

Souvenir/Abstract Book - ABCD - 2017

International Conference

on

**ADVANCES IN AGRICULTURAL AND BIODIVERSITY CONSERVATION
FOR
SUSTAINABLE DEVELOPMENT
(ABCD - 2017)**

27 – 28 October, 2017

VENUE: Brahaspati Bhawan, C. C. S. University, Meerut, Uttar Pradesh, India

Organized by:



**Agricultural Technology
Development Society (ATDS) Ghaziabad, UP**

Co-organized by:



**Department of Horticulture
C. C. S. University, Meerut, UP**



In Association With:



Shobhit University, Gangoh, Saharanpur, UP



Monad University, Hapur, UP

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WELCOME

**TO ALL
DIGNITARIES, DELEGATES AND DEAR PARTICIPANTS
IN
INTERNATIONAL CONFERENCE
ON
ADVANCES IN AGRICULTURAL AND BIODIVERSITY
CONSERVATION FOR SUSTAINABLE DEVELOPMENT (ABCD - 2017)
OCTOBER 27 – 28, 2017**

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Content

S. N.	Title	Page No.
1.	Messages	i - xvi
2.	Programme Schedule	xvii-xviii
3.	Conference Organizing Committee	xix - xx
4.	Local Organizing Committee	xxi
5.	Abstracts	1-472



त्रिलोचन महापात्र, पीएच.डी.

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सचिव एवं महानिदेशक

TRILOCHAN MOHAPATRA, Ph.D.

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कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद्
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MESSAGE

I am extremely delighted to know that an International Conference on 'Advance in Agricultural and Biological Conservation for Sustainable Development' is being jointly organised by Agriculture Technology Development Society (ATDS) Ghaziabad, (U.P.) and Department of Horticulture, C.C.S. University, Meerut on 27-28 October 2017. 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 a platform to researchers, academicians and other stateholders to discuss and interact with each other in the area of Agriculture and Biodiversity Conservation.

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.

(T. MOHAPATRA)

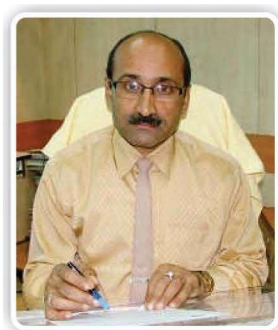
Dated 22nd September, 2017

New Delhi

Prof. RAJENDRA KUMAR
DIRECTOR GENERAL
U.P. COUNCIL OF AGRICULTURAL RESEARCH
उ०प्र० कृषि अनुसंधान परिषद



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MESSAGE

I am extremely delighted to know that Agricultural Technology Development Society, Ghaziabad, U.P. and Department of Horticulture, C.C.S. University, Meerut, U.P. are jointly organising an International Conference on "Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD-2017)" in Association with Shobhit University, Gangoh, Saharanpur, U.P. and Monad University, Hapur, U.P. during October 27-28, 2017 at Brahaspati Bhawan, C.C.S. University, Meerut.

The impact of growing population is affecting the natural resources. Unsustainable crop, livestock, forestry, fisheries and aquaculture practices, as well as other unsustainable productive systems and urbanization processes, are adversely affecting health of biodiversity and our econyste. Today's key challenge is how to increase production to meet thegrowing demand for food, feed and bioenergy, while conserving biodiversity and reducing the presseure on natural resources and ecosystems. Hence, the organization of the event is very timely and relevant.

I hope large number of participants from different parts of the country and abroad are going to participate in this event. I am sure that the Coference would serve as an excellent platfor for delegates, leading scientist, academicians and representatives from R&D sectors to have fruitful discussions and deliberations.

I extend my best wished for thesuccess of the Conference.

(RAJENDRA KUMAR)



भारतीय कृषि अनुसंधान परिषद
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MESSAGE

I am extremely delighted to know that an International Conference on 'Advances in Agricultural and Biological Conservation for Sustainable Development' is being jointly organised by Agriculture Technology Development Society (ATDS) Ghaziabad, (U.P.) and Department of Horticulture, C.C.S. University, Meerut during 27-28 October 2017. 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 and Biodiversity Conservation.

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.

(Dr. N.S. Rathore)



**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 an International Conference on “**Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD-2017)**” is going to be organised by Agriculture Technology Development Society (ATDS), Ghaziabad (U.P.) and Department of Horticulture, C.C.S. University, Meerut during 27-28, October 2017 at C.C.S. University, Meerut.

Innovations in agricultural technology and conservation of biodiversity are crucial to solving the problems of food security 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.

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


(N. K. Taneja)

सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिक विश्वविद्यालय, मेरठ 250 110
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प्रोफेसर गया प्रसाद

कुलपति

Professor Gaya Prasad
Vice Chancellor



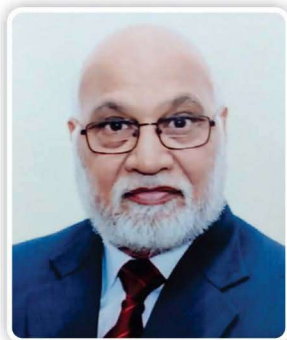
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MESSAGE

It gives me a great pleasure to know that Agriculture Technology Development Society (ATDS), Ghaziabad, (U.P.) in collaboration with Department of Horticulture, C.C.S. University Meerut is organizing an International Conference on '**Advances in Agricultural and Biodiversity Conservation for Sustainable Development**' (ABCD, 2017) on 27-28 October 2017. The theme of the conference is both relevant and contemporary. I am sure that the proposed conference will provide an international platform to scientist, researchers, academicians and other stakeholders to discuss and interact with each other in the area of recent research in agriculture and biodiversity conservation.

My best wishes to the organizers of the conference for all round success.

(GAYA PRASAD)



भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान

ICAR-Indian Institute of Farming Systems Research

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Dr A.S. Panwar
Director



MESSAGE

I am happy to note that Agricultural technology Development Society (ATDS), Ghaziabad, Uttar Pradesh is organizing the International Conference on "Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD-2017)" during October 27-28, in collaboration Department of Horticulture, CCS University, Meerut, Uttar Pradesh.

