways. The system does not believe in the mining of the soil of its nutrients and does not degrade it in any way for today's needs.

Key words: Organic farming, Sustainable agriculture, Bio-fertilizers

FIELD EFFICACY OF CERTAIN CHEMICALS AND NEEM PRODUCTS AGAINST SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE) ON BRINJAL (*SOLANUM MELONGENA* L.) IN TRANS YAMUNA REGION OF ALLAHABAD**KOLHE PRALHAD SARJERAO*, ASHWANI KUMAR** AND ANOORAG TAYDE***Department of Entomology, SHUATS, Allahabad*

A field experiment was conducted during kharif 2016 at Central agriculture field, SHUATS (Sam Higgin bottom University of Agriculture, Technology and Sciences), Allahabad, Uttar Pradesh (India). to determine field efficacy of certain chemicals and neem products against shoot and fruit borer (*Leucinodes orbonalis* Guenee) on brinjal (*Solanum melongena* L.) in trans yamuna region of Allahabad. The result showed that the carbosulfan 25 EC @ 0.05% was found most effective and showed (6.50%) shoot infestation, per cent fruit infestation (8.70%), followed by Quinolphos 20 EC @ 0.05% (7.96%) and (9.75%), Cypermethrin 25 EC @ 0.05 (8.02%) and (10.29), Chlorpyrifos 20EC @0.05% (8.07%) and (11.42%), Neem oil @ 2% (8.61%) and (11.62%), NSKE @ 5% (10.94%) and (12.58%) and Neem leaf extract @ 5 % (12.11%) and (16.45%) respectively.

Keywords: *Leucinodes orbonalis*, insecticides, neem products.

EFFECT OF STRAW AND PLASTIC MULCHING ON SOIL ENVIRONMENT, CROP PERFORMANCES AND PROFITABILITY OF BRINJAL (*SOLANUM MELONGENA* L.) IN SEMI ARID REGION OF BIHAR**VIJAY KUMAR, SURENDRA PRASAD, DEVENDRA KUMAR, JEETENDRA KUMAR^{1*}, BRAJESH SHAHI², SANTOSH KUMAR SINGH², MUKESH KUMAR²***Krishi Vigyan Kendra, Manjhi, Saran, ²Department of Soil Science, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur - 848 125, Bihar, ¹Krishi Vigyan Kendra, Gandhar, Jehanabad, Bihar Agricultural University, Sabour- 813210, Bihar*

A field experiment was established at semi arid region of Bihar to evaluate the effect of mulching (i.e., Black plastic mulch: M₁, Rice straw mulch: M₂ & Unmulched control: M₀) on soil environment and crop performances. Results revealed that black plastic and straw mulch conserved higher soil moisture as compared to without mulch in 0-7.5 & 7.5-15 cm soil depths. The maximum reduction in bulk density (BD), improvement in air filled porosity (AFP) and water holding capacity (WHC) was observed in straw mulch followed by black plastic mulch and unmulched control in 0-7.5 cm soil depth. Black plastic mulch and straw mulch reduced the weed population, promoted plant root growth and improved the yield of brinjal. Based on benefit cost ratio, the treatment of straw mulch was most economical which closely followed by black plastic mulch as compared to unmulched control.

Key Words: Brinjal, Economics, Moisture, Mulching, Root growth, Weed growth, Yield

Morphological and Biochemical Characterization of Cellulolytic enzyme by *Aspergillus niger* from agricultural waste PUSHANJALI SINGH¹, VISHAL SRIVASHTAV^{1*} AND ANKITA SARKAR²*¹Genetics and Plant Breeding, IAS, Banaras Hindu University, Varanasi-221 005, (U.P.), India, ²Mycology and Plant Pathology, IAS, Banaras Hindu University, Varanasi-221 005, (U.P.), India*

Cellulases are enzyme complex of hydrolytic enzymes such as endoglucanase (CMCase), exoglucanase, β -glucosidase (BGL) and FPase that are responsible for the bio-conversion of the cellulosic biomass into valuable products. *Aspergillus niger* was isolated from the waste of rice field and grown on potato dextrose agar medium. A morphological study was done on different pH, incubation period and different concentration of ammonium sulphate. Growth of *Aspergillus niger* was at pH 7.7, for 72 hrs of incubation and 0.14% of ammonium sulphate. Plate screening was done by using carboxy methyl cellulose as carbon source which showed clear zone formation on staining with congo red dye. By using DNSA method, cellulase activity was observed at different concentration of nitrogen source, pH and incubation time. At pH 4.2, with incubation period of 96 hrs, 0.125% peptone, 0.14% of ammonium sulphate and 0.04% of urea were recorded best for the cellulase activity.

IMPACT OF TREATED ROCK PHOSPHATE (TRP) ON PHOSPHORUS AVAILABILITY AND GROWTH OF MUNG BEAN (*VIGNA RADIATA*)**MAHESH PATIDAR¹, PRIYANKA JADON², SANDEEP MOHBE², S.K. UPADHYAY², C.K. DOTANIYA², RUCHI RAI², ARVIND K. SINGH³, RASHMITA SONARE³, BHARTI PARMAR⁴, SUDEEP BILGAINYA⁵***^{1,2}ICAR- Indian Institute of Soil Science, Bhopal M.P. 462038, ^{3,4}Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior MP – 474002*

Laboratory incubation study was carried out in the division of soil chemistry and Fertility, IISS, Bhopal (MP) to release of phosphorous from some rock phosphates under chemical and biological treatments. In this connection, an investigation entitled "Impact of treated rock phosphate (TRP) on phosphorus availability and growth of Mung bean (*Vigna radiata* L.)" was carried out during rabi season. The experiment consists of six treatments i.e. T₁ 2% TRP, T₂ 5% TRP, T₃ 2% NRP, T₄ 5% NRP, T₅ 2% NRP + Phospho-compost, T₆ 5% NRP + Phosphocompost, with three replication in a complete randomized block design. The different mixture of PRs, Zeolite, Acid clay and three size fraction of rock phosphates (<0.125 mm, 0.125 mm to 0.25mm, 0.25mm to 0.50mm) were incubated for 30 days. The observation of citrate soluble phosphate and total phosphate were at 10 days interval up to 120 days. The citrate soluble fraction of P in the natural RP after 30 days of incubation ranged from 2.8 to 6.6%, the highest being in Jhamarkotra-1 RP, and lowest being in Jhabua RP. Incubation of the organic matter with RP increased the solubility of RP further. The other two treatments i.e. Zeolites and acid clay increased the solubility of RP significantly when added in 1:1 ratio with RP, the maximum solubility was observed under incubation with acid clay in all the rock phosphate. Both Zeolite and acid clay because of their specific surface area provide a sink to the Ca₂₊ released in the process of RP dissolution however, acid clay enhanced the solubility further due to low pH of the medium. The trend of P-release by the RPs was more pronounced for the treatments with acid clay. The results on P release showed the maximum release of P during the 30 days of incubation from the acid clay treated rock phosphates at higher proportion (1:5 and 1:10) since thorough acidulation of the RP with the acid clay was achieved. However at lower ratio (1:1 of RP and acid clay), the dissolution of RP was not complete. This shows that more reactive time was required at lower ratio of RP and acid clay mixture. Release of P from rock phosphate in soil was affected by different treatments. Untreated rock phosphate (Jhamarkotra-1) released more P in Alluvial than in Vertisols because of relatively lower pH

in Alluvial than in Vertisols. The zeolite system had a gradual release of P in the soil system. However, there was a decrease in slope with increase in the number of extractions in Alluvial. The decrease in slope of the zeolite-system curve shows that the zeolite-system's ability to release P decreases as the number of extractions increases.

Keyword: Rock Phosphate, Phosphorus Availability, Vertisols of Mung Bean.

A STUDY ON POULTRY PRODUCTION PRACTICES AT VARIOUS FARMS IN VARANASI

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The study entitled "A study on poultry production practices at various farms in Varanasi" was conducted to determine the socio-economic profile of the farmers, managerial practices, profitability and income utilization under various system of poultry production. Five villages were selected purposively having presence of good number of poultry farmers. Data were collected from the 20 respondent with the help of structured interview technique. The study area was dominated by the male farmers belonging to middle age group followed by young. Most of respondents belongs general followed by other backward class and SC category. Education statuses of most of the respondents were high and 10+2. The average sizes of family in both organised system and backyard were 7 and have medium family size. joint type family were mostly present in most of the farms irrespective to the poultry production system, as is the trend in the present rural social dynamics all over the country and majority of respondents were high and 10+2. In both the systems of poultry farming, majority of the respondents had animal husbandry (including poultry) and agriculture as the main occupation. Majority of the organised poultry farmers 5 to 10 years' experience in poultry farm while majority of unorganised poultry farmers had more than 10 year experience. In organised system were practicing semi intensive and intensive systems of poultry farming, whereas in unorganised system all respondent were practicing extensive system of poultry production in all the five villages. Under organised system all the respondents were rearing broiler and they provide separate houses. Majority of poultry owners rearing birds in unorganised system made necessary arrangements for night shelters of the bird to protect them from predators. Majority of respondents of the organised system reported that Coccidiosis and IBD are major disease affecting production while in unorganised system respiratory problems, Fowl pox, Coccidiosis, IBD and Ranikhet diseases were reported which affects production.

Keyword- Backyards, organised, management, poultry, production, unorganised

AN EVALUATION OF MARKET CHANNEL/SUPPLY CHAIN OF POMEGRANATE IN AHAMADNAGER DISTRICT OF MAHARASHTRA

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Horticulture is better way of economic development. India stands second after china in production of fruit crops. Maharashtra stood first in production of pomegranate. Maharashtra shares 70 % production to total production of pomegranate in India. Pomegranate fruit crop produced in drought prone area of Maharashtra include Solapur, Sangali, Pune, Ahmednagar, Nashik, Dhule and some part of Osmanabad districts. In Ahmednagar districts mostly Karjat, Jamkhed, Shrigonda, Rahuri, Sangamner, Rahata and Ahmednagar tehsils were prominent in pomegranate production. Market is last and an important step in pomegranate cultivation. So market chain in pomegranate is very complicated. purpose of study market chain in Ahmednagar because centrally located district for Mumbai, Hyderabad, Solapur, and Surat market on transport and prices arriving from this market. The present study related with market chain, relation between growers rates and market chain or channel rate. For present study random sampling design methodology is apply for selection of villages, growers and data evaluation has been made on distance between growers and consumers. For good returns chain must smaller. There are certain market chain between growers and consumers i.e. pre- and post harvest contractors. Every market chain gets its own benefit hence rate of fruit is increased. It has been survey and on study seen that when growers get Rs.40/Kg rate then its selling price for consumer is Rs.100/kg. it seen that growers get Rs.45 and market chain gets Rs.60. For getting good returns for growers must have market awareness to sell is fruits in smaller chain or growers could reach directly to consumers to avoid market chain.

Keywords: market channel, supply chain, pre-harvest contractor, commission agent, wholesaler, aggregator.

DESIGN AND DEVELOPMENT OF A PORTABLE RAINFALL SIMULATION SYSTEM

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Owing to uncertainty associated with the occurrence of rainfall, rainfall simulators are widely used to produce artificial rainfall to conduct hydrological studies including runoff and sediment outflow studies. These rainfall simulation systems are, generally, installed at a particular place to facilitate hydrological studies under controlled conditions of a laboratory. Under such situations, various parameters related to soil system become difficult to simulate and soil erosion and sediment outflow studies are conducted based on several approximations and assumptions. These approximations and assumptions are not likely to represent the actual conditions of a field and therefore, the outcome of such studies will always be subjected to elements of deviation and uncertainty. In order to enhance the quality of hydrological studies, it was conceived to design and develop a portable rainfall simulation system which is light in weight, easy to assemble and disassemble and capable of generating artificial rainfall similar to natural rainfall with varying intensities. The developed portable rainfall simulation system capable of generating artificial rainfall similar to the natural rainfall which can be taken to actual field offers an effective and convenient mechanism to conduct hydrological studies including runoff and sediment outflow studies under actual field conditions. The portable rainfall simulation is 3.4 m long and 1.4 m wide has been developed by using hypodermic needles fixed at specified spacing. The rainfall generation unit is kept at 6.0 m height from the ground on a frame made of mild steel pipes. The entire rainfall simulation system consists of three units as base, supporting structure, rainfall generation and water supply units. The entire assemble is mounted on wheels to facilitate easy movement. The system is operated at a water supply pressure of 0.120 kg/cm² to 0.800 kg/cm² which produces rainfall intensities in the range of 3.77 cm/h to 12.73 cm/h with raindrop size in the range of 3.05mm to 4.76 mm. The uniformity coefficient of the generated rainfall ranges from 82.81% to 93.52% in the selected operating pressure range.

Keywords: Portable rainfall simulator, Hypodermic needles, Artificial rainfall, Operating pressure.