Scientifically designed integrated farming systems play significant role in providing sustainable livelihood to marginal and small households as the existing naturally systems do not provide sufficient production and income round the year to meet the requirement of relatively larger family size of these households. On-farm farming systems study across the country indicates existence of 38 types of farming systems, three systems namely crop + dairy (49.2 % marginal households), crop + dairy + goat (12.8 %) and crop + dairy + poultry (8.2 %) are predominantly adopted by marginal households in the country. The number of components integrated in IFS was observed to be up to 5 depending upon the location, resources and social acceptability. Crop and dairy are the most obvious components across the agro climatic regions except Eastern Himalayas where a dairy component is lacking in the dominant farming system.

India is predominated by small farm agriculture. The total number of operational holdings in the country is 138.35 million with an average size of 1.15 ha. Of the total holdings, 85% are in marginal and small farm categories of less than 2 ha. These small farms, though operating only 48.16% of net irrigated area and 44% of land under cultivation, are the main providers of food and nutritional security to the nation. These households are also having mean family size of 4 to 5 indicating availability of at least 900 man days per year for the farm work. Availability of sufficient man-power within the family and full-time devotion for farming are considered to be the strength of small farms in India. However, the fragmented holdings, low level of literacy and low-risk bearing ability due to poverty are often their weaknesses that expose them to vagaries of farming. The technologies that cater to the needs of landless, small and marginal farmers are need of the hour to free the rural households from poverty. Location specific and integrated farming system based technological management is the key options for reducing the climatic risk and better utilization of available natural resources to produce higher agricultural productivity and thereby enhance food and livelihood security of small and marginal farmers of India. Therefore, this requires a paradigm shift in agricultural research through integrating locally available farm resources along with restoration of environment, i.e. Integrated Farming Systems.

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. Past experience has clearly demonstrated that the income from cropping alone is hardly sufficient to sustain the farmers' needs. With enhanced consumerism in rural areas, farmer's requirement for cash has also increased due to their rising standard of living, especially with small and marginal farmers. Therefore, farmer's income and food requirement must be augmented and supplemented by adoption of efficient secondary or tertiary enterprises like animal husbandry, horticulture (vegetables/ fruits/ flowers/ medicinal and aromatic plants), apiary, mushroom cultivation, fisheries etc. However, these IFS 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 to exploit synergies through adoption of close cycles keeping in mind that these systems are also to be socially acceptable, environment friendly and economically viable.

In the light of above context, the international conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD-2017) is being organized during October 27-28, 2017 at C.C.S. University, Meerut, U.P. aimed to bring all stake holders concerned with Agriculture, biodiversity, natural resources, livelihood and climate change. I am sure the deliberations will come in form of recommendations which will be great value at regional and global scale to conserve the biodiversity for sustainable development of the society.

I extend my best wishes for the successful organization of international conference.

(A.S. Panwar)



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MESSAGE

Conservation and judicious use of biodiversity using advance tools and techniques are necessity of the present era for meeting the basic needs of ever growing world population. In fact, agricultural biodiversity includes plants, livestock including wild life, fisheries and aquaculture, insects, microorganisms and other living beings which are used or able to be used directly or indirectly. Biodiversity is an integral part of agriculture and the agriculture is supposed to be life for existence of men and animals on this earth. Thus, framing must be done in such a way to minimize the loss of biodiversity and maximize the use of flora and fauna above and beneath the soil for sustainable development.

I am extremely happy to know that the Department of Horticulture, C.C.S. University Meerut and Agriculture Technology Development Society, Ghaziabad (UP) is jointly organizing an International Conference on “Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD- 2017)” in association with Shobhit University, Gangoh, Saharanpur and Monad University, Hapur (UP) at Brahaspati Bhawan, C.C.S. University, Meerut on October 27-28, 2017, where scientists, teachers, research scholars, professionals, students, farmers, NGOs, social workers, policy makers and others who are involved in research areas and practices pertaining to Agriculture, Life Science and all other applied sciences from 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 experiences, significant recent research findings and exchange new ideas for formulating suitable future strategies for advancement of agriculture and conservation of biodiversity for sustainable development.

I congratulate the organizers and wish the conference for grand success.

(P.L. Saroj)

MESSAGE

Nation wide massive infrasturue growth and pressing economic concern/demand for high productivity is dwindling natural and agricultural biodiversity at one hand and climate change related increased uncertainty in occurrence of extreme weather events demands for increased conservation of plant and animal biodiversity and natural resources for sustainable growth in agricultural system on other hand. In this pretext, this International Conference on **Advances in Agricultural and Biodiversity Conservation for Sustainable Development** is very relevant to address the contempary issues the present day agricultural is facing. The theme areas of the conference is very well chosen and very exhaustive covering plant and animal biodiversity to natural resources conservation climate change to environmental pollution, ITK, ICT to precision farming and bio-nanotechnology. Besides, it is hearting to know that there will also be discourse on transfer of technology for conservation and development of agricultural systems and Intellectual Property Right issues.



A large number of delegates with widely divergent profile are likely to participate in the conference providing an excellent common platform for the academicians, scientists, polices maker, NGOs, students and farmers to interact and come up with practical recommendations for development of polices, researchable and developmental programmes and biodiversity conservaton.

I wish the conference a great success.



(Manoj Kumar)



MESSAGE

It is indeed a matter of pleasure that “An International Conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development” is being organized by the Agricultural Technology Department of Horticulture Development Society (ATDS) Ghaziabad, C. C. S. University, Meerut, Shobhit University, Gangoh, Saharanpur and Monad University, Hapur, of Uttar Pradesh, 27-28 October 2017 at Meerut.

The late twentieth century model of land use segregated agricultural production from areas managed through biodiversity conservation. This model is no longer adequate in much of the world. However, agricultural landscapes can be designed and managed to host wild biodiversity of many types, with neutral or even positive effects on agricultural production and livelihoods. Innovative practitioners, scientists and indigenous land managers are adapting, designing and managing diverse types of 'eco-agriculture' landscapes to generate positive co-benefits for production, biodiversity and local people. The potentials and limitations for successful conservation of biodiversity in productive agricultural landscapes, the feasibility of making such approaches financially viable, and the organizational, governance and policy frameworks needed to enable eco-agriculture planning and implementation at a globally significant scale. The components of biodiversity used in agriculture have a significant economic value due to the market price of products as they provide jobs and incomes for number of people working in 'agribusiness'. Resources are also saved and production costs reduced in that the use of resistant varieties, more frequent crop rotation and breeding of more hardy animals.

Increasingly research suggests that the level of internal regulation of function in agro-ecosystems is largely dependent on the level of plant and animal biodiversity present. In agro-ecosystems, biodiversity performs a variety of ecological services beyond the production of food, including recycling of nutrients, regulation of microclimate and local hydrological processes, suppression of undesirable organisms and detoxification of noxious chemicals. The role of biodiversity in securing crop protection and soil fertility is explored in detail. It has been mentioned that because biodiversity mediated renewal processes and ecological services are largely biological, their persistence depends upon the maintenance of biological integrity and diversity in agro-ecosystems. Various options of agro-ecosystem management and design that enhance functional biodiversity in crop fields. Integrated Farming System (IFS) is a judicious mix of agricultural with enterprises like dairy, poultry, piggy, fishery, sericulture which is suited to the given agro-climatic conditions and socio-economic status of the farmers. It brings prosperity in the life of the farming as the web of life is sustained. As an advantage, the farm wastes are better recycled for productive purposes. It introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. It turns out to be economical as the family labor is one of the major contributions.

These deliberations will also open so many innovative approaches shall emerge through discussions/presentation and brain storming scientific sessions are going to be witnessed from eminent scientists, academicians and research scholars.

On this occasion, I would like to thank Dr. Joginder Singh, organizing Secretary and members of advisory and organizing committee who worked hard to make it a grand success. I would also like to congratulate to all the awardees of the different categories on this occasion of the academy. I am sure that the farming community of the nations along with scientist, research scholars can derive multi dimensional benefits and solution regarding their agricultural problems.

My best wishes for this International Conference-2017.

(Durg Vijay Rai)

Prof. (Dr.) Ram Chandra

M.Sc., Ph.D, PGDDE

Vice- Chancellor

Ex – Deputy Vice Chancellor, Cavendish University, Zambia

Ex – Director, Mewar University

Ex – Joint Director, IGNOU

Ex – Regional Director, IGNOU

Ex – Director, CESR, DAVV Indore

Ex – Advisor, Alliance Educare



MONAD UNIVERSITY

(Established by Uttar Pradesh State Government
Act. 23 of 2010 & U/S 2(f) of U.G.C. Act 1956)



MESSAGE

It is a matter of great pleasure to know that Agricultural Technology Development Society (ATDS) is organizing with association of Monad University and Shobhit University an International Conference on **“Advances in Agricultural and Biodiversity Conservation for Sustainable Development”** (ABCD – 2017) during 27-28 October, 2017 at C.C.S. University, Meerut (U.P.). The subject of conference is more appropriate today because per capita agricultural land in the country is constantly decreasing and therefore the only option to increase the agricultural production is through agri-innovation led new state of the art technologies. The conference focuses on problems related to natural resources, conservation, soil and water conservation, plant biodiversity, climate change, global warming and intellectual property rights etc. and will be helpful in agricultural sector.

Actually the agriculture and allied sectors continue to be the largest source of employment and livelihood security for more than 60% of population. India has achieved a major breakthrough in agricultural production as a result of the technology evolved by the scientists and its wide adoption by the farmers.

I hope that the international conference would prove an important step forward through efforts being made by different scientists. The conference is likely to give a new direction to agri-innovations for sustainable agriculture productions.

I am sure all related issues will be discussed and deliberated to define future road map to transform Indian agriculture into more productive and knowledge based industry. It is my pleasure to convey my warm greeting to the participants and organizers. I wish for the grand success of conference.

Prof. (Dr.) Ram Chandra
Vice Chancellor



JANTA VEDIC COLLEGE

BARAUT-250 611, BAGHPAT (U.P.)

NAAC Accredited "A" Grade College with " 3.39/4.00 C.G.P.A.

Ref. No. 36722

Dated 10/10/17



MESSAGE

I am glad to know that the Agriculture Technology Development Society (ATDS) Ghaziabad, (U.P.) and Department of Horticulture, C.C.S. University, Meerut is jointly organizing an International Conference on 'Advances in Agricultural and Biodiversity Conservation for Sustainable Development' (ABCD, 2017) on 27-28 October 2017 at Brahaspati Bhawan, C. C. S. University Meerut. The theme of the conference is both relevant and contemporary. I hope and believe that issues pertaining to various aspects of agriculture 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 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 ensure food security.

I appreciate the organizers for their best efforts to conduct a International Conference on such a important topic which will definitely helpful in context of environment and promote the research in the field of agriculture.

I extend my best wishes for the success of the conference and publication of souvenir.

(Dr. Yeshveer Singh Tomar)

Principal
Janta Vedic College, Baraut (Baghpat)
Baraut (Baghpat)

10/10/17



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

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. 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. 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's) to conserve natural resources and bio-diversity for achieving food security besides maintaining the ecological balance for sustainable agriculture.

I am glad to know that the Agricultural Technology Development Society, Ghaziabad and Department of Horticulture, C.C.S. University, Meerut, U.P., India is jointly organizing an International Conference on "Advances In Agricultural And Biodiversity Conservation For Sustainable Development (ABCD-2017)" in association with Shobit University, Gangoh, Saharanpur and Monad University, Hapur on 27-28 October, 2017 to share the knowledge and expertise in the concerned areas based on the theme of the conference.

I am sure that the deliberations/discussions to be held in this International 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 and income security with a human touch.

I wish for the grand success of the conference.

(Ram Ji Lal)

Dated the 30th September, 2017
Lucknow



चौधरी चरण सिंह विश्वविद्यालय, मेरठ Chaudhary Charan Singh University, Meerut

Prof. Jitendra Kumar Dhaka
Dean Faculty of Agriculture
C.C.S. University, Meerut



MESSAGE

I am pleased that Agriculture Technology Development Society (ATDS) Ghaziabad, (U.P.) and Department of Horticulture, C.C.S. University, Meerut is jointly organizing two days an International conference on '**Advances in Agricultural and Biodiversity Conservation for Sustainable Development**' (ABCD, 2017) from 27-28, October 2017 at Brahaspati Bhavan, C.C.S. University, Meerut (U.P.).

The conference offers a unique opportunity to the delegates to discuss various issues on advances in agriculture and biodiversity conservation concerning agriculture scientist, students and farmers whose contributions assume significance for the sustainable development of agriculture in the country and world.

It is my privilege to welcome and greet all the participants and speakers at CCS University, Meerut for this novel cause and I wish conference a grand success.