EFFECT OF INTEGRATED WEED MANAGEMENT ON WEEDS AND YIELD OF DIRECT SEEDED RICE

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Weed infestation in direct seeded rice fields remains the single largest constraint limiting their productivity. An effective early weed management tactic is imperative for any DSR production technology aiming at achieving higher productivity and profitability (Jaya Suria *et al.* 2011). Raj *et al.* (2013) found 72% reduction in grain yield due to the infestation of non-grassy, broad-leaved weeds and sedges in direct-seeded rice. The incorporation of green manure crops with 2, 4-D significantly reduced weed population and weed dry weight compared to other incorporation method (Anitha *et al.* 2009). Singh *et al.* (2007) reported that *Sesbania* coculture reduced broadleaf and grass weed density by 76-83% and 20-33% respectively, and total weed biomass by 37-80 % compared with a sole rice crop. Weed problem in direct seeded rice can be managed by implementing integrated weed management. A field experiment was conducted during the Kharif season of 2015 at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh to identify the best integrated weed management method for reducing density and dry weight of weeds and optimizing the yield of DSR. The experiment was laid out in a randomized block design, comprising 9 treatments and replicated thrice. Rice variety 'MTU-7029' was sown by zero till drill during the last week of June following the seed rate of 30 kg/ha and 20 cm row-row spacing. A recommended dose of fertilizer (150 kg N, 60 kg P₂O₅ and 60 kg K₂O) was applied using urea, single super phosphate and muriate of potash during experiment. Data on weeds and yields were recorded. **RESULTS** At 90 DAS, *Sesbania* cover crop fb bispyribac Na 25 g/ha + azimsulfuron 30 g/ha at 15 DAS had lesser total density and dry weight of weeds in comparison to sunhemp cover crop fb bispyribac Na 25 g/ha + azimsulfuron 30 g/ha at 15 DAS and both treatments were statistically at par to each other during investigation. However, *Sesbania* cover crop fb *Sesbania* coculture fb 2, 4 D 0.5 kg/ha at 30 DAS recorded lower total density and dry weight of weeds as compared to sunhemp cover crop fb sunhemp coculture fb 2, 4 D 0.5 kg/ha at 30 DAS. *Sesbania* cover crop fb bispyribac Na 25 g/ha + azimsulfuron 30 g/ha at 15 DAS had higher weed control efficiency and lower weed index in comparison to sunhemp cover crop fb bispyribac Na 25 g/ha + azimsulfuron 30 g/ha at 15 DAS. *Sesbania* cover crop fb bispyribac Na 25 g/ha + azimsulfuron 30 g/ha at 15 DAS had higher grain and straw yields in comparison to sunhemp cover crop fb bispyribac Na 25 g/ha + azimsulfuron 30 g/ha at 15 DAS (Table 1). **CONCLUSION** It was concluded that *Sesbania* cover crop fb *Sesbania* coculture fb 2, 4 D 0.5 kg/ha at 30 DAS was most effective for controlling weeds and improving grain and straw yields of DSR.

PHYTOPHTHORA INFESTANS A RE-EMERGING PATHOGEN**PAGOTI HEMALATHA¹ BATHULA JAGADEESH²***Department of Plant Pathology, GBPUA&T, Pantnagar*

Phytophthora infestans has been a named pathogen for well over 150 years and yet it continues to “emerge”, is one of the most confounding pathogen and model organism that exhibits high evolutionary potential and rapidly adapts to changing environment. This fungus like organism is responsible for global annual crop loss of US\$ 12 billion. Despite potato resistance breeding, fungicide use, and other control measures, it still continues to be a major threat to sustainable potato production worldwide. *P. infestans* population has undergone drastic change during the last two decade. New population has emerged which is more diverse having more pathotypes, carrying the new mating type (A2), haplotype etc (Fry *et al.*, 2015). Goodwin suggested that the Irish famine might have been caused by the US1 clonal lineage of *P. infestans*. Analyses of collected herbarium specimens by using shotgun sequencing indicated that US1 genotype was not present in 1845 to 1896 but instead, populations were dominated by a single genotype named HERB-1. The HERB-1 apparently dominated for 50 years but was subsequently replaced by the closely related US1 clone. The US-1(Ib) lineage increases in frequency in the middle 20th century in the US and globally and then declined. The mefenoxam (metalaxyl) sensitive US-22 is more common on tomato in 2009, has been displaced by US-23 in 2011, which infects both hosts of potato and tomato. In India it was introduced into the Nilgiri hills between 1870 and 1880. Soon spread to Darjeeling in Himalayas after introduction of English potato. Severe outbreak of late blight was recorded in India since 2008. A total of 276 isolates of *Phytophthora infestans*, 146 isolates from potato and 130 from tomato, were collected from major potato and tomato growing regions of India between 2009 and 2014. All the isolates were highly aggressive, A2 mating type and resistant to metalaxyl, that has replaced the US-1 population of *P. infestans* in India. This A2 mating type is almost identical to the 13_A2 clonal lineage reported in Europe. The 13_A2 lineage was responsible for severe late blight outbreaks on potato and tomato in South India. Revised management strategies will be required to combat this destructive 13_A2 clonal lineage and monitoring of the population across other potato- and tomato-growing regions of India. (Chowdappa *et al.*, 2013).

REDUCING PHOSPHORUS-REQUIREMENT BY TAKING ADVANTAGE OF ITS RESIDUAL EFFECT IN RICE-WHEAT CROPPING SYSTEM**AJIT KUMAR PASWAN, JEETENDRA KUMAR, WAJID HASAN, SHOBHA RANI***Krishi Vigyan Kendra, Gandhar, Jehanabad, Bihar Agricultural University, Sabour- 813210, Bihar*

The On Farm Trial conducted at farmers field in Jehanabad district to investigate the residual effect of Phosphorus applied in rabi season which is utilized in kharif by the rice crop. Phosphorus is used in both crops under rice-wheat cropping system leads to increase in cost of cultivation. The result reveals that the application of N:P:K (120Kg/ha N+60Kg/ha P₂O₅+40 Kg/ha) produced highest grain yield as 41.4 q/ha with highest B:C ratio (1:2.08) but with dose of N:P:K (120Kg/ha N+0 Kg/ha P₂O₅+40 Kg/ha) yield is 40.20 q/ha and the B:C ratio is highest (1:2.20), and yield is the lowest in N:P:K (150Kg/ha N+40Kg/ha P₂O₅+ 0kg K₂O) as 37.5 q/ha with the lowest B:C ratio (1:1.98) which is Farmer Practice. Therefore it can be recommended that application of N:P:K (120Kg/ha N+0 Kg/ha P₂O₅+40 Kg/ha) for wheat crop in Jehanabad District, Bihar.

Keywords: Phosphorus, B:C ratio, rice-wheat cropping system**MOLECULAR MARKER BASED IDENTIFICATION OF RICE RESTORES AND THEIR VALIDATION IN TEST CROSS HYBRID****JYOTSNA MISHRA***Department of PMB and Biotechnology, IGKV, Raipur-492012*

The study of hybrid rice and their evolutionary system is based on the fertility restoration system. Keeping this view of fertility restoration system of hybrid rice, the present study was carried out with the objective of molecular marker based identification of rice restorer and their performance in test cross. In this study the marker RM 6100 was used for the allele specific identification of rice restorer. 60 rice germplasm have been testing for the identification of rice restorer and out of 60 24 were found to be positive for the fertility restoration gene *Rf*. These *Rf* gene positive rice germplasm were crossed with cytoplasmic male sterile line (CMS line) and developed 24 hybrids for yield and yield components in comparison to commercial check hybrid PA6444. From these 24 test cross hybrids, the spikelet were ranged from 53.5 to 95.4 per cent with an average spikelet fertility of 74.4 per cent. The single plant yield were also calculated as 18.5 to 24.6 gm with an average single plant yield of 21.5 gm. The extent of heterosis in the test cross for yield and yield components were computed over the performance of the pollinator parents and standard heterosis over the commercial check PA6444. Out of 24 test cross hybrid 4 showed superiority of 16.8 per cent over the commercial check PA6444.

However, this findings concluded that the identified rice restorer play a major role in hybrid rice production technology in respect to spikelet fertility and other major yield attributing components.

ADVERTIZING IMPORTANCE AND GENETIC IMPROVEMENT OF MOTH BEAN FROM A LAND OF SEMI-ARID TRACT- RAJASTHAN

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Moth bean originated in India, chromosome number $2n=2x=22$, Scientific name- *Vigna aconitifolia*, family-fabaceae, Crop is having typical papilionaceous flowers like other leguminous crops. It is considered as most drought resistance crop among *kharif* crops and mainly grown in Rajasthan (Arid and semiarid part of country). Maximum area and production also contributed by Rajasthan. Crop offers several advantages like minimizing wind erosion, Nitrogen fixation, nutritional quality and without much investment starting from land preparation to harvesting. In spite of its great advantage genetic improvement are still at low level. However sincere and deliberate effort of plant breeding made to exploit some improved varieties for farming community i.e Type - 1, Type-3, MG-1, Baleshwar-12 (Late maturing varieties-100-120 days), Jadia, Jwala, Maru Moth, ICPMO-800, ICPMO-912, CAZRI Moth-1 (Medium maturing varieties 90-100 days) and RMO-40, RMO-257, FMM-96, RMO-225 and RMO-435 (early maturing varieties- 75-90 days). However constraint in crop like it is susceptible to terminal drought, yellow mosaic virus, nematode, bean weevil and still there are lot of scope to increase the yield plateau for feeding an increasing population which can be initiated from introduction, screening of germplasm, evaluation, hybridization breeding, Mutation breeding, genetic engineering approaches etc. and the integrated approaches of exploiting traditional methods as well as non conventional method will be more suitable option in fluctuating environment. The content will be helpful in advertizing importance and needed genetic improvement of the crop.

Key word- Moth bean, drought, genetic improvement, improved varieties and Rajasthan

STUDIES ON CULTIVATION TECHNOLOGY OF BLUE OYSTER MUSHROOM (*HYPsizYGUS ULMARIUS*) (BULL.EX.FR.) REDHEAD IN HARYANA

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The investigation entitled “Studies on cultivation technology of Blueoyster mushroom (*Hypsizygus ulmarius*) in Haryana” was carried out in the Mushroom Technology Laboratory, Department of Plant Pathology, CCS Haryana Agricultural University, Hisar to optimize physiological conditions, suitable substrate, supplement and its cultivation to harvest maximum yield. Two cultivation cycle trials were taken during October - December, 2015 and February – April, 2016 under natural conditions of Haryana. Among the substrate tried, cereal grains (Sorghum) was found an ideal substrate for spawn preparation as it took significantly less period and supported faster and enhanced vegetative growth of *H. ulmarius* followed by wheat grains and bajra grains. Wheat straw and wheat straw + paddy straw (1:1 w/w) were taken up and supplemented with different doses (i.e. 2.5 % and 5 % of dry substrate) of gram flour and wheat bran to assess the ideal combination of agro-residues and supplements for mycelial growth of *H. ulmarius*. Gram flour (5 %) supplemented wheat straw was found as best substrate for mycelial growth and it was treated with hot water (60 °C) and different chemicals viz., Bavistin ; 50 ppm, Formalin (500 ppm) and Bavistin(50 ppm) + Formalin (500 ppm). With cropping duration of two months; maximum yield was observed when substrate treated with hot water (661 g) followed by Bavistin (50 ppm) (538.1 g); Bavistin (50ppm) + Formalin (500ppm) (486.0 g); Formalin (500ppm) (410.5 g) and control (359.4 g). Similarly, least spawn run period (21.9 days), pinhead appearance (23.7 days) and least mould incidence was observed with hot water treatment (60 °C for 30 minutes). Physiological study of *H. ulmarius* was conducted to optimize temperature and pH using PDA (potato dextrose agar) medium to obtain maximum growth. Radial growth and biomass were maximum at 25 ± 1 °C and pH 7.0. The finding of the study are useful for cultivation of the mushroom .

Keywords: *Hypsizygus ulmarius*, mycelial growth, substrate, supplement, hot water, mould incidence, yield.

EFFECT OF INTEGRATED WEED MANAGEMENT ON NUTRIENT UPTAKE BY WEEDS AND CROP IN DIRECT SEEDED RICE**PRATIK SANODIYA* AND M.K. SINGH***Department of Agronomy, Rani Laxmi Bai Central Agricultural University, Jhansi, Uttar Pradesh 284003*

A field experiment was conducted during the *Kharif* season of 2014 and 2015 at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh to identify the best integrated weed management. Amongst the integrated weed management treatments, penoxsulam 35g/ha at 10 DAS *fb* 1 HW at 35 DAS recorded highest nutrients content while minimum uptake of nutrients by weeds in comparison to all other integrated weed management treatments except hand weeding at 15 and 35 DAS during both the years. Penoxsulam 35g/ha at 10 DAS *fb* 1 HW at 35 DAS reduced nutrients uptake by weeds as weed infestation and their dry matter accumulation in these treatments were statistically lower than other treatments except hand weeding at 15 and 35 DAS. Bispyribac Na 25g/ha at 10 DAS *fb* 1 HW at 35 DAS recorded lesser nutrients uptake by weeds in comparison to bispyribac Na 25g/ha at 20 DAS *fb* 1 HW at 35 DAS due to reduction of weed population and dry weight. At 60 DAS, penoxsulam 35g/ha at 10 DAS *fb* 1 HW at 35 DAS resulted in higher nutrients content and uptake by crop than all other integrated weed management treatments except hand weeding at 15 and 35 DAS in comparison to harvest stage of crop growth. This could be attributed to higher nutrient content in crop at 60 DAS as compared to harvest stage. At harvest stage, amongst the integrated weed management treatments, penoxsulam 35g/ha at 10 DAS *fb* 1 HW at 35 DAS had higher nutrients content and uptake in grain and straw compared with all other integrated weed management treatments except hand weeding at 15 and 35 DAS during both the years of investigation. Amongst the integrated weed management treatments, the highest total N, P, K and Zn uptake was observed under penoxsulam 35g/ha at 10 DAS *fb* 1 HW at 35 DAS except hand weeding at 15 and 35 DAS. This is owing to lower nutrient depletion by weeds under these treatments, whereas the lowest uptake of nutrients (N, P, K and Zn) by crop was recorded under weedy.