(Jitendra Kumar Dhaka)



**AGRICULTURAL TECHNOLOGY DEVELOPMENT SOCIETY (Regd.)
(ATDS) Muradnagar, Ghaziabad, Uttar Pradesh, India**

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

[www. agriinventionjournal.com](http://www.agriinventionjournal.com), Email: agroecologyconf16@gmail.com, ijaijournal82@gmail.com

Dr. Anant Kumar

President



MESSAGE

It is great pleasure to know that an International Conference on “Advance in Agricultural and Biodiversity Conservation for sustainable Development” is being organized by the Society for Agricultural Technology Development Society, Ghaziabad and Co-Organized by Department of Horticulture C C S University, Meerut during October 27-28, 2017.

It is known that enhancement of production and productivity of agricultural crops depends on efficient use of land, water and genetic resources. The nutrient supply to the crop plants is linked to physico-chemical and biological properties of soil and water. Optimized use of these resources can yield environmental and social benefits from agricultural systems. Growing human population and climate change are twin formidable challenges that warrant development of appreciate climate resilient varieties and technologies for sustainable agriculture.

The conference offers a unique opportunity to the delegates to discuss various concerning agriculture scientists and farmers whose contributions assumes significance for the development of agriculture in the world.

I extend my best wishes for the successful organization of international conference.

(ANANT KUMAR)

Asst. Prof /SMS

KVK, Muradnagar, Ghaziabad

SVPuat, Meerut, UP



**AGRICULTURAL TECHNOLOGY DEVELOPMENT SOCIETY (Regd.)
(ATDS) Muradnagar, Ghaziabad, Uttar Pradesh, India**

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FROM THE DESK OF CONVENER

This is a matter of great honour that Agricultural Technology Development Society, Ghaziabad and Department of Horticulture C.C.S. University, Meerut is jointly organizing a International Conference on “Advances in Agricultural and Biodiversity Conservation for Sustainable Development' (ABCD, 2017)” in association with Shobhit University, Gangoh, Saharanpur, U.P. and Monad University, Hapur, U.P. on 27-28 October 2017 at Brahaspati Bhawan, C.C.S. University, Meerut (U.P.). 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, Eritrea, Philippines, USA and China.

Agriculture is central to human survival as it provides food, fuel and other ecosystem services. It is an important source of livelihood, and plays a crucial role in economic development. 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 and conservation of biodiversity for sustainable development. I am sure that scientific/ technical deliberations and discussions 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. In this event we are indebted to the Chief Patrons Hon'ble Vice Chancellor Prof N.K. Taneja, C.C.S.University Meerut (U.P.) and other University authorities for their kind support and cooperation. 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 conference and pray almighty to bless us for making this International Conference a grand success.

(Rashmi Nigam)

Convener



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FROM THE DESK OF ORGANIZING SECRETARY

It is a matter of great privilege for me to organize two day International Conference on “Advances in Agricultural and Biodiversity Conservation for Sustainable Development’ (ABCD, 2017) on 27-28 October, 2017. On behalf of the organizing committee and the Department of Horticulture, C.C.S. University, Meerut 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 India and abroad 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 and Biodiversity Conservation for Sustainable Development. The conference will include sessions with invited speakers and exclusive poster and oral presentations.

I am grateful to the chief patron Hon'ble Vice Chancellor Prof N.K. Taneja and the principal of J.V. College for their constant encouragement and valuable suggestion for organization of this conference.

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.

Once again, I wish all of you a nice time at Brahaspati Bhawan, C.C.S. University, Meerut (U.P.)

(Joginder Singh)

Organizing Secretary

INTERNATIONAL CONFERENCE
on
Advances in Agricultural and Biodiversity Conservation for
Sustainable Development (ABCD, 2017)

27-28 October, 2017

Venue: Brahaspati Bhawan, C.C.S. University, Meerut (U.P.)

CONFERENCE PROGRAM SCHEDULE

Date: 27.10.2017

8:00 am to 9:00am:

Registration

INAUGURAL SESSION

9:00 am to 10:30am:

Completion of Dias

Inaugural session-Lightening of lamp

Welcome of chief guest and keynote speaker

Welcome Address

Introduction of guest

Address by chief guest

Note of thanks

DIGNITARIES OF THE INAUGURAL FUNCTION

Chief Guest:

Dr. Narendra Singh Rathore , DDG, Ag. Edn. ICAR, New Delhi

Chief Patron/Special Guest:

Prof. N. K. Taneja, Hon'ble VC, C. C. S. Univ. Meerut, UP

Guest of Honors:

Dr. A. S. Panwar, Director, ICAR-IIFSR, Meerut, UP

Dr. Manoj Kumar, Joint Director , ICAR- CPRI, R. S., Meerut, UP

Dr. Yeshveer Singh Tomar, Principal, J. V. College, Baraut, UP

10:31 am to 11:00am:

High Tea

11:01 am to 11:30am:

Keynote Address

TECHNICAL SESSION - I

11:31 am to 01:30pm: (Theme: Recent Advances in Agriculture Science and Technology)

Invited Lectures: Oral Presentation:

01:30 pm to 02:00 pm:

Lunch and Poster Presentation (Theme I & II)

TECHNICAL SESSION - II

02:01 pm to 03:30 pm: (Theme: Natural Resources Conservation, Environment and Food Security)

Invited Lectures: Oral Presentation:

Date: 28.10.2017

9:00 am to 9:15am: Morning Tea

TECHNICAL SESSION - III

9:15 am to 11:15 noon: (Theme: Innovative Approach in Biological Science, Biotechnology, Genetic diversity, Bio-nanotechnology and Green technology)

Invited Lectures: Oral Presentation:

11:15 am to 11:30am: High Tea

TECHNICAL SESSION - IV

11:31 am to 2:00pm: (Theme: Socio-Economic, Sustainable Development & Eco-friendly Agriculture)

Invited Lectures: Oral Presentation:

02:00 pm to 02:30 pm: Lunch and Poster Presentation (Theme III & IV)

VALEDICTORY SESSION

02:31 Pm To 04:30 Pm:

Welcome of chief guest

Welcome Address

Introduction of guest

Address by chief guest

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Chief Guest: Prof. Gaya Prasad, Hon'ble V C, SVPUAT, Modipuram, Meerut, UP

Special Guest: Prof. H. S. Singh, Pro V C, C. C. S. Uni. Meerut, UP

Guest of Honors: Prof. Ram Chandra, Hon'ble VC, Monad University, Hapur , UP
Dr. Ramji Lal, Prin. Scientist, ICAR- IISR, Lucknow, UP

04:31 pm to 05:00 pm:

Mark of Rapporteur

Special Remark by Guest

Felicitations of Guests/Key Speaker

Vote of thanks

5:00pm to 5.15 pm: Tea

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1.	EFFECT OF FREEZING RATE ON the MECHANICAL PROPERTIES OF Egyptian Medjool DATES. A.M. Elansari, S.G. Mahmoud, Yehia S. Ahmed*, E. M. Abo Tour**	1	27.	INFLUENCE OF DIFFERENT CONTAINERS ON SEED ROT OF RICE IN STORAGE Rajbir Singh	9
2.	EFFECTS OF SOWING DATE AND PHOSPHORUS LEVEL ON GROWTH AND YIELD OF BLACK GRAM (<i>VIGNA MUNGO</i> (L) HEPPER) UNDER RAINFED CONDITIONS OF ERITREA F. I. A. Brima, Awet Tesfay, Filmon Melake, Ibrahim O. Mussa and Idris M. Assire*	1	28.	COMPARATIVE PERFORMANCE OF BER (<i>ZIZYPHUS MAURITIANA</i> LAMK.) GENOTYPES UNDER SEMI-ARID CONDITIONS OF RAJASTHAN H.D. Choudhary and O.P. Garhwal	9
3.	EVALUATION OF NEW INSECTICIDE MOLECULES FOR THEIR EFFECTIVENESS IN THE MANAGEMENT OF INSECT PESTS OF RICE Umashankar H.G., Rajanna, M.P., Chethana B.S., Deepak, C.A.,	1	29.	STUDIES ON THE EFFECT OF LOW TUNNEL POLYHOUSE ON SOLANACEOUS SEEDLINGS DEVELOPMENT Manoj Singh	9
4.	EFFECT OF DATE OF PLANTING ON INSECT PEST INCIDENCE IN RICE, <i>ORYZA SATIVA</i> L Umashankar H.G., Rajanna, M.P., Chethana B.S., Deepak, C.A.,	2	30.	IDENTIFICATION OF TRAINING NEEDS OF RURAL FEMALES IN IMPROVED HOME AND FARM MANAGERIAL PRACTICES IN WESTERN UTTAR PRADESH Kirti M. Tripathi	9
5.	COLLECTION AND CHARACTERIZATION OF FENUGREEK (<i>TRIGONELLA FOENUM-GRÆCUM</i> L.) GENOTYPES TO STRENGTHEN NUTRITIONAL SECURITY Anita Singh, Richa Naula and Manoj Raghav	2	31.	PARTICIPATORY DIAGNOSIS OF DRUDGERY PERCEIVED BY THE WOMEN FARMERS: A MICRO LEVEL ANALYSIS Kirti M. Tripathi, S.K. Dubey*, U. S. Gautam* and Razia Parvez**	9
6.	EVALUATION OF TREATED TANNERY WASTEWATER OF THE PHYTOTOXIC AND GENOTOXIC EFFECTS OF USING <i>VIGNA RADIATA</i> AND <i>ALLIUM CEPA</i> Ashutosh Yadav and Ram Naresh Bharagava	2	32.	STUDIES ON DIVERSITY AND VARIABILITY IN CLUSTER BEAN [<i>CYAMOPSIS TETRAGONOLOBA</i> (L.) TAUB.] GENOTYPES THROUGH MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION Vikas Kumar, R. B. Ram and Chhatrapal Singh*	10
7.	PSEUDOMONADS FOR GROWTH ENHANCEMENT AND BIOCONTROL AGAINST PHYTOPATHOGENS OF <i>BRASSICA JUNCEA</i> (L.) Rishabh Chitranshi and Naveen Kumar Arora	3	33.	INHERITANCE OF CHARACTERISTICS AND THEIR INFLUENCE ON DAM PERFORMANCE IN MURRAH BUFFALOES Devesh Gupta, Vimlandu and H.C.L.Gupta	10
8.	ADVANCE SURFACE IRRIGATION METHOD FOR EFFICIENT WATER USE Jitendra Kumar	3	34.	EFFECT OF PROCESS AND OPERATIONAL PARAMETERS OF EXTRUSION COOKING OF SORGHUM, HORSE GRAM AND DEFATTED SOY FLOUR BLENDS TO PRODUCE PROTEIN RICH READY – TO – EAT FOOD SNACK A. L. Basediya, Sheela Pandey*, Ajeet Sarathe*, Puneet Kumar, and Kamlesh Ahirwar	11
9.	ROLE OF BIOTIC STRESS THROUGH ANTIOXIDANT SYSTEM IN MUNG BEAN (<i>VIGNA RADIATA</i> L. WILCZEK) Mukul kumar and Uma kant singh	3	35.	SHORT TERM RESPONSES OF CROPS TO CADMIUM TOXICITY-AN OVERVIEW WITH REFERENCE TO SORGHUM Prasann Kumar, Padmanabh Dwivedi*, Ajeet Prakash**, Vinay Kumar*** and Arun Kumar K****	11
10.	LAND USE PASSION ENTER POLLINATION CRISIS DEBATE Mukul Kumar	3	36.	ROLE OF POLYAMINES AND MYCORRHIZA FOR THE MITIGATION OF CADMIUM TOXICITY IN RABI MAIZE VARIETY BIO-9544 WITH SPECIAL REFERENCE TO TOTAL SOLUBLE SUGAR Prasann Kumar, Padmanabh Dwivedi*, Preethem E*, Ajeet Prakash**, Vinay Kumar*** and Arun Kumar K.****	11
11.	EFFECT OF PHOSPHORUS AND SULPHUR ON THE YIELD OF GREEN GRAM (<i>Vigna radiate</i> L.) Daddu Singh Dharwe, H. C. Dixit, Veena Malvi, C.K. Dotaniya* and R.K. Dautaniya**	4	37.	EFFECT OF FOLIAR APPLICATION OF GA ₃ ON YIELD AND QUALITY OF INDIAN MUSTARD [<i>BRASSICA JUNCEA</i> (L.) CZERN. & COSS.] UNDER SODIC SOIL Pradip Kumar Saini, Mayank Pratap, R.K.Yadav, Uma Singh, R.N. Kewat, Chandrapaal, Anuj Jaiswal, Shipra Pandey	12
12.	A STUDY ON ORGANIC MANURE ON GREEN GRAM [<i>PHASEOLUS RADIATA</i> L.] UNDER RAINFED CONDITION OF CHITRAKOOT AREA Sandeep Mohbe, U.S.Mishra, C.K. Dotaniya* and RK Dautaniya**	4	38.	EFFECT OF PRE-HARVEST SALICYLIC ACID TREATMENT ON POSTHARVEST QUALITY OF STRAWBERRY FRUIT Kalyan Barman, Ruby Rani* and H. Mir*	12