EVALUATION OF NITROGEN LOSSES AND NITROGEN USE EFFICIENCY IN MAIZE CROP, FERTILIZED WITH RESIN COATED UREA (RCU)**PRIYANKA JADON¹, RAJENDIRAN SELLADURAI², SHASHI S. YADAV², ARVIND KUMAR SINGH³, BHARTI PARMAR⁴, MAHESH PATIDAR²***^{1,2}Department of Soil Science and Agricultural Chemistry, ³Department of Agricultural Extension and Communication, ⁴Department of Agronomy, ¹Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior - 474002, Madhya Pradesh, India*

The chemical fertilizers are one of the costly inputs in agriculture and it is ironical that the nutrient use efficiencies of the conventional chemical fertilizers are very low. The rest of the applied fertilizers are lost causing pollution to soil, water and atmosphere continuum. Therefore, the development of nutrient efficient fertilizers is the need of the hour. In this context controlled release coated fertilizer might provide solution to the above issues. This might improve the mineral nutrition and yield of the crop. Keeping in view of the above, an attempt was made to study the nutrient losses specifically N from different coated urea fertilizers; and their effect on yield, nutrient content and uptake, nutrient use efficiency of maize (*Zea mays* L.) var. Nutan KH-101 grown on a Vertisol. The coated urea fertilizers were applied to maize crop at 100% and 75% recommended doses (RDs) along with RDs of P and K; conventional urea fertilizers along with P and K (100% RDs) and absolute control without any fertilizers were maintained. Application of coated urea fertilizers such as neem coated urea (NCU) and pine oleoresin coated urea (RCU) in a Vertisol reduced the ammonia volatilization by 27.5% and 41.1%, respectively. Similarly reduction of NO₃-N leaching due to application of neem, resin, nano rock phosphate and nano ZnO coated urea were 18.3%, 28.0%, 25.7% and 35.1%, respectively. The percent increase in shoot and grain yield due to application of urea (100% RD), RCU (100% RD) and NUC (100% RD) along with P and K was 29.4% and 28.3%, 53.2% and 67.5%, and 61.0% and 51.9%, respectively. N, P and K content of leaf, grain and stem was significantly higher in RCU (100% RD) and NUC (100% RD) applied treatments than urea (100% RD) applied treatment. The higher N uptake in shoot and grain was found in coated urea fertilizers applied treatments than normal urea applied treatment. In case of P and K uptake also coated urea fertilizers particularly RCU (100% RD) and NUC (100% RD) applied treatments showed significant improvement than normal urea. Agronomic efficiency, utilization efficiency and partial factor productivity for N, P and K were improved in coated urea fertilizers applied treatments than normal urea applied treatment. There was no much significant difference in soil physico-chemical properties among different fertilizer treatments. Further it is worth to mention that application of coated urea at 75% RDs also over performed the normal urea for improving crop yield and NUE. Therefore, the reduction of N losses, higher crop yield and nutrient use efficiency imparted by coated urea fertilizers could be a viable N source for crops. Moreover both neem and pine oleoresin coated urea applied treatments were almost equal in their impact on maize yield and

nutrient uptake, that indicates resin coated urea could be a good alternative N source to neem coated urea that is largely consumed in India at present.

EVALUATION OF GENETIC VARIABILITY AND VARIETAL PERFORMANCE OF GLADIOLUS (GLADIOLUS HYBRIDUS HORT.)

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A field experiment was conducted during Rabi season of 2014-15 to study "Evaluation of Genetic Variability and Varietal Performance of Gladiolus (Gladiolus hybridus Hort.)" at the Instructional Farm, Department of Floriculture & Landscaping, College of Horticulture & Forestry, Jhalrapatan, Jhalawar. The experiment consisted of 12 varieties „African Star“, „Arti“, „Darshan“, „Friendship“, „Hunting Song“, „Legend“, Pusa Srijana“, Pusa Kiran“, „Snow Princess“, „Sunayana“, „Trader Horn“ and „Urmi“ laid out in randomized block design with three replications. The variety „Trader Horn“ was found superior for number of leaves per plant (9.75), plant height (137.09 cm), spike length (123.38 cm), floret diameter (10.93 cm), duration of flowering (16.17 days), number of florets per spike (20.08) and number of cormels per plant (70.83). The „Legend“ was noted best yielding variety in respect to, maximum number of spikes (37.0) per plot, number of corms per plant (2.50), number of corms per plot (37.67), sprouts per corm (2.67) and B:C ratio (2.18). The maximum vase life was observed in „Darshan“ (17.56 days) and maximum number of florets remaining open at a time in vase was observed in „Hunting Song“ (6.78 florets). These characters may be considered by breeder for breeding program. High heritability with high values of genetic advance was observed for weight of cormels / plant, number of cormels / plant, rachis length, spike length, weight of corm and number of spikes / plots. Spike length had high positive association with rachis length, floret diameter, spike diameter, duration of flowering, number of florets / spike, number of cormels / plant, diameter of corm, weight of corm, weight of cormels / plant, size index of corms and number of florets remain open at a time in vase.

EFFECT OF CROPPING SYSTEMS IN FRUIT CROPS

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Fruit growing is one of the most important and profitable venture in horticulture. India ranks second in area and production of fruit crops next only to China. Fruit crops are widely spaced and are amenable for crop diversification in the interspaces. Mono cropping of fruit crops is not ecologically and economically sound farming system. Farmers are cultivating different crops in different seasons based on their adaptability to a particular season, domestic need and profitability. Cropping system is the answer to the problem of increasing production and farm income and for improving nutrition of the small scale farmers with limited resources without any adverse effect on environment and agro-ecosystem Cropping system refers to scientific integration of different interdependent and interacting farm enterprises for efficient utilization of resources, i.e. land, labour, water, sunlight and other resources of farm family which provides year round income to the farmers. In India about 53.34 million tones of top soil (16.4t/ha) containing 5.4 million tons of plant nutrients is lost annually due to agriculture and associated activities. To avoid this problem we need cropping systems. Cropping pattern means the proportion of area under different crops at a point of time, change in this distribution over a period of time and factors affecting this change in distribution. Cropping pattern is a dynamic concept as it changes in time and space. Cropping pattern in a state keep on changing from time to time with the change in related factors. Intercropping system has various advantages like insurance against failure of base crop, higher gross return per unit area, efficient use of environmental factors (light, water and nutrients), reduction in weed population, intensive utilization of labour throughout the year, protecting soil from erosion, diversity of diet and improvement of socio-economic status of growers Besides, intercropping also provide greater stability in production as well as help the farmers in maintaining the soil fertility level Therefore, cropping systems are necessary.

COMPARATIVE ANALYSIS OF CARBOHYDRATES IN ACACIA NILOTICA SEED AND SEED PARTS

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Objective: Identification and quantification of carbohydrates for part specific comparative study in *Acacia nilotica* seeds for nutritional and medicinal aspects.

Hypothesis: *Acacia nilotica* indigenously known as 'Babool' and belong to family Leguminosae. *A. nilotica* has many traditional and ethanobotanical uses. All the plant parts of *A. nilotica* are important, but seeds are rich in phytochemicals viz. protein, sugar, starch, fatty acid, oil, alkaloids, glycosides, steroids, tannins, phenolics, flavanoid and cyclitols with high nutritional value and therapeutic effects viz. anti-microbial, antifungal, anti-pyretic, analgesic, anti-inflammatory, anti-diarrhoea, anti-asthmatic, cytotoxic and anti-diabetic. Carbohydrate is an important group of phytochemical with such nutritional and medicinal properties. Thus, *A. nilotica* seeds and their parts evaluated for carbohydrates to compare the part specific potential for safer utilization to mankind.

Method: *A. nilotica* seeds along with cotyledon and endosperm were separated mechanically and powdered to 40 mesh. Powdered materials were then extracted in differential solvents viz. hexane, chloroform, acetone, ethanol and water. These extracts were used for qualitative study of carbohydrates. The quantitative estimations viz. total carbohydrate, sugar and starch were carried out in powdered materials according to the standard methods.

Results: Ethanol and water extracts of seed, cotyledon and endosperm showed the presence of carbohydrates. Quantitative estimation revealed that total carbohydrate and total sugar were high in cotyledon i.e. 17.83% and 4.73% than seed and endosperm respectively whereas total starch was less in cotyledon than seed and endosperm i.e. 2.3%.

Implication: Study revealed that cotyledon has rich nutritional and medicinal carbohydrates than the seed and endosperm. Thus, it may be specifically and better utilized for carbohydrate rich supplements and for useful bioactive extracts as natural products for sustainable health benefits.

Key words: *Acacia nilotica*, Carbohydrate, Health, Medicinal, Nutritional.

APPROACHES TO REDUCE JUVENILITY OF FRUIT CROPS

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Juvenility is defined as the extended period of post-germination, vegetative development in which flowering is repressed even under favourable environmental conditions. The length of the juvenile phase for tree fruit crops extend from at least three years (peach) to 15 or more years (Avocado). In nature, juvenility ensures that flowering is not initiated before the plant has reached the photosynthetic capacity to produce fruit and viable seed, or that resources are not diverted to flowering before a plant has reached a competitive size in its environment. However, this natural safeguard can be subverted by breeders, who are able to maintain plants under optimal growth conditions, and often need only to obtain pollen to advance to the next generation. Approaches to reduce juvenility of fruit crops are cultural (Use of dwarfing rootstocks, Soil solarisation, Girdling), chemical and biotechnological tools. Reducing juvenility is benefit for early fruit production, reaching profitable orchard early and rapid breeding cycle. As the long juvenility period in fruit crops became barrier to both producer and breeder to evolve new improved varieties there is urge to adapt these approaches. All the approaches are able to meet standard tree characters with respect to yield and quality of produce. There is gap to make these technologies reach to the growers and make them adopt these methods thereby they can reduce non profitable orchard period which reduces the orchard budget and can fetch the economic yield in shorter period.

EFFECT OF CONSORTIUM OF NITROGEN FIXING ENDOPHYTIC BACTERIA ON NUTRIENT AND JUICE QUALITY IN SUGARCANE (*SACCHARUM OFFICINARUM*)**P. S. CHOUGULE, P. K. LOKHANDE, R. M. NAIK AND A. L. PHARANDE***Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar (M.S.) – 413722**e-mail: pankaj.chougule32@gmail.com*

Sugarcane is cultivated throughout the Indo-Gangetic plains of South Asia and Maharashtra is second largest producer. The leaf samples were collected at different stages of crop growth from PGI farm and CSRS, Padegaon and were evaluated for nitrogen, phosphorous, nitrate content and juice quality. The experiment was laid out in Randomised Block design with four replications and six treatments. Nitrogen fertigation was given as 100 % N through urea (T₂), 50 % N + *Acetobacter diazotrophicus* (T₃), 25 % N + consortium endophytic bacteria (T₄), 0 % N + consortium endophytic bacteria (T₅), 0 % N + without consortium endophytic bacteria (T₆) with absolute control (T₁). The results of the experiment revealed that nitrogen, phosphorous, nitrate content by sugarcane crop was significantly higher in T₄ treatment (25 % N + foliar application of consortium of endophytic bacteria) followed by RDF treatment and 0% N with foliar application of consortium of endophytic bacteria. The juice quality the T₄ treatment (25 % N + foliar application of consortium of endophytic bacteria) recorded minimum POL and CCS % at both locations. The differences in quality attributes at both the locations could possibly be due to crop management practices. Hence, the use of foliar spray of consortium of N fixers @ 25 % concentration can save 75 % of nitrogen without affecting the yield.

Key words: Sugarcane, Nitrogen fixing endophytic bacteria,

TRANSGENIC FRUIT CROPS**S. M. CHOUDHARY¹, RAJANI PANT², S. S. KULKARNI¹, A. M. MUSMADE¹ AND RAJENDER KUMAR¹**¹*Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri- 413 722*²*Department of Horticulture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar- 263 145 Uttarakhand**E mail: sanwarchoudhary999@gmail.com*

A transgenic crop plant contains a gene which has been artificially inserted instead of the plant, acquiring them through fertilization or pollination. Transgenic means transfer of genetic material (DNA fragment carrying known genes) from across the biological systems through *in-vitro* techniques. Genes so transferred are known as transgene. Breeder always tries to incorporate beneficial genes in a crop which will be more useful and productive. Through conventional breeding approaches genes can be incorporated from related species, but most of the times it does not possible due to several reasons, so in that case transgene pave the wonderful way, where gene can be taken from unrelated species. Purpose of the transgenic is design plants with specific characteristics from other species or sometimes even different kingdoms eg. Transgenic papaya. The power of this technique lies in its ability to move genes from one organism to crop plants to impart novel characteristics. Transgenic research in fruit crops is very low due to difficulty in regeneration and transformation procedure being perennial and woody in nature. So that present information will be utilized by fruit breeders to a design future program for developing transgenic that ultimately open the way for those crops where gene transfer is difficult through conventional breeding. Need of the transgenic is meet the world's need of balance food, increase quality yield, improve quality (Shelf life, Texture), crop better with climatic change, nutritional improvement, reduce loss during transportation and storage, abiotic stress resistance (drought, heat, cold, salt etc.), Biotic stress resistance (Insect, pest and diseases), resistant against herbicides.

Key words: Transgenic, Biotic resistance, Fruit, Abiotic stress resistances

DYSTOCIA DUE TO UTERINE TORSION IN A BUFFALO**KAMLESH K AHIRWAR* AND K AHIRWAR****1. *Veterinary Hospital: Alipura, Dist. Chhatarpur (M.P.)*2. *Krishi Vigyan Kendra, Chhatarpur (MP.)**Email: dr.kamleshahirwar@gmail.com*

A pluriparous full-term pregnant Murrah buffalo was presented to Veterinary Hospital- Alipura, with history of complete gestation, excessive straining and restlessness for the previous 8 hr. Per-rectal examination reveals that broad ligaments are displaced with one side of ligament being pulled tightly over the uterus while other is pulled ventrally to the uterus. Per rectal examination of the animal indicated more than 180 degree right-sided uterine torsion. Per vaginal examination revealed no fluid discharges and the os-cervix could not be palpated. Per vaginal examination confirmed right-sided uterine torsion. The detorsion was achieved by casting the animal in right lateral recumbent position with rolling of animal in the same direction as that of torsion. After the first roll, per vaginal examination was done to assess the degree of detorsion. A second roll was needed to detort the uterus completely.

After giving two complete rolls, the foetal fluids gushed out of the uterus and the foetal head was now easily palpable. On application of gentle traction to the foetus, live buffalo calf was delivered.

Keywords: Pluriparous, buffalo, torsion, foetus, straining.

ROLE OF PLANT HORMONES IN PLANT DEFENCE

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Plant hormones play important roles in regulating developmental processes and signaling networks involved in plant defence to biotic and abiotic stresses. Progress has been made in identifying the key components and understanding the role of salicylic acid (SA), jasmonates (JA) and ethylene (ET) in plant responses to biotic stresses. Other hormones such as abscisic acid (ABA), auxin, gibberellic acid (GA), cytokinin (CK), brassinosteroids (BR) and peptide hormones are also implicated in plant defence signaling pathways but their role in plant defence is less well studied. Plant hormones interact in complex networks to balance the response to developmental and environmental cues and thus limiting defense-associated fitness costs. A complex network of signaling pathways mediates defense responses as well as plant development and abiotic stress adaptation. Hormonal signaling pathways share hubs for crosstalk, which include DELLA, JAZ, and BZR1/BES1 proteins. A significant progress has been made in elucidating the roles of phytohormones in rice immune responses. The negative role of GAs in rice immunity is a breakthrough for the mechanism underlying the virulent strategy of *G. fujikuroi*. In general, growth-promoting hormones such as auxin and GAs are susceptible factors for pathogen infection on rice plants, whereas growth-repressing hormones such as SA and JA are resistant factors. However, there is exception to this generalized concept.

Keywords: Pathogens, abscisic acid, auxin, hormone crosstalk, salicylic acid, trade-off

INTENSIVE AGRICULTURE AND ITS COMPONENTS

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Intensive farming involves various types of agriculture with higher levels of input and output per cubic unit of agricultural land area. It is characterized by a low fallow ratio, higher use of inputs such as capital and labour, and higher crop yields per cubic unit land area. The term "intensive" involves various meanings, some of which refer to organic farming, and others that refer to nonorganic and industrial methods. Techniques include planting multiple crops per year, reducing the frequency of fallow years, and improving cultivars. It also involves increased use of fertilizers, plant growth regulators, and pesticides and mechanised agriculture, controlled by increased and more detailed analysis of growing conditions, including weather, soil, water, weeds, and pests. The System of Crop Intensification (SCI) was born out of research primarily at Cornell University and smallholder farms in India on SRI. Integrated multi-trophic aquaculture (IMTA) is an example of a holistic approach. IMTA is a practice in which the by-products (wastes) from one species are recycled to become inputs (fertilizers, food) for another. Biointensive agriculture focuses on maximizing efficiency such as per unit area, energy input, and water input. Agroforestry combines agriculture and orchard/forestry technologies to create more integrated, diverse, productive, profitable, healthy, and sustainable land-use systems. Intercropping can increase yields or reduce inputs and thus represents (potentially sustainable) agricultural intensification. Vertical farming is intensive crop production on a large scale in urban centers, in multi-story, artificially-lit structures, using far less inputs and producing fewer environmental impacts. An integrated farming system is a progressive, biologically-integrated sustainable agriculture system such as IMTA or Zero waste agriculture, whose benefits include sustainability and increased profitability. The challenges and issues of industrial agriculture for society, for the industrial agriculture sector, for the individual farm, and for animal rights include the costs and benefits of both current practices and proposed changes to those practices.

Keywords: intensive agriculture, zero tillage, system of crop intensification

EFFECT OF SPACING AND NUTRIENT LEVEL ON GROWTH, YIELD AND ECONOMICS OF BT COTTON CROP**DEEPAK KOCHAR^{1*} AND SAROJ SHARMA²**^{1,2} *Department of Soil Science, CCS Haryana Agricultural University, Hisar-125004*** Corresponding author's Email-deepakkochar9@gmail.com*

A field experiment was conducted during *kharif* season of 2017-18 to study the effect of spacing and nutrient level on growth, yield and economics of Bt cotton crop at research farm of CCS HAU, Hisar-(Haryana). The experiment was laid out in split plot design with three replications. There were fifteen treatment combinations comprising three fertility levels viz, 100:50:50, 125:65:65 and 150:70:70 NPK kg ha⁻¹ and three plant spacing viz., 90 cm x 60 cm, 150 cm x 30 cm and 180 cm x 30 cm. The number of sympodial branch per plant and seed cotton weight per plant were higher in crop geometry of 150 cm x 30 cm over 90 cm x 60 cm and 180 cm x 30 cm. Based on the results it can be concluded that the growth and yield attributes of Bt cotton were improved in crop geometry of 150 cm x 30 cm. The seed cotton yield of Bt cotton was significantly higher in crop geometry of 150 cm x 30 cm than 90 cm x 60 cm and 180 cm x 30 cm. Application of 125:65:65 kg NPK ha⁻¹ to Btcotton was at par with 150:70:70 kg NPK ha⁻¹ and significantly superior over 100:50:50 kg NPK ha⁻¹. Also, the same spacing and fertiliser level provide the highest net profit of Rs.75,463 ha⁻¹.

Keywords: Bt cotton, plant spacing, crop geometry, fertility level, economics.

EFFECT OF WEATHER PARAMETERS ON INSECT PEST INCIDENCE AND THEIR NATURAL ENEMIES IN RICE**DHARMENDAR SINGH AND VIJAYA***Department of Entomology CCSHAU, Hisar-125004-Haryana(India)**dr.dharmendrasingh1008@gmail.com*

Rice is one of the important staple foods for half of the world population particularly for Asian countries for the livelihood, socio-economic development and nutrition. Climatic factors e.g., temperature and humidity/rainfall are the key factors for the development of many rice insect pest and the natural enemies (arthropods). The analysis of various studies of the weather parameters on the incidence of insect pest in rice revealed that Yellow stem borer *Scirpophaga incertulus* incidence showed a positive correlation with minimum temperature and average rainfall and wind velocity. The damage of Leafhopper *Cnaphalocrocis medinalis* was also found negatively correlated with minimum temperature and average humidity and wind velocity. The correlation of Brown planthopper (BPH) *Nilaparvata lugens* showed a positive correlation with temperature rise, rainfall amount and average relative humidity. WBPH *Sogatella furcifera* incidence was observed to be negatively correlated with minimum temperature. Gundhibug *Leptocorisa acuta* showed significant and negative correlation with minimum temperature and minimum relative humidity. Among the natural predators the spiders and mirids were found the most important natural enemies. Spiders and Odonata recorded as general predators of rice pests. The population of Odonata, damselflies was found positively correlated with the temperature fall and increase in relative humidity. Mirids *Cyrtorhinus lividipennis* (Reuter) was considered as important, potential and efficient predator of BPH and WBPH and negatively correlated with wind velocity. Staphylinids *Paederus fuscipes* were identified as a predator on leafhoppers and significantly and positively correlated with rainfall amount and relative humidity.

Keywords: Climatic factors, BPH, relative humidity, predators.

CONSERVATION OF NATURAL RESOURCES & ITS RECOVERY: A NEED OF GROWING WORLD**NEHA BHATNAGAR***Department of Zoology, G.G.D.S.D College, Palwal (Haryana)**Email: vneha.2008@gmail.com*

Natural Resources are important for life that we cannot imagine our life without it. These are the precious gift of the nature with several uses. These resources are becoming scarce with growing population day by day. It is the matter of great concern for all of us. Besides coordinating the demand and supply of the resources, there is a need to keep the balance of these in nature. So we need to recover and reuse the resources present in the environment as these are limited. Global population is expected to cross 9 Billion by 2050, which means a lot of pressure on the resources. Resource recovery includes the use of waste material for the production of valuable products. It includes recognizing the waste material as a resource together with collection of source, their separation, reuse and its recycling. It utilizes the concept of treating the waste material to produce beneficial products and reducing the need of raw material. For example, waste water is a good source of organic matter, heavy metals, nutrients like Nitrogen & phosphorus, thermal energy etc. Organic matter which includes food or agricultural waste can be used to produce methane gas which can be

used for heating and cooking purpose. Plastics can be converted into constructive elements like plastic bottle walls and plastic bottles green houses. The reuse and recycling of natural resources not only reduce pollution but it also reduces energy consumption and landfills problems. It also improves the quality of the environment and also produce employment for peoples.

POPULATION DYNAMICS OF MAJOR INSECT PESTS OF LENTIL

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Population dynamics of insect- pests viz *Aphis craccivora*, *Etiella zinckenella* and *Helicoverpa armigera* on lentil was studied under field conditions during Rabi 2015-16. Peak population of *A. craccivora* (78.0 aphids/ 5 plants), *E. zinckenella* (11 larvae+ faecal material/ plant) and *H. armigera* (0.83 larvae / 5plant) was recorded on 7th, 12th and 9th Standard meteorological weeks (SMW), respectively. Population dynamics studies revealed significant negative correlation of *Aphis craccivora* population with the Temperature (max. & min.) i.e $r = -0.5015^{**}$ and $r = -0.6138^*$, significant positive correlation of *Etiella zinckenella* with the Temperature (Tmax. & Tmin.) i.e $r = 0.8251^*$ and $r = 0.8481^*$ and non-significant correlation of *H. armigera* population with the abiotic factors.

Keywords: Population dynamics, lentil, *E. zinckenella*, *H. armigera*, *A. craccivora*

OVIPOSITIONAL PREFERENCE OF POTATO TUBER MOTH, *PHTHORIMAEAOPERCULELLA* (ZELLER) ON SOME POTATO VARIETIES AND ITS MANAGEMENT THROUGH SOME PLANT VOLATILE OILS

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The Potato Tuber Moth, *Phthorimaeoperculella* Zeller (Lepidoptera:Gelechiidae) is a cosmopolitan dominant pest in sub-tropical and tropical areas and it is responsible for important losses in potato production (Daset *et al.*, 1992). The moth has high reproductive potential and is apparently developing resistance to some insecticides. It can cause damage to foliage and to tubers in the field especially high potential to destroy potatoes in storage. The principal economic damage occurs towards the end of the growing season when tubers become exposed and are infested by PTM prior to all during harvest (Lacey *et al.*, 2007). The effect of five potato varieties on fecundity and hatchability of PTM was studied and the highest fecundity per female was recorded when larvae were fed on Kufri Kanchan (67.5 eggs) followed by Kufri Jyoti (62.5 eggs). The larvae that fed on KufriSindhuri showed the lowest fecundity of 43.75 eggs. The descending order of fecundity with respect to varieties was Kufri Kanchan (67.5 eggs)>Kufri Jyoti (62.5 eggs)>KufriHimalini (53.75 eggs)>KufriGridhari (53.75 eggs)>KufriSindhuri (43.75 eggs). Kufri Jyoti proved to be highly susceptible variety which encouraged female to deposit the largest number of eggs (61.5) followed Kufri Kanchan with an average number of 59 eggs. KufriGridhari and KufriHimalini showed to be moderately susceptible with an average number of deposited eggs of 44.75 and 43.75 respectively. The least susceptible variety was KufriSindhuri which was significantly different from all the other tested varieties. Effectiveness of five plant volatile oils at five different concentration and their relative toxicity were evaluated against PTM. The mortality data obtained by bioassay against PTM caused by different concentrations of plant volatile oils revealed that the larval mortality was significantly much higher in all the concentration and the percent larval mortality decreases as the concentration of the plant volatile oil decreases. After 24 hours of treatment at high concentration of 1.0% Patchouli oil gave highest mortality of 79.99% followed by Citronella oil with 70% mortality and Lemongrass oil with 66.66% mortality. After 48 hours of treatment, the highest larval mortality was obtained in Patchouli oil with 79.99% mortality followed by Citronella oil (73.33%) and Lemongrass oil (69.99%) at the highest concentration of 1.0%. The larvae treated with Patchouli oil at the concentration of 0.8% and 1.0% and Citronella oil@ 1.0% failed to pupate whereas the pupation percentage was maximum in case of control (89.99%) showing that the plant volatile oils at higher concentration suppress the pupation success. The lowest percentage of adult emergence of 8.34% was obtained when treated with Lemongrass oil@ 0.4% concentration while the highest percentage of adult emergence (96.66%) was obtained when treated with Citronella oil @ 0.2% concentration. The LC₅₀ values of Citronella oil, Lemongrass oil and Patchouli oil were 0.727%, 0.772% and 0.525% respectively after 48 hours of treatment. Patchouli oil showed the lowest LC₅₀ value and proved to be the most toxic plant volatile oil followed by Citronella oil. Lemongrass oil shows the highest LC₅₀ value and proved to be the least toxic to the larvae of PTM. The descending order of toxicity of the plant volatile oils with respect to LC₅₀ value is as Patchouli oil (0.526%)> Citronella oil (0.727%)>Lemongrass oil (0.772%). In the present investigation, when the relative toxicity of the different plant volatile oils against the larvae were calculated considering the LC₅₀ values of the least toxic plant oils i.e., Lemongrass oil as unity, Patchouli oil was 1.46 times and

Citronella oil was 1.06 times more toxic than Lemongrass oil. The order of relative toxicity was Patchouli oil (1.46) > Citronella oil (1.06) > Lemongrass oil (1.00).

EFFECT OF BIO-FERTILIZERS AND PHOSPHORUS LEVELS ON YIELD AND QUALITY OF CHICKPEA (*CICER ARIETINUM* L.)