13.	INFLUENCE OF SULPHUR DOSE AND SPACING ON QUALITY ATTRIBUTES AND ECONOMICS OF KNOL-KHOL R. K. Bairwa and C. K. Dotaniya	4	39.	COMPARATIVE PERFORMANCE OF BER (<i>ZIZYPHUS MAURITIANA</i> LAMK.) GENOTYPES UNDER SEMI-ARID CONDITIONS OF RAJASTHAN H.D. Choudhary and O.P. Garhwal	12
14.	GROWTH ATTRIBUTES OF PIGEON PEA BASED INTER CROPPING SYSTEM AS INFLUENCED BY CONSERVATION TILLAGE UNDER RAINFED CONDITION Rajesh kumar, A.N. Paslawar and Ummed Singh*	5	40.	EFFECT OF DIFFERENT FERTILITY LEVELS AND BIO-FERTILIZERS ON GROWTH AND YIELD OF KNOL-KHOL (<i>BRASSICA OLERACEA</i> VAR. CAULORAPA L.) UNDER AGRO-CLIMATIC CONDITION OF BIKANER REGION Mamta Meena, H.D. Choudhary and S.L. Jat	13
15.	AGRO-TECHNIQUES FOR QUALITATIVE SEED CANE PRODUCTION WITH NEW SUGARCANE VARIETIES UNDER SUBTROPICAL REGION Sonia Yadav, Shriprakash Yadav, A.Kumar and B.L. Sharma*	5	41.	STUDIES ON EFFICIENCY OF DIFFERENT SUGARCANE GENOTYPES AND FERTILITY LEVELS ON PRODUCTIVITY OF SUGARACENE Satendra Kumar, I.S Singh and S.C.Singh*	13
16.	EFFICACY OF ORGANIC MATTER AND BIOCONTROL AGENTS AGAINST ROOT –KNOT NEMATODE (MELOIDOGYNE INCOGNITA) IN TOMATO (LYCOPERSICON ESCULENTUM) Hemlata Pant	5	42.	IMPACT OF BALANCED NUTRITION ON NUE AND ECONOMIC FEASIBILITY OF MAIZE (ZEA MAYS L.) IN WESTERN UTTAR PRADESH Satish Prajapati and Adesh Singh*	13
17.	WEEDS AS INDICATORS OF SOIL CONDITIONS Swati Verma	6	43.	PHENOLOGICAL PERFORMANCE OF WHEAT (<i>TRITICUM AESTIVUM</i> L.) VARIETIES UNDER DIFFERENT DATES OF SOWING IN WESTERN UTTAR PRADEH. Raju, Vipin kumar**, Kamlesh kumar Yadav*, Rajesh kumar	14
18.	POLLEN FORAGING BEHAVIOUR OF <i>APIS DORSATA</i> AT THE ONSET OF SPRING IN LUCKNOW, UTTAR PRADESH, INDIA Reshmi Chatterjee	6	44.	STUDY ON THE MAJOR MINERAL CONSTITUENTS OF COW AND BUFFALO MILK IN DIFFERENT STAGE OF LACTATION Devesh Gupta*, Prem Singh and H.C.L.Gupta	14
19.	STUDIES ON DIFFERENT LEVELS OF MAJOR NUTRIENTS ON GROWTH, YIELD AND QUALITY OF KALMEGH (ANDROGRAPHISPENICULATA BURN. F.) Uma kant singh and Mukul kumar*	6	45.	EFFECT OF CINTURING ON FLOWERING, FRUITING, YIELD AND QUALITY IN LITCHI CV. LATE BEDANA Satish Chand, Hitesh Agarwal, J. C. Chandola and Ranjan Srivastava	14
20.	PHARMACOLOGICAL EXPLOITATIONS OF <i>BARLERIA LUPULINA</i> LINDL. : A FOLK MEDICINE Ajeet Singh and Navneet	7	46.	TAXONOMICAL STUDIES OF MAJOR MANGO LEAFHOPPERS FROM INDIA Srinivasa. N and Naresh M Meshram	14
21.	BIOLOGICAL ATTRIBUTES OF <i>TETRASTICHUS HOWARDI</i> (OLLIFF) (HYMENOPTERA: EULOPHIDAR) ON PUPAE OF SUGARCANE BORERS Pradeep Kumar Bareliya, Harpal Singh, and Ajay Kumar	7	47.	PHYSIOLOGICAL RESPONSE OF RICE GENOTYPES TO SALINITY Anuradha Singhand Dhananjaya Singh*	15
22.	PROSPECTS AND ROLE OF PLANT DERIVED ANTIFEEDANT PRODUCTS IN INSECT PEST MANAGEMENT. Bashir A Rather, G. N. Parrey, F. A. Misgar, Z. A. Badri, M. Zubair and R. A. Dar7	7	48.	MOLECULAR CLONING AND EXPRESSION ANALYSIS OF <i>ALDOLASE</i> GENE UNDER ABIOTIC STRESS CONDITIONS IN LENTIL (<i>LENS CULINARIS</i>) Shruti, Pankaj Kumar and Ujjwal Sirohi*	15
23.	EVOLUTION OF SOME IMPROVED AND LOCAL VARIETIES OF RADISH (<i>RAPHAANUS SATIVUS</i> L) UNDER VALLEY CONDITION OF GARHWAL HILLS Arjun Lal Ola, D.K. Rana, M. R.Jhajhra and L.N. Bairwa	8	49.	STUDY OF GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN TUBEROSE (<i>POLIANTHES TUBEROSA</i> L.) GENOTYPES. Ujjwal Sirohi, Mukesh Kumar*, Pankaj Chauhan, Ravindra Kumar, Pooran Chand** and Veena Chaudhary***	15
24.	ASSOCIATION AMONG GENETIC PARAMETERS IN INDIAN MUSTARD (<i>BRASSICA JUNCEA</i> L. CZERN&COSS.) Vipin Kumar Malik, Shiv Kumar Singh*, Vijay Kumar, Norang Pal Singh, Ankit Malik*** and Vipin Kumar Dwivedi****	8			
25.	COMPARATIVE EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON VEGETATIVE GROWTH, YIELD AND QUALITY OF BER (<i>ZIZYPHUSMAURITIANA</i> LAMK.) CV. GOLA UNDER SEMI-ARID CONDITIONS Rajbala Choudhary, O.P. Garhwal, H.D. Choudhary and Indu Choudhary	8			