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The field experiment was conducted to evaluate the effect of biofertilizers and phosphorus levels on yield and quality of chickpea at Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, India during *Rabi* season, 2015-2016. Nine treatments were comprised of biofertilizers (0, PSB and VAM) and three phosphorus levels (0, 40 and 60 kg ha⁻¹) in randomized block design replicated thrice. The experimental soil having silty loam in texture, pH (1:2.5) 8.24, EC 0.34 dSm⁻¹, Organic carbon 3.5 g kg⁻¹, available nitrogen 180, phosphorus 18.20 and potassium 226.33 kg ha⁻¹. Row to row 30cm and plant to plant 10cm. Variety PG-186 was taken as a test crop. The seed and straw yield and protein content were increased significantly with the application of increasing levels of phosphorus along with inoculation of biofertilizers. The maximum seed and straw yield was recorded with the application of phosphorus @ 60 kg P₂O₅ ha⁻¹ which was significantly superior over control and statistically at par with 40 kg P₂O₅ ha⁻¹. Among the biofertilizers, the maximum yield was obtained with inoculation of VAM followed by PSB. In respect of quality, the maximum protein content was recorded with the application of phosphorus @ 60 kg P₂O₅ ha⁻¹ which was significantly superior over 40 kg P₂O₅ ha⁻¹. The inoculation of bio-fertilizers also significantly influenced in increasing the protein content. The maximum protein content was received with inoculation of VAM followed by PSB.

NON-THERMAL PLASMA FORELIMINATION OF PESTICIDE REMOVAL FOR FRUITS AND VEGETABLES: A NOVEL TECHNIQUE

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Fruits and vegetables are the vital components to maintain health due to abundant sources of vitamins and minerals. In present scenario, it was impossible to get fresh fruit and vegetables in the market due to excess application of pesticides. In order to eliminate this Non-thermal Plasma Technology came into a emerging method. Non-thermal Plasma is a novel technique which was used to decontaminate food product, food processing surfaces, inactivate microbial activity and pesticide removal. It involves exposing food to ionizing radiation including positive charged particles, negative charged particles and neutral particles. This flexible sanitizing method uses electricity and a carrier gas, such as air, oxygen, nitrogen, helium or argon and generates plasma. NTP provides high efficiency on microbial inactivation as well as removing toxicant residues at low temperature (<50 °C), resulting in improved shelf life and safety of foods and reduced usage of preservatives. It is also compatible with most packaging types and modified atmospheres due to in situ generation of reactive species. By applying NTP, harmful bacteria and toxins in fruits and vegetables can be eliminated effectively, while the fresh taste, aroma, texture, wholeness and nutritional content were still preserved. Thus, Non thermal Plasma has the potential to be an effective method to ensure chemical safety for fruits and vegetables by preserving nutritional as well as sensory qualities.

Keywords: Non-thermal Plasma, Fruits, Vegetables, Pesticides and Toxins

EFFECT OF PHOSPHORUS AND ZINC FERTILIZATION ON THEIR AVAILABILITY AND PERFORMANCE OF GREEN GRAM (*VIGNA RADIATA* L. WILCZEK)**PADMA ANGMO^{1*} AND MAMTA PHOGAT²**¹Department of Soil Science, PAU, Ludhiana, Punjab²Department of Soil Science, CCS HAU, Hisar, Haryana

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An investigation was carried out to study the "Effect of phosphorus and zinc fertilization on their availability and performance of green gram (*Vigna radiata* L. Wilczek)" at Research Farm of Division of Soil Science and Agricultural Chemistry, SKUAST-Jammu, Main campus, Chatha during summer season of 2015 with four levels of phosphorous (0, 20, 40 and 60 kg ha⁻¹) and four levels of zinc (0, 5, 10 and 15 kg ha⁻¹) with different treatment combination replicated thrice. The experiment was laid out in Factorial Randomized Block Design (F-RBD) using cv. SML-668 a high yielding variety of green gram as the test crop. The results of the investigation revealed that the effect of phosphorous and zinc on different growth and yield attributing parameters i.e. plant height at 20, 40 DAS and at maturity and plant population, number of pods per plant, 1000 seed weight, number of nodules per plant, seed yield and stover yield of green gram was found statistically significant. The grain yield (957.25 kg ha⁻¹) and stover yield (2399.40 kg ha⁻¹) of green gram were highest with the combine application of P and Zn and found to increase with the successive application of phosphorous up to 60 kg ha⁻¹ and zinc up to 10 kg ha⁻¹ respectively and further increase in zinc levels found to decrease the growth and yield attributing trait, indicating antagonistic effect of P and Zn on each other as high P in soil reduce the uptake of Zn by roots. The interaction of P and Zn were also significant for all the growth and yield attributing parameters except plant population. The available phosphorous and zinc in soil were also significantly influenced and found to decrease with increase in time interval i.e. 20, 40 DAS and at maturity. So the application of 60 kg of P and 10 kg of Zn ha⁻¹ is best for optimum production of green gram (cv.SML-668) in the subtropical zone of Jammu which can be recommended for the farmers of the area for long term sustainable soil health.

WATER MANAGEMENT OF HORTICULTURAL CROPS IN DRY REGIONS**PANKAJ**

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There is a fundamental role of water in agriculture and anybody planning to set out as a farmer must consider the availability of water resource near the place where he intends to put up the farm. Water is very important both for livestock and for plants. It forms a large part of tissues and cells. Due to increase in population there is also an increase in demand of fresh water. And the water resources are degraded to large extent. Ground water level is also dropping at the rates faster than ever. Water is one of the most important plant growth regulator and how we manage it will influence our future well being. Agriculture sector is the largest user of water i.e. >70%. In agriculture water is used for irrigating the fields, for diluting the insecticides and herbicides. Increase in water demand and water scarcities will have a major economic and political impacts. As the horticultural crops have high value and intense cultural practices they are better suited for adaptation to improve water saving technologies than many agronomic crops. Not only the arid regions but other regions with saline water are suffering from the water scarcity. The productivity of dry regions is less due to unavailability of irrigation water. But water can be used with maximum efficiency by using drip irrigation system. Recently drip irrigation system is used for many vegetable in southern and eastern United States. Micro irrigation have also been used successfully in fruit trees. Horticultural crops have higher market value than traditional agricultural crops. Hence, improved water saving technologies have been focused on certain horticultural crops.

Key words : Water management, horticultural crops, dry region etc.

SYNTHESIS OF NOVEL HETEROCYCLIC COMPOUNDS USING FRUIT JUICE AS GREEN CATALYST**POOJA^{1*}, RAJVIR SINGH² AND POONAM³**

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The fundamental aspects of green chemistry are use of natural catalysts and environmental benign solvents under mild conditions. Natural catalysis represent a unique class of green catalysts which are eco-friendly, stable, non-hazardous, non-toxic, non-polluting, easily available, generally cheap and can be easily reused and recycled. These catalysts have large number of application in the organic transformations. Also green chemistry has amazing applications for the synthesis of different organic compounds.

The technique involves as an alternative reaction media to replace toxic, hazardous and high cost solvents in organic synthesis. Heterocyclic compounds are universal in natural products and pharmaceuticals and represent the most important class of key structural units in a large number of bioactive molecules. Polycyclic heterocycles with potential medicinal and biological activities has received significant attention for research in organic and medicinal chemistry. Coumarins find widespread applications in a broad range of fields, including food, cosmetics, as dispersive fluorescent laser dyes, as light-activated compounds in the field of medicine and as anticoagulants in the production of pesticides. Dihydropyrimidinones (DHPMs) are well known for their wide range of bioactivities and their applications in the field of drug research have stimulated the invention of synthetic methods for their preparation and chemical transformation. Due to their applications in the field of pharmacological and therapeutic properties such as antibacterial, antimalarial agents and behaves as calcium channel blockers. Several approaches have been made to synthesise coumarins and Dihydropyrimidinones but all these were hazardous to the environment. Therefore a simple method is required for the synthesis of heterocyclic compounds. The growing interest in fruit juice as catalyst ensures the nontoxic or nonhazardous pathway for the synthesis of heterocyclic compounds.

ADVANCES IN MODIFIED ATMOSPHERE PACKAGING TO ENHANCING THE SHELF LIFE OF FRUITS

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Modified atmosphere (MA) means an atmospheric composition around the fruit that is different from that of normal air i.e., 78.08% N₂, 20.95% O₂ and 0.03% CO₂ that MA can interplay with the physiological processes of commodity resulting in reduced rate of respiration, transpiration and other metabolic processes of fruits. Modified atmosphere packaging (MAP) is a defined as packaging of fruits in polymeric films that creates modified atmospheric conditions around the produce inside the package. MAP can be achieved either actively or passively. The most common polymers used for MAP are polypropylene, polyethylene, low density polyethylene, linear low density polyethylene, polyethylene terephthalate, ethylene vinyl alcohol and polyvinylchloride. Water loss after harvest leads to weight loss and quality reduction of the produce while an accumulation of water at the product surface will help the growth of spoilage microorganisms. Nowadays antifog compounds and microperforations are used to diminish the impact of this problem. Nanomaterials are a new class of materials that have been proven to be a promising option for packaging materials. The packaging industry is actively exploring the potential of nanotechnology to obtain new packaging materials with improved properties (mechanical, barrier) and new functionalities such as antimicrobial activity and monitoring the quality of produces and conditions within package.

Key words: Modified atmosphere, packaging, polymers and nanotechnology

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACHES

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The programme of Doubling Farmers' Income was announced by the Finance Minister, Mr. Arun Jaitley during his budget speech on February 29, 2016. The targeted year that has been set by the govt. for doubling the farmers income is 2022 i.e. from 2015-16 to 2021-22 (Six years) with the objective to double the real income of farmers, not output or value added or the GDP of the agriculture sector. Targeted income includes income from agricultural as well as allied activities. Achieving the goal of Doubling Farmers' income by 2022 help to reduce persistent disparity between farm and non-farm income, alleviate agrarian distress, promote inclusive growth and infuse dynamism in agriculture sector." Jaitley had said in budget speech in February. "Government will, therefore, reorient its interventions in the farm and non-farm sectors to double the income of the farmers by 2022." But doubling of real incomes would be "a miracle of miracles" as it would imply a compound growth rate of 12 percent per annum. The average monthly income from raising crops and rearing animals increased from Rs.1,060 in 2003 to Rs.3,844 in 2013, according to the report Situational Assessment of Agricultural Households by the National Sample Survey Organisation, a compounded annual income growth rate of 13.7 percent. From base year 2016. The findings from the National Sample Survey Office (NSSO) data indicated that the share of income has increased drastically from 5 per cent to 12 per cent in the case of livestock farming, 45 per cent to 48 per cent in crop production, while that of the wages and non-farm have declined between 2003 and 2013. Post-harvest management and small-scale processing would help farmers capture benefits of value addition.

Key words: Farmers' Income, alleviation, government organisation, Strategies, processing

ROLE OF POPLAR BASED AGROFORESTRY SYSTEM IN DOUBLING FARMER'S INCOME IN NORTH-WESTERN INDIA***SNEH YADAV, R.S. DHILLON AND VISHAL JOHAR***Department of Forestry, CCS Haryana Agricultural University, Hisar-125004 (Haryana)***Corresponding Author- snehyadav1091995@gmail.com*

The fast agricultural development in the Haryana has deteriorated the agro-ecosystem through excessive use of natural resources. Heavy depletion of soil health, lowering of water table and high rate of environmental pollution are the matters of great concern for the future of the state. Diversification in agriculture in general and a rice-wheat rotation in particular has strongly been advocated in irrigated agro-ecosystems to conserve the natural resources. Poplar (*Populus deltoides*) based agroforestry systems are one of the viable alternative land use systems to diversify the rice-wheat rotation, prevent further degradation and obtain biological production on a sustainable basis. The comparative economic viability of poplar based agroforestry system with rice-wheat system shows that agroforestry system is able to enhance farmer's income about double in seven or eight years and it can be triple if farmers can take incentive of their carbon sequestered by agroforestry system in comparison to existing rice wheat cropping system. It is verified that if a farmer growing rice wheat continuously at his farm for seven years, he could receive net income of only Rs. 327703/ha while another adjacent farmer with poplar based agroforestry at his farm (agrisilviculture system with 500 poplar trees, first four years wheat in rabi and fallow in kharif season) could get net income of Rs. 594811.

Keywords: Poplar, agroforestry system, Double and income

ROLE OF BIOCHAR IN SOIL HEALTH**USHA RANI¹, AMIT KUMAR² AND R. S. GHARWAL***¹Department of Business management, CCS Haryana Agriculture University Hisar**²Department of Soil Science, CCS Haryana Agriculture University Hisar**Corresponding Author: ushaduhan12@gmail.com*

Biochar amendments alter soil physical properties; there also could be corresponding impacts on the reliability of flux chamber results from field plots due to differing chamber effects as a consequence of different soil physical properties. It can increase soil aeration and reduce soil emissions of N₂O, a greenhouse gas. In current years, biochar has been shown as one promising mean of reducing the atmospheric CO₂ concentration because biochar slows the rate at which photo synthetically fixed carbon (C) is returned to the atmosphere. In addition biochar can improve agricultural productivity, particularly in low-fertility and degraded soils, where it can be especially useful to the world's poorest farmers. It reduces the losses of nutrients and agricultural chemicals in run-off, it can improve the water holding capacity of soils and it is producible from biomass waste. Biochar can influence CO₂ emission by affecting on the quality and quantity of residue returned to the soil, Increased above and below ground biomass production can increase the amount of residue returned to the soil, thereby increasing CO₂ flux. The CO₂ emission from the soil to the atmosphere is the primary mechanism of C loss from the soil. Soil carbon plays a role in regulating climate, water supplies and biodiversity, and provides the ecosystem services that are essential to human well-being. On the other hand, maintenance of a threshold level of organic matter in the soil is crucial for maintaining physical, chemical and biological integrity of the soil and also for the soil to perform its agricultural production and environmental functions. Hence, conversion of organic waste to produce biochar using the pyrolysis process is one viable option that can enhance natural rates of carbon sequestration in the soil, reduce farm waste and improve the soil quality.