50. BIO EFFICACY OF NEWER MOLECULES OF INSECTIFIED AND BIOPESTICIDES AGAINST EGGPLANT/BRINJAL SHOOT AND FRUIT BORER (EFSB) (*LEUCINODES ORBONALIS*) GUENEE LEPIDOPTERA PYRALIDAE
B.B. Singh, Anil Kumar and Sanjeev Kumar 16
51. EVALUATION OF BIOPESTICIDE FOR MANAGEMENT OF INSECT-PESTS COMPLEX WITH SAFETY TO NATURAL ENEMIES ON INDIAN MUSTARD *BRASSICA JUNCEA* (L.) OF NORTH EASTERN UP
B.B. Singh, Anil Kumar and Sanjeev Kumar 16
52. EFFECT OF SEED RATE AND WEED CONTROL METHODS ON YIELD OF DIRECT SEEDED RICE (*ORYZA SATIVA* L)
Rajneesh singh, Abhinaw Kumar Singh and O.P. Rai 16
53. MITROCHONDRIAL CYTOCHROME OXIDIZE I(MT COI) DIAGNOSTIC TECHNIQUE FOR THE QUICK IDENTIFICATION OF BIOTYPES WHITEFLY, *BEMISIA TABACI* (GENNADIUS) ON DIFFERENT CROPS
Swati Tomar, Kamlesh malik* and Seema Sharma 16
54. DEVELOPMENT OF TRANSGENIC CHICKPEA (*CICER ARIETINUM* L.) PLANTS WITH *OSRUVB* GENE FOR SALT STRESS TOLERANCE
Preeti and Pushpa Kharb 17
55. RECENT DEVELOPMENT IN AGRICULTURE SECTOR OF AGER COMMUNITY IN COSTAL KARNATAKA, INDIA.
Ashokkumar A. and S. R. Shirodkar 17
56. EFFECT OF SEED RATE AND WEED CONTROL METHODS ON YIELD OF DIRECT SEEDED RICE (*ORYZA SATIVA* L)
Rajneesh singh, Abhinaw Kumar Singh and O.P. Rai 17
57. EFFECTS OF SURFACE STERILIZATION AGENTS ON *IN VITRO* PLANT GROWTH IN BANANA CULTIVAR "GRAND NAINÉ"
Anil Kumar Yadav and Yogesh Prasad 18
58. PHYSICO-CHEMICAL PROPERTIES OF PUMMELO[*CITRUS GRANDIS* (L.) OSBECK] GROWN UNDER NORTHERN PARTS OF WEST BENGAL
Nilesh Bhowmick, Arghya Mani*, Prodyut Kumar Paul, V.S.S.V. Prasanna 18
59. STUDY OF PREFERRED INFORMATION SOURCES AND CHANNELS BY THE RAPESEED-MUSTARD GROWERS
Saurabh Sharma, D.V. Rai , Deepika Saini, and Surjeet Kumar Arun 18
60. EVALUATION OF PLANT PRODUCTS AGAINST TOBACCO CATERPILLER, *SPODOPTERA LITURA* (FABRICIUS) ON SOYBEAN
V. K. Soni, Bhupesh Joshi, V. K. Dubey and R. K. Dwivedi 18
61. RESPONSE OF CAPSICUM TO DRIP IRRIGATION LEVELS AND BLACK PLASTIC MULCH UNDER NATURALLY VENTILATED POLYHOUSE
Sajal Debbarma, Lalit Bhatt, S.K. Maurya, Dharendra Singh and P.K. Singh 19
62. EXPLOITATION OF CMS BASED PIGEONPEA (*Cajanus cajan* L.) HYBRIDS FOR YIELD AND ITS CONTRIBUTING TRAITS
V.S. Pawar, M.W. Marawar*, S.D. Tayade, G.S. Mhasal, Minakshi Neware, Priya Pardeshi and P.M. Tayade 19
63. BIO-EFFICACY OF ECO-FRIENDLY PESTICIDES ON THE MANAGEMENT OF AGAINST DIAMONDBACK MOTH, *PLUTELLA XYLOSTELLA* (L.) ON CABBAGE, *BRASSICA OLERACEA*, VAR. *CAPITATA* (L.)
S.L. Jat, S. Ahmad, M.P. Chula, R.R.Meena and R.S. Nitharwal 19
64. HETEROISIS AND INBREEDING DEPRESSION IN RELATION TO HETEROIC PARAMETERS IN BREAD WHEAT (*TRITICUM AESTIVUM* L.) UNDER LATE SOWN CONDITION
Jaydev Kumar, Arun Kumar*, Mukul Kumar**, Sanjay Kumar Singh, Lokendra Singh and Anuj Kumar*** 20
65. PRODUCTIVITY OF SOME BREAD WHEAT CULTIVARS UNDER DIFFERENT NITROGEN FERTILIZER LEVELS
Gheith, E.M.S., EL-Metwally, A. El-M., Ola Z. El-badry and Shemi, R.G. 20
66. EFFECT OF MANURES AND FERTILIZERS ON GROWTH, FLOWERING AND YIELD PARAMETERS OF OKRA (*Abelmoschus esculentus* L. Moench)
Krishan Pal, Avdhesh Kumar and Vinod Kumar Dhangra 20
67. EFFECT OF MICRONUTRIENT AND BIOFERTILIZER ON GROWTH AND YIELD OF CAULIFLOWER (BRASSICA OLERACEA L. VAR. BOTRYTIS)
Krishan Pal, Manjeet Kumar and Vinod Kumar Dhangra 21
68. EFFECT OF POTASH MANAGEMENT THROUGH GLIRICIDIA GREEN LEAF MANURING ON SOIL FERTILITY AND NUTRIENT BALANCE IN VERTISOLS OF MAHARASHTRA
V. H. Jadhao and V.V. Gabhane 21
69. PERFORMANCE OF WHEAT TO NITROGEN, ZINC AND IRON FERTILIZERS
Ola Z. EL-Badry and Gheith, E. M. S. 21
70. ANTITRANSPIRANTS FOR CONTROL OF ABIOTIC STRESS
Ashutosh Kumar, Anupam Adarsh, Durgesh Singh* and Randhir Kumar 21
71. AGRICULTURE PROCESSING IN INDIA: SCOPE, OPPORTUNITY, FUTURE AND CONSTRAINT
Upendra Singh 22
72. DEVELOPMENT OF BIOPESTICIDES: AN IMPORTANT ORGANIC INPUT FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS OF SIGNIFICANCE
F. A. Mohiddin and Mujeebur Rahman Khan* 22
73. MOLECULAR CHARACTERIZATION OF *TRICHODERMA* SPECIES ISOLATED FROM TEMPERATE REGION OF INDIA AND THEIR ANTIFUNGAL ACTIVITY AGAINST *DEMATOPHORA NECATRIX* CAUSING ROOT ROT OF APPLE
F. A. Mohiddin, B. A. Padder, Shahid A. Padder, M. A. Bhat and Z.A. Bhat 22
74. EFFECT OF ZINC LEVELS ON GROWTH, YIELD AND QUALITY OF SPROUTING BROCCOLI (BRASSICA OLERACEA VAR. ITALICA L.)
Bhag Chand Shivrani, M.L.Meena, and Arjun Lal Ola* 23
75. AGRICULTURE PROCESSING IN INDIA: SCOPE, OPPORTUNITY, FUTURE AND CONSTRAINT
Upendra Singh and S. K. Khinchi* 23
76. EFFECT OF NPK DOSES AND CUTTING MANAGEMENT ON GREENS AND SEED YIELD OF CORIANDER (*CORIANDRUM SATIVUM* L.)
Chaman Singh, M. K. Singh, Mukesh Kumar, Satendra Kumar, Vipin Kumar and Sunil Malik 23
77. EFFECT OF DIFFERENT POST HARVEST TREATMENT AND WRAPPING MATERIALS ON VARIOUS PHYSICAL CHARACTERS OF MANGO FRUIT CV. DASHEHARI
M. K. Singh, A.K. Singh, Mukesh Kumar, Sunil Malik, Satya Prakash and Vipin Kumar 23
78. ASSESSMENT OF MULTIPLE TOLERANCE INDICES FOR SALINITY STRESS IN CHICKPEA (*CICER ARIETINUM* L.)
Rajat Chaudhary, Anurag Mishra, Sonum Arya and Mukesh Kumar 24
79. SCREENING TECHNIQUES FOR IDENTIFYING RHIZOBIA: CURRENT STATUS AND FUTURE STRATEGIES
Priyanka Shakya, Shilpa Singh, M. Senthil kumar 24
80. RECENT DEVELOPMENT IN AGRICULTURE SECTOR OF AGER COMMUNITY IN COSTAL KARNATAKA, INDIA.
Ashokkumar A., E. B. Sedamkar* and S. R. Shirodkar** 24
81. INDIGENOUS AND TRADITIONAL USE OF MEDICINAL PLANTS BY LOCAL PEOPLE IN DHARWAD DIST, KARNATAKA, INDIA.
E. B. Sedamkar, S. R. Shirodkar* and Ashok Kumar A.** 25
82. SUR HONNE (*CALOPHYLLUM INOPHYLLUM*) OF KARNATAKA COAST, A POTENTIAL PLANT FOR BIODIESEL
Shirodkar S. R., Ashok Kumar A.* and E. B. Sedamkar** 25
83. EFFECT OF POLLINATION METHOD ON FRUIT SET IN COMMERCIAL CULTIVARS OF LITCHI
Shweta Kumari, J.C. Chandola*, Ruby Rani and Hidayatullah Mir 25
84. WEEDY RICE: A THREAT FOR DIRECT SEEDED RICE
Neelam Bisen and C. P. Rahangdale* 26
85. ECONOMICS OF DIFFERENT NITROGEN SOURCES (ORGANIC AND INORGANIC) IN KHARIF PEARLMILLET
Shobha Kumari, Vikram Singh, Neha and Preeti Choudhary 26
86. EFFECT OF VARYING NITROGEN LEVELS ON YIELD OF PEARL MILLET [PENNISETUM GLAUCUM (L.)] AND SOIL PROPERTIES
Neha, Gautam Ghosh and Preeti Choudhary 26
87. STUDIES ON INTERACTION BETWEEN *MELOIDOGYNE INCOGNITA* AND *FUSARIUM OXYSPORUM* F.SP. *LYCOPERSICI* IN TOMATO
Naresh Kumar, Kamlesh Kumar Jat and Lalita Lakhran 26
88. THREAT AND CHALLENGE OF *SCLEROTINIA SCLEROTIUM* IN THE VEGETABLE CROPS
Kamlesh Kumar Jat, Naresh Kumar and Arjun Lal Choudhary* 27
89. EFFECT OF NUTRIENT MANAGEMENT ON PRODUCTIVITY AND ECONOMICS OF SOYBEAN
Y. A. Bhosale and D.P. Pacharne 27
90. EFFECT OF BIO-REGULATORS ON GROWTH, FLOWERING AND FLOWER YIELD OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.) CV. PUSA NARANGI GAINDA
Harvindra Pal 27
91. MOLECULAR ANALYSIS OF PHOSPHINE RESISTANCE IN POPULATIONS OF LESSER GRAIN BORER *RHYZOPERTHA DOMINICA* (FABRICIUS) FROM UTTAR PRADESH, INDIA REGION
Rahul Kumar Chandel, Manju Sharma*, Sabtharishi Subramanian, Chitra Srivastava and SM Paul Khurana* 28
92. FLOWERING, FRUITING AND PHYSIO-CHEMICAL CHARACTERISTICS OF BAEL (*AEGLE MARMELOS* CORREA.) GROWN IN NORTHERN DISTRICTS OF WEST BENGAL
Arghya Mani 28
93. EFFECTS OF ALOEVERA EDIBLE COATING ON QUALITY AND POSTHARVEST PHYSIOLOGY OF BER (*ZIZYPHUS MAURITIANA* LAMK.) UNDER AMBIENT STORAGE CONDITIONS
Arghya Mani 28
94. PHYSIO-CHEMICAL PROPERTIES OF JALPAI (*ELAEOCARPUS FLORIBUNDUS* BLUME.) GROWN IN NORTHERN PARTS OF WEST BENGAL
Arghya Mani 29
95. PHYSIO-CHEMICAL PROPERTIES OF PUMMELO [*CITRUS GRANDIS* (