INTEGRATED FARMING SYSTEM: AN APPROACH TOWARDS ACHIEVING LIVELIHOOD AND NUTRITIONAL SECURITY**VIKAS GILL^{1*} AND RITU²***¹Department of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004**²Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125004***Corresponding author's E-mail id: gillvikas44@gmail.com*

World is facing population explosion and there is high rise in demand for food, continuing poverty and urbanization. The Indian population of 1.326 billion is increasing at the rate of 1.6% per annum and is expected to touch 1.705 billion by 2050. On the basis of present consumption, estimated total requirement for food grain will be around 300 and 350 million t by 2020 and 2030, respectively, as against present production of approximately 270 million tonn. For these two years, the demand for edible oil, milk,

vegetables and fruits is expected to rise to 7.9 and 9.5, 93.1 and 119.5, 93.6 and 110.7, and 53.7 and 70.5 million tonn, respectively. Similarly, a 30-50% increase in demand is anticipated in respect of marine and livestock products from present levels of 5.4 and 3.6 million tonn, respectively. Thus, to ensuring food, nutritional and income security for such a large population on sustainable basis under depleting and degrading natural resources integrated farming system (IFS) is best option. The Integrated farming system (IFS) therefore assumes greater importance for better management of farm resources to enhance the farm productivity and reduce the environmental degradation, improve the quality of soil and life of resource-poor farmers and maintain sustainability. The approach aims at increasing income and employment from small-holdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself.

Key words: Integrated farming system, Sustainability, Livelihood security and Nutritional security

A WAY TO IMPROVE SOIL PHYSIO-CHEMICAL PROPERTIES

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Land holding for agriculture is decreasing continuously and soil related problems are increasing day by day and at the same time population is also increasing at faster rate hence, considering such situation this is our responsibility to reap maximum yield from limited piece of land to mitigate the requirements of food and fibre of present generation but without deteriorating the soil health & its fertility so that our next generation can be benefited which is the concept of sustainable crop production. Soil health includes physical, chemical and biological aspects of soil and their interaction with each other and with continuous application of inorganic fertilizers resulted in decreased soil fertility due to degraded soil health whereas, FYM plays a very significant role in maintaining soil health. With the addition of FYM for a long time either alone or in combination with inorganic fertilizers, it was observed that physical properties such as infiltration rate, Aggregate mean weight diameter, Saturated hydraulic conductivity, soil moisture retention was found to be improved whereas, penetration resistance was found to be decreased which ultimately contribute to improvement soil physical health whereas, Chemical properties such as organic carbon, Available N, P & K and Micronutrients (Zn, Fe, Cu & Mn) was also found to be increased at surface as well as sub-surface due to continuous application of FYM alone or in combination with fertilizers for long time. As organic matter in soil act as chelates which holds nutrients and make them available to the plants. Soil biological properties like SMBC (Soil microbial biomass carbon), SMBN (Soil microbial biomass nitrogen) and (DHA) Dehydrogenase activity has also found to be increased with the application of FYM or other organic amendments on long term basis which ultimately which resulted not only in improved soil physical, chemical and biological health but also increased crop yield.

DRIP IRRIGATION AND FERTIGATION: NEED AND IMPORTANCE

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Horticulture crops contribute to national income by sharing almost one fifth of the total income from agricultural produce. It is widely recommended that horticultural crops can play a vital role in competing problems of malnutrition, generating greater employment potential in rural areas and bringing nutritional security. A large variety of fruits, vegetables, flowers, plantation crops, medicinal and aromatic plants, root and tuber crops cover roughly seven percent of the gross cropped area but contribute more than 18-20% gross value of agriculture output. The increasing demand of water and its continuously reducing availability has brought drip irrigation system into limelight. Drip irrigation is a micro irrigation method which optimizes the use of irrigation water by providing it uniformly and directly to the roots of the plants rather than the entire land surface on which the crop is grown, through a closed network of plastic pipes and emitters. Drip irrigation more advantages such as saving water up to 40-60%, yield increase from 20-50%, highly uniform distribution of water, reduction in deep percolation in surface run off and in evaporation from soil. High returns per unit area and time and high water use efficiency. Fertigation is the application of soluble fertilizers through drip irrigation systems. It is easy and simple to install requires very little maintenance and is ideal for dry formulations. A complete irrigation and fertilizer application project is installed collectively in the field it includes source of water, motor, sand filter, various valves, venturi pump, fertilizer tank, main lines and lateral lines. Although there is a huge initial investment in the installation of the system but govt. provides subsidy on it. This drip irrigation system is highly effective in most of the fruit crops with great advantages as well as higher production with lower inputs.

Keywords: Fruit crops, irrigation, fertigation and water use efficiency

PRECISION NUTRIENT MANAGEMENT FOR SUSTAINABILITY IN AGRICULTURE**ASHUTOSH UPADHYAY***Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, U. P.*

Sustainable agriculture aims to develop farming system that are productive, profitable, conserved the natural resource base, protect the environment and enhance the productivity over the long time. Modern agricultural practices leads to degradation of soil health to a great extent without which it is impossible to secure a sustainable future in agricultural production. Multinutrient deficiency in soil occurs due to inadequate and over application of fertilizer which become toxic and entered in food chain through bio-magnification ultimately posing threat to human health. Precision nutrient management emerges as a viable option for these severe problems. The cultivable field have a great variability in term of nutrient status so blanket application is not a sound recommendation for whole the field. Precision nutrient recommendation based on 4R concept of right product of fertilizer, right time of application, right rate of application and right place of application so variability within the field could be managed. For precise nutrient recommendation Collection of soil samples (grid soil sampling) to a depth of 30 cm across land use and Laboratory analysis of soil samples for nitrogen, phosphorus, potassium, calcium, magnesium and the organic matter content done and application of fertilizer according to spatial variation in soil fertility map by using hi tech geo spatial tools and techniques like variable rate technology were recommended. The current fertilizer practice results in high loss of applied fertilizers. Recently, scientists have developed a new technique of nutrient management known as site specific nutrient management- based on site, climate and actual plant needs. So increasing fertilizer use efficiency will become more important with increasing fertilizer costs and environmental concerns with precision nutrient management tools.

DRYING CHARACTERISTICS OF GREEN CHILLIES (*CAPSICUM ANNUM* L.)**RAVI KUMAR, VIVAK KUMAR, KAVINDRA SINGH, TARUN KUMAR***Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut- 250110**Email: ravichaudhary027@gmail.com*

Chilli (*Capsicum annum* L.) from family Solanaceae, is one of the universal spices and is grown in almost all states of India for domestic market and export purpose. Chilli has health benefiting alkaloid compound in them known as capsaicin which gives strong spicy pungent character. The colour of chilli is due to the presence of red pigmented carotenoids, the main being Capsanthin, Capsorubin, Zeaxanthin and Cryptoxanthin. Drying is defined as the process of moisture removal due to simultaneous heat and mass transfer. Harvesting is done when the pods are well ripened and partially withered on the plant itself. The harvested pods are kept in heaps either indoor or in shade away from direct sun light for 2 or 3 days so as to develop uniform red colour and then dried in the sun by spreading them on clean dry polythene sheets, cemented/concrete drying yards etc. Pods are spread out in thin layers for uniform drying with frequent stirring to prevent mold growth and discolouration. The initial moisture content of chillies ranged from 300-400 per cent (db) which is very high for processing and storage. Therefore reduction of moisture in chilli to a safe level of 8-9 per cent (db) becomes necessary before their processing and storage. In fresh chilli oxidation is catalysed by peroxidases. Most of the vitamins, and pigments are lost during drying. So drying has been used for decades in chemical and food processing industries for long term preservation of the final product. The chilli is very sensitive to temperature. Normally, conventional hot air drying temperature is maintained between 50-70°C.

Keywords: - Chillies, Drying, Moisture, Temperature.**EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON 50% HEAD INITIATION OF BROCCOLI (*BRASSICA OLERACEA* L. VAR. *ITALICA*).*****VIVAK UJJWAL, *MANOJ KUMAR SINGH, *MOHIT CHAUDHARY, **AKSHAY UJJWAL AND *ASHISH KUMAR****Department of Horticulture, S.V.P. University of Agriculture and Technology, Meerut, U.P. 250110**** Department of Agronomy, SKUAST, Jammu, Jammu & Kashmir*

Sprouting Broccoli (*Brassica oleracea var italica*) belongs to the family Brassicaceae. Broccoli is an important cole crop after cabbage and cauliflower. It is one of the most nutritious cole crops and contains vitamin A (130 times and 22 times higher than cauliflower and cabbage, respectively), thiamin, riboflavin, niacin, vitamin C and minerals like Ca, P, K and Fe. Integrated nutrient management having chemical fertilizers applied along with organic sources of nutrients is an effective method for economization of production cost as well as maintenance of soil fertility. A field experiment was carried out during 2016-17, at the Horticulture

Research Center of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut to find out the "Effect of integrated nutrient management on 50% head initiation of Broccoli (*Brassica oleracea* L. var. *italica*). During experiment organic, inorganic and bio fertilizers were used in an integrated manner i.e. T₁ (Control), T₂ (150 Kg N + 100 Kg P₂O₅ + 100 Kg K₂O/ha (RDF), T₃ (75 % RDF + 25% FYM, T₄ (75 % RDF + 25% Vermi Compost, T₅ (75 % RDF + 25% FYM + PSB, T₆ (75 % RDF + 25% Vermi Compost + PSB, T₇ (75 % RDF + 25% FYM + PSB + Azospirillum), T₈ (75% RDF + 25% Vermi Compost + PSB + Azospirillum), T₉ (RDF + FYM), T₁₀ (RDF + Vermi Compost), T₁₁ (RDF + FYM + PSB), T₁₂ (RDF + Vermi Compost + PSB), T₁₃ (RDF + FYM + PSB + Azospirillum) and T₁₄ ((RDF + Vermi Compost + PSB + Azospirillum). Among the treatments significantly maximum earliness (57.80 days) for 50% head initiation of Broccoli was observed in the treatment T₈ (75% RDF + 25% Vermi Compost + PSB + Azospirillum). This earliness is observed due to the application of organic manure which produce the early crop of broccoli because organic resources reduce the mining of soil nutrients and improve soil productivity, by improving soil tilth, aeration, water holding capacity and activity of microorganisms. Vermi Compost prepared with the help of earthworms. Earthworms consume large quantities of organic matter excrete soil as casts which have several plant growth promoters, enzymes rich in plant nutrients, beneficial bacteria and mycorrhiza.

ERUCIC ACID PROFILING IN INDIAN MUSTARD (*BRASSICA JUNCEA* L) GENOTYPES

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Erucic acid is one of the most important fatty acids in mostly found within *Brassica* genus. This 22-carbon fatty acid is undesirable for human consumption when present in higher amounts in edible oil. Higher erucic acid in cooking oil hampers the myocardial conductance in humans and leads to increased blood cholesterol levels. Earlier studies has been reported to cause lipidosis in children and myocardial fibrosis in monkeys. The improvement of seed quality is one of the most important objectives in *Brassica* breeding for satisfying future quality edible oil requirements. In this present study 15 *Brassica juncea* genotypes was use for the erucic acid profiling. The erucic acid content in *Brassica juncea* genotypes varied from 0.90 to 59.83 %. Minimum erucic acid content (as per international oil quality norms $\geq 2.0\%$) was observed in PM 24 (1.56%), PM 21 (0.96%) and PusaKarishma(0.90%). However, highest erucic acid content was noted in SKJM-5(51.83%). Maximum genotypes in the present study which showed higher levels of erucic acid. Therefore there is an urgent need to develop new varieties, containing low levels of erucic acid. Hence there is great need to screen out breeding lines for lower levels of erucic acid ($<2\%$) and higher yield potential.

MINOR MILLETS FOR FOOD AND NUTRITIONAL SECURITY

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Nutritional insecurity is a major threat to the world's population that is highly dependent on cereal-based diet, deficient in micronutrients. Micronutrient malnutrition has been considered as a serious challenge, which is commonly known as hidden hunger, as two-thirds of the world's population is at risk of deficiency in one or more essential micronutrients as they rely on cereal-based foods. Millets can be served as an important food in attaining both food security as well as nutritional security. In recent years, millets have been recognized as important substitutes for major cereal crops to cope up with the world food storage. Minor millets are the storehouse of many chemical components including nutrients, phyto-chemicals and non-nutritive functional constituents. Hence, an investigation was undertaken with an objective to find the nutritional composition of minor millets in comparison with staple crops. Minor millet such as finger millet, foxtail millet, kodo millet, proso millet, little millet, barnyard millet and staple crops like rice and wheat were selected for the study. The results revealed that minor millets have high nutrient content which includes protein, dietary fibre, minerals such as calcium, iron, zinc and potassium content compared to rice and wheat. Minor millets offer nutritional security and there is a need for promoting millets as they are highly nutritious. Millets hold great potential in contributing substantially to food and nutritional security of the country and they are not only a powerhouse of nutrients but also are climate resilient crops and possess unique nutritional characteristics. Millets can provide nutritional security and act as a shield against nutritional deficiency, especially among children and women.

Keywords: Minor millets, Protein, Dietary fibre

STUDY ON PHYSICAL PROPERTIES OF KODO MILLET (*PASPALUM SCORBICULATUM*)**NITHYASHREE, K AND K. GEETHA***Department of Food Science and Nutrition, G.K.V.K, UAS, Bangalore-65**E-mail: nithyashree.k.119@gmail.com*

Kodo millet, (*Paspalum scorbiculatum* L.,) is widely distributed in damp habitats across the tropics and subtropics of the world. It is indigenous cereal crop of India and is grown today in Uttar Pradesh in the north, Kerala and Tamilnadu in the south. It forms the main stay of the dietary nutritional requirements. Kodo millet is commonly known as 'kodo' in Hindi, *varaguin* Tamil and *harkain* Kannada. It is predominately grown in India and West African countries. The physical properties of kodo millet and other grains and seeds, are essential for the design of equipment for handling, harvesting, processing and storing the grain. Physical appearance of the grain is also an important characteristic which determines the consumer acceptability. Hence the present study was undertaken with an objective to find the physical characteristics of kodo millet. The physical characteristics such as thousand seed weight, thousand seed volume, hydration capacity, hydration index, swelling capacity, swelling index, specific gravity and bulk density were studied. The result revealed that thousand seed weight in kodo millet found to be 3.58 g, thousand seed volume 4.40 ml, hydration capacity 0.76 g, hydration index 0.21, swelling capacity 1.90 g, swelling index 0.43, specific gravity 0.64 and bulk density was found to be 0.81 g/ml.

Keywords: Kodo millet, Specific gravity, Bulk density.

RESIDUAL EFFECT OF ZINC AND BORON ON GROWTH, YIELD AND QUALITY OF GROUNDNUT UNDER FINGER MILLET – GROUNDNUT CROPPING SYSTEM IN CHITRADURGA DISTRICT, KARNATAKA**PRASHANTHA, G. M., CHIKKARAMAPPA, T., PRAKASH, S. S. AND SRINIVASA, D. K.,***Department of Soil Science and Agricultural Chemistry, UAS, GKV, Bengaluru-560065*

A field experiment was conducted to study the residual effect of zinc and boron on growth, yield and quality of groundnut during *rabi/summer* 2016-17 at Farmer's field, Gutthikatte village, Hosadurgataluk, Chitradurga district. Immediately after harvesting of finger millet, groundnut was cultivated as succeeding crop without applying any fertilizers and organic manure. The experiment was laid out in randomized complete block design with 15 treatments and replicated thrice. Results revealed that application of RDF + FYM + ZnSO₄ @ 20 kg ha⁻¹ + Borax @ 12.5 kg ha⁻¹ recorded significantly the highest residual impact on growth (plant height and branches per plant) and yield (number of pods per plant, 100 kernel weight, shelling percentage, pod and haulm yield ha⁻¹) of groundnut and on par with application of RDF + FYM + ZnSO₄ @ 20 kg ha⁻¹ + Borax @ 10 kg ha⁻¹ as compared to other treatments. The oil content (%) of groundnut differs significantly due to residual effect of graded levels of zinc and boron application. However, higher oil content was recorded with the effect of RDF + FYM + ZnSO₄ @ 20 kg ha⁻¹ + Borax @ 12.5 kg ha⁻¹ (46.05%) and lowest oil content were recorded in absolute control treatment of 39.47%. The micronutrient application caused significant variation in oil yield. Among the different treatments, residual effect of RDF + FYM + ZnSO₄ @ 20 kg ha⁻¹ + Borax @ 12.5 kg ha⁻¹ recorded significantly higher oil yield (491.57 kg ha⁻¹) as compare to all other treatments. However, lowest oil yield was recorded in absolute control (141.33 kg ha⁻¹).

Keywords: Groundnut, Oil content, Residual effect, Oil yield, Zinc.

EFFECT OF ZINC AND BORON APPLICATION ON YIELD AND UPTAKE OF NUTRIENTS IN FINGER MILLET IN ALFISOLSO OF CHITRADURGA DISTRICT, KARNATAKA**PRASHANTHA, G. M., CHIKKARAMAPPA, T., PRAKASH, S. S. AND SRINIVASA, D. K.,***Department of Soil Science and Agricultural Chemistry, UAS, GKV, Bengaluru-560065*

A field experiment was conducted on farmer's field, Gutthikatte village, Hosadurgataluk, Chitradurga district during *Kharif* 2016-17 in soil which was deficient in DTPA extractable zinc and hot water soluble boron, to study the effect of zinc and boron application on yield and uptake of nutrients in finger millet. The experiment was laid out in a randomized complete block design with fifteen treatments replicated thrice with finger millet variety GPU-28. The treatments were composed of recommended NPK with varied levels of Zn and B with FYM. The results revealed that application of RDF + FYM with ZnSO₄ @ 15 kg ha⁻¹ and Borax @ 12.5 kg ha⁻¹ recorded significantly higher uptake of N (74.83 & 74.83 kg ha⁻¹), P (14.17 & 13.99 kg ha⁻¹) and K (45.17 & 72.40 kg ha⁻¹) both in grain and straw compared to absolute control. Significantly higher uptake of Ca (13.73 & 59.62 kg ha⁻¹), Mg (11.96 & 35.90 kg ha⁻¹) and S (12.40 & 18.86 kg ha⁻¹) in grain and straw were recorded in the treatment combination of RDF + FYM with ZnSO₄ @ 15 kg ha⁻¹ and Borax @ 12.5 kg ha⁻¹. The results of the present study evidently concluded that the application

of 100:50:50 kg N: P₂O₅: K₂O ha⁻¹, ZnSO₄ @ 15 kg ha⁻¹ and Borax @ 12.5 kg ha⁻¹ along with FYM at 10.00t ha⁻¹ under irrigated condition is beneficial for getting higher yield of finger millet as well as higher benefit cost ratio as compared to absolute control.

Key words: Finger millet, Zinc, Chitradurga district and Uptake

MANAGEMENT OF SILICON IN SUSTAINABLE RICE PRODUCTION

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Rice is heavy feeder of silicon, its content as well as Si: Ca ratio is higher than 1 percent and therefore, it requires high amounts of silicon for sustained productivity. Although agricultural soils are largely composed of silicate minerals, many soils contain an inadequate supply or are naturally low in plant available silicon. Most likely, silicon content in some regions might be limiting to sustainable rice production. In addition, silicon depletion can occur in traditional rice soils from the continuous monoculture of high yielding cultivars with intensive cultivation practices especially if farmers are not applying the silicon removed by rice. The form of silicon absorbed by plant roots is silicic acid which is transported to the shoot. It is concentrated due to loss of water and is polymerized to colloidal silicic acid and finally to silica gel with increasing silicic acid concentration. Rice is known as silicon accumulator and plant benefits much from silicon nutrition. Silica is required for healthy and productive development of the rice plant. This element is absorbed by rice from the soil in large amounts that is several fold greater than those of other macro-nutrients. On an average, it is estimated that a rice crop producing a total grain yield of about 5 tonnes ha⁻¹ will normally remove 230 to 470 Si kg ha⁻¹ (500-1000 SiO₂ kg ha⁻¹) from soil. Silicon interacts with other native or applied nutrients and has the potential to induce resistance or tolerance in the rice plant to biotic (insects, pests and diseases) and abiotic stresses like Al, Fe and Mn toxicity, salt injury and lodging. From this, it clearly shows that silicon is a quasi-essential element for rice plant.

Key words: Silicon, Rice and salicylic acid

EFFECT OF URBAN WASTE WATER ON AGRICULTURE FIELD

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The area around Meerut is rich in municipal sewage. Hence it will be worthwhile to study the effect of urban waste water on some crops under study. This polluted waste water is generally used for irrigating agriculture crops. Due to their enormous use, these crops have been selected for present study. The experiments have been done on physiological feature & biochemical parameters of these crops. It was observed that the low concentration of sewage mixed with harmful for crop production in general. Seeding growth was inhibited with increase in concentration and duration of experiment. At higher concentration all the seeding parts that is Plumule, Radical, Residual, Cotyledons, Root & shoot were affected. Dry matter weight decreased with increase in concentration of sewage. In seed treatment there is slight increase at S-1, S-3 and S-6 in some cultivars of crops. Even it has been observed promoting effect in higher concentration of sewage also. The area around Meerut is rich in municipal sewage. Hence it will be worthwhile to study the effect of urban waste water on some crops under study. This polluted waste water is generally used for irrigating agriculture crops. All the parts of seedlings plumule, Radical and residual cotyledons increase in control. However acid phosphatase activity decreased with the increase in concentration of sewage. The promotory effect had been observed in S-1 concentration of sewage of wheat CU PBW-16 and Gram CU's sadbhawana and inhibitor effect have been observed S-10 concentration of sewage the activity of acid phosphatase in all the three parts of seedling viz. plumule radical and residual cotyledon increased in control. However alkaline phosphatase activity decreased with the increase in concentration of sewage. The promoter effect was also observed in S-1 concentration of Moong CU pant Moong-1 and Mustard CU-1-30 kranti, Palak CV all green and Tomato CV's kasari-P-202 and Lady finger CO-1 and Barley CU DWR-28 and Cucumber diva (f-1) and inhibitor effect in S-10 sewage. **Highlight:** cultivate a settleable and wastewater – born algal – bacterial culture. Realize simultaneous and high efficiency carbon and nutrients removal. Monitor the process of biomass, N and P accumulation during the treatment. Identify the microbial consortium as an addition of knowledge in this area.

Keywords: algal-bacterial culture, nutrient removal, biomass accumulation, N and P accumulation

GREEN SYNTHESIS OF SILVER NANOPARTICLES: A NOVEL SOURCE FOR PLANT GROWTH IMPROVEMENT**JYOTI SINGH¹, NEELESH KAPOOR², ARZOO, REKHA DIXIT², ABHA VERMA³ AND RAVINDRA KUMAR²**¹Department of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut- 250005, U.P., India²Department of Fingerprinting, College of Biotechnology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut- 250110, U.P., India³Department of Biotechnology, IFTM University, Moradabad- 244102, U.P. India

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The “green nanotechnology” is the emerging field of life sciences that aims to exploit biological materials to generate products and processes that are energy efficient, environmentally and economically sustainable and most importantly will revolutionized the field of agriculture. Nobel metal nanoparticles especially silver nanoparticles have been explored in each and every field of scientific research. In the present study, silver nanoparticles have been synthesized using biological method, popularly known as green synthesis. Phyto-silver nanoparticles were fabricated using aqueous plant leaves extract of three different plant species i.e. *Azadirachta indica*, *Camellia sinensis* and *Oxalis stricta*. Bio-reduction of the synthesized silver nanoparticles was monitored by UV-Vis spectrophotometer while the possible biomolecules responsible for bio-reduction, capping and efficient stabilization of the nanoparticles were identified using Fourier transform infrared spectroscopy (FTIR) and further the size, shape and dispersity of the synthesized silver nanoparticles was determined using Scanning electron microscopy (SEM). The study shows that the plants used were efficient in synthesizing the useful and stable silver nanoparticles and hence green synthesis of nanoparticles is a rapid, simple, ecofriendly and cost effective approach therefore the study concludes that the synthesized silver nanoparticles may have potential application in various fields including agriculture, catalysis, sensors, electronics, biomedicine and biotechnology. In the field of agriculture, the synthesized silver nanoparticles can be used as nanofertilizer or nanocatalyst and hence may aid in the plant growth improvement by increasing its yield, stress tolerance and protein content as well as may provide disease resistance to the plant. The synthesized silver nanoparticles may have the potential to revolutionize the field of agriculture by playing the role of a magic bullet and hence exploring the forthcoming field of “nano agriculture”.

Keywords: Silver nanoparticles, Green synthesis, Bio-reduction, Nano agriculture, Nanofertilizer**PHYTOCHEMICAL CONSTITUENTS OF SOME SELECTED AURVEDIC MEDICINAL PLANT****PRATIBHA PATEL¹* EKTA DEVI² AND DR. PANKAJ CHAUHAN³**^{*}Department of Cell Biology, Saradar Vallabh Bhai Patel University of Agriculture and Technology, Meerut

Saponins, phlobatannins, flavonoids, anthraquinones, terpanoids, steroids, alkaloids, carbohydrates and glycosides distribution in four medicinal plants belonging to different families were investigated and compared. *Carica papaya*, *Cymbopogon citratus* and *Annona muricata* were investigated which were found to contain tannins, flavonoids, terpanoids, steroids and carbohydrates. Glycosides were present in *Annona muricata* and *Cymbopogon citratus*. The extraction of oils was carried out by solvent extraction, steam distillation and ethanolic extraction (using rotator evaporator). The percentage yield of steam distillation is found to be 5.60 (*C. papaya*), and 3.82 (*C. citratus*) and solvent extraction is found to be 7.40 (*C. papaya*) and 5.63 (*C. citratus*). Ethanolic extraction gave negative results for steroids and anthraquinone. The significance of the plants in traditional medicine and the importance of the distribution of these chemicals constituents are discussed with respect to the role of these plants in Ayurvedic medicine in India.

SIGNIFICANT ROLE OF CELLULASE PRODUCING MICROORGANISMS IN INDUSTRIAL BIOTECHNOLOGY**PANKAJ CHAUHAN, RICHA SONI, NISHI CHANDRA, NIKKI KUMARI, *MAHENDRA KR. SINGH,**NAMITA BASNAL**

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Cellulolytic microbes are primarily carbohydrate degraders and are generally unable to use proteins or lipids as energy sources for growth. Cellulolytic microbes notably the bacteria *Cellulomonas* and *Cytophaga* and most fungi can utilize a variety of other carbohydrates in addition to cellulose, while the anaerobic cellulolytic species have a restricted carbohydrate range, limited to cellulose and or its hydrolytic products. The ability to secrete large amounts of extracellular proteins is characteristic of certain fungi and such strains are most suited for production of higher levels of extracellular

cellulases. One of the most extensively studied fungi is *Trichoderma viride*, which converts native as well as derived cellulose to glucose. Most commonly studied cellulolytic organisms include: Fungi-*Trichoderma*, *Humicola*, *Penicillium*, *Aspergillus*; Bacteria-*Bacilli*, *Pseudomonas*, *Cellulomonas*; and Actinomycetes- *Streptomyces*, *Actinomucor* and *Streptomyces*. Cellulases have become the third largest group of enzymes used in the industry since their introduction only since a decade. They are used in the bio-stoning of denim garments for producing softness and the faded look of denim garments replacing the use of pumice stones which were traditionally employed in the industry. Cellulases, in particular EGIII and CBHI, are commonly used in detergents for cleaning textiles. Several reports disclose that EG III variants, in particular from *T.reesei*, are suitable for use in detergents.

Keywords: Cellulolytic species, Biostoning, EGIII, CBHI.

ISOLATION, IDENTIFICATION AND BIOCHEMICAL CHARACTERIZATION OF NATIVE AZOTOBACTER ISOLATES FROM DIFFERENT RHIZOSPHERE

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Azotobacter belongs to family *Azotobacteriaceae*, aerobic, free living, and heterotrophic in nature. *Azotobacter* are present in neutral or alkaline soils and *A. chroococcum* is the most commonly occurring species in arable soils. *A. vinelandii*, *A. beijerinckii*, *A. insignis* and *A. macrocytogenes* are other reported species. The number of *Azotobacter* rarely exceeds of 10^4 to 10^5 g⁻¹ of soil due to lack of organic matter and presence of antagonistic microorganisms in soil. The bacterium produces anti-fungal antibiotics which inhibits the growth of several pathogenic fungi in the root region thereby preventing seedling mortality to a certain extent. The population of *Azotobacter* is generally low in the rhizosphere of the crop plants and in uncultivated soils. The occurrence of this organism has been reported from the rhizosphere of a number of crop plants such as rice, maize, sugarcane, bajra, vegetables and plantation crops. In the present study a total 30 native *Azotobacter* isolates and one microbial culture from IARI were isolated and characterized on the basis of their Gram's staining, colony morphology and biochemical test. Gram negative, oval-rod shaped bacteria showing milky-white, creamy, translucent, mucoid, and circular colonies on *Azotobacter* agar (Mannitol) medium were processed many times in order to obtain pure culture of *Azotobacter*. Isolates A-2, A-8, A-16, A-23, A-24 and A-28 were found positive to all the biochemical tests (Triple sugar iron agar test, Citrate utilization test, Methyl red test, Voges-Proskauer test, Catalase test, Oxidase test, Nitrate reduction test, Urease test, Starch hydrolysis test and Motility test). This shows that these isolates are different as compared to each other.

PHYTOREMEDIATION: ITS CLASSIFICATION, HIGHLIGHTS AND CHALLENGES

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Heavy metals are one of the important contaminants in the environment. All the human activities have the potential to produce these heavy metals. Movement of these contaminants to the surrounding leads to contamination of ecosystem. Presently, phytoremediation has a definite solution to extract or remove inactive metals and metal pollutants from contaminated soil. Phytoremediation is an emerging technology that uses various plants to degrade, extract, contain, or immobilize contaminants from soil and water. Phytoremediation can be defined as "the efficient use of plants to remove, detoxify or immobilize environmental contaminants in a growth matrix (soil, water or sediments) through the natural biological, chemical or physical activities and processes of the plants". Plants with exceptional metal-accumulating capacity are known as hyperaccumulator plants. Phytoremediation takes the advantage of the unique and selective uptake capabilities of plant root systems, together with the translocation, bioaccumulation, and contaminant degradation abilities of the entire plant body. There are mainly two strategies for metal accumulations: 1. Use of natural hyperaccumulators 2. Enhancement of uptake of metals by normally non-accumulating species by applying various chemicals that increase uptake. Heavy metal uptake by plant occurs through phytoextraction, phytostabilisation, rhizofiltration, phytovolatilization, rhizodegradation and phytohydraulics. Heavy metals uptake, by plants using phytoremediation technology, seems to be a prosperous way to remediate heavy metals-contaminated environment. Several factors must be considered in order to accomplish a high performance of remediation result. The most important factor is a suitable plant species which can be used to uptake the contaminant.

Keywords: Phytoremediation, Heavy metals and uptake

CHANGES IN GENE EXPRESSION AND BLOOD BIOCHEMICAL PARAMETERS IN BLACK BENGAL GOATS DURING PRE-PUBERTAL GROWTH PERIOD IN SUMMER AND WINTER SEASON**S PERVEEN, P K DAS, P R GHOSH, D BANERJEE, J MUKHERJEE, S NASKAR¹, M MONDAL ² AND D MAZUMDER³***Department of Veterinary Physiology, West Bengal University of Animal & Fishery Sciences, 37, K B Sarani, Kolkata – 700037, West Bengal*¹ ICAR-IVRI (ERS), ² ICAR-NDRI (ERS), ³ BCKV

The study was undertaken to evaluate the relationship between growth performance of pre-pubertal black Bengal kids with the levels of blood biochemical parameters including growth hormone and expression levels of growth-related genes. In this study, 50 male and 50 female kids were selected randomly. Body weight, average weight gain, heart girth, height and linear length were recorded from such kids starting from day 15 up to the age of six months. Kids were weaned at 2 months and reared in a completely free ranged system without any concentrate. Out of 100 animals blood samples were collected from randomly selected 6 male kids and 6 female kids (total 12 kids) which were born in summer and winter season respectively for analyzing plasma glucose, cholesterol, total protein (TP), albumin and growth hormone (GH). Relative abundance of transcripts encoding GHR/LEP/IGF1R was analyzed using reverse transcriptase PCR. It was noticed that all the growth attributes increased significantly ($P \leq 0.01$) due to age with higher values in males. Body weight was more in the kids born in winter, which was found to be reversed when heart girth is considered. Linear length was found unaltered in respect to kidding season. It was observed that the level of glucose and cholesterol declined and level of TP increased due to advancement of age ($P \leq 0.01$). Glucose and cholesterol were negatively ($P \leq 0.01$) correlated and TP was positively ($P \leq 0.01$) correlated with growth attributes. The concentration of glucose, cholesterol and albumin were significantly ($P \leq 0.01$) higher in those kids which were born in winter. Definite patterns of changes in abundance of transcripts encoding GHR, LEP and IGF1R genes were observed with a peculiar synchronous expression throughout the period studied. The concentration of GH increased significantly ($P \leq 0.01$) with age in such a way that it remained positively ($P \leq 0.01$) correlated with all such nutrients as well as heart girth and linear length irrespective of both sex and season. But there was no significant correlation between GH and body weight. The mean concentration of GH was found to be 0.41 ± 0.01 ng/ml. This value was below than earlier reports of GH in other breeds of goats; hence, this may be one of the causes of stunted growth in highly prolific black Bengal goat breed.

CRITICAL LIMITS OF SULPHUR FOR GROUNDNUT (*ARACHIS HYPOGAEA* L.) IN ALLUVIAL SOILS OF EASTERN INDIA**RAHUL KUMAR¹, GORA CHAND HAZRA¹, RUMA DAS², VIVEK KR. TRIVEDI², SHYAM PRASAD MAJUMDER¹, AMAL CHANDRA DAS¹**¹ *Department of Agricultural Chemistry and Soil Science, Bidhan Chandra Krishi Viswavidyalaya, West Bengal-741252, India*² *Division of Soil Science and Agricultural Chemistry, ICAR-Indian Agricultural Research Institute (IARI), Pusa Campus, New Delhi 110012, India*

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Sulphur (S) is very essential for growth and development of oilseed crops like groundnut. Deficiency of S is wide spread in soils of India and it is becoming a major concern for the quality and yield of groundnut crop (*Arachis Hypogaea* L.). A pot experiment was conducted at Gayeshpur, BCKV farm, to investigate the response of groundnut to S application in alluvial Inceptisols of West Bengal with four levels of S i.e. 0, 15, 30 and 45 kg ha⁻¹. For this purpose collected 20 soil samples from different agro-climatic zone of different district of West Bengal. The critical limits of Sulphur in soil and plant for deficiency, adequacy and toxicity were determined from Bray percent yield (BPY). The amount of 0.15% CaCl₂ extractable S in soils varied from 11.90 to 29.17 mg kg⁻¹ while the critical level for deficiency of S to groundnut was 18.6 (graphical method) or 19.58 (statistical method) mg kg⁻¹ in soils. Application of Sulphur significantly increased groundnut dry matter yield, concentration and uptake of S in plant. The critical limit was determined to be 3.0 g kg⁻¹ for groundnut plants and 4.42 g kg⁻¹ for groundnut nuts at harvest.

EFFECT OF DIFFERENT AGRONOMIC MANAGEMENT PRACTICES ON GROWTH AND PRODUCTIVITY OF AEROBIC RICE IN EASTERN INDIA

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Aerobic rice (*Oryza sativa* L.) cultivation has been greatly emphasized as a potential solution to high water-demanding transplanted rice. Moisture stress, iron-deficiency and inappropriate plant population are important constraints for lower growth and yield in aerobic rice. Maintaining ideal soil moisture regimes by optimal irrigation and achieving adequate number of panicle bearing tillers by modifying planting methods, hold the promise in addressing the above issue associated with aerobic rice production. Hence, a field experiment was conducted during *kharif* seasons of 2016 at Central Rainfed Upland Rice Research Station (CRURRS), Hazaribagh, Jharkhand. The experiment was laid out in split-plot design keeping 4-irrigation schedules, viz., I₁: Irrigation at 0.9 IW/CPE ratio, I₂: 1.2 IW/CPE ratio, I₃: 1.5 IW/CPE ratio and I₄: Un-irrigated (rainfed) and 2-soil adjuvants (A₁: soil adjuvant applied and A₂: No-soil adjuvant) in the main-plots and 2-planting methods (P₁: Conventional dry seeding and P₂: Spot-sowing (dibbling of 4-seeds per hill at 20 × 15 cm) in the sub-plots, thus there were a total of 16 treatment combinations. Aerobic rice crop irrigated at 1.5 IW/CPE ratio produced the plants that were significantly taller with higher number of tillers, higher leaf area index (LAI), greater dry matter accumulation, than rainfed crop and the crop irrigated at IW/CPE ratio 0.9 and 1.2. However, for some of the growth characteristics, IW/CPE ratio 1.5 was at par with IW/CPE ratio 1.2. Scheduling irrigation at 1.5 IW/CPE ratio increased grain yield by 37.3% over rainfed crop, 23% over crop irrigated at IW/CPE ratio 0.9 and 13.5% over IW/CPE ratio 1.2. Application of soil adjuvant (APSA 80™) did not improve growth parameters, and grain yield over no-soil adjuvant applied crop. However, spot-planting significantly improved all studied growth parameters and yield compared to conventional planting. The increase in grain yield due to spot-planting was more than 7%.

INTEGRATED NUTRIENT MANAGEMENT IN MAIZE (ZEAMAYS)

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Maize (*Zeamays*) is a major rainy season cereal crop, which provides the nutritional security due to its high nutritional value and having great demand. Maize grain contains about 10% protein, 70% carbohydrates, 4.1% oil and 2.3% crude fibre. It is having special significance because it is a staple food of the tribal areas. The demand of maize plant for nitrogen and phosphorus is more than any other essential element for the development of all phases of maize plant. Integrated nutrient management plays an important role in sustainable agriculture by maintaining the productivity of crops in cereal based cropping sequences. The chemical fertilizers are very costly and harmful for soil health. Therefore, combination of organic manure with inorganic fertilizer may be beneficial to maximize the crop productivity and improve soil properties. Organic manures such as poultry manure and farmyard manure are important components of integrated nutrient management. Organic manures supply the traces amount of micronutrients, which are generally not supplied by the farmers as straight fertilizers. Organic farming is, therefore, the only remedy, which should be encouraged in order to lower down the cost of inputs and to improve soil health. The use of organic manures like FYM and poultry manure not only helps to maintain the soil productivity by improving the physico-chemical properties of soil but also improves the efficiency of applied chemical fertilizers. It counteracts the ill effects of chemical fertilizers applied to the soil by way of reducing chemical toxicity to the microbes and thereby favours their growth. Besides this, organic manure improves the waterholding capacity and cation exchange capacity of the soil, which results into smooth supply of nutrients to the crop plants and finally results into profitable yields. The information on the combined impact of organic and inorganic fertilizers in different proportions is not available for the maize growers of this region.

Key words: Adjuvant, Aerobic rice, IW/CPE, planting methods, Productivity

EFFECT OF SALT STRESSES ON FRUIT CROPS (*LITCHI CHINENSIS*)**JYOTI SINGH***Department of Horticulture, J.N.K.V.V. Jabalpur (MP)**Email: js944871@gmail.com*

The relations between salinity and mineral nutrition of horticultural crops are extremely complex and a complete understanding of the intricate interactions involved would require the input from a multidisciplinary team of scientists. Salinity and sodicity are soil conditions that occur mainly in arid and semiarid regions. Ions that contribute to soil salinity include Cl^- , SO_4^{2-} , HCO_3^- , Na^+ , Ca^{2+} , Mg^{2+} , and, rarely, NO_3^- or K^+ . The salts of these ions occur in highly variable concentrations and proportions. Saline soils contain soluble salts in quantities that affect plant growth adversely, the lower limit for a saline soil being set conventionally at an electrical conductivity of 4 mmho/cm in the soil saturation extract. Studies of crop response to water and salt stress vary either salinity with a high leaching fraction or irrigation in the absence of salinity to isolate and quantify the effects of the two types of stress. Abiotic stresses caused due to these changes are responsible for inducing various modifications at molecular and cellular level in plants that in turn cause irreversible damage to agricultural yields of several major fruit crops. Lychee is a delicious, juicy fruit packed with numerous health benefits. The lychee production on a commercial level in Southeast Asia is a source of livelihood for thousands of people. Being highly specific in its climatic prerequisite, lychee crop quality and yield is adversely affected by any alteration in the environmental factors causing serious economic loss for the growers. In the near future, this situation might become more critical due to scarcity of land and water resources and deterioration of growing conditions in many parts of the world. Thus, it is necessary to develop fruit crop varieties that are resilient to abiotic stresses to ensure nutritional and financial security to a large population of the world. With the development of new biotechnological tools such as genomics, transcriptomics, microarray, and next-generation sequencing, plant scientist can investigate molecular, physiological, and biochemical regulatory pathways activated *in planta* to cope with various abiotic stresses and use this information for genetic improvement of crop as well as the formation of new generation GMOs.

Keywords: salinity, sodicity, stress, lychee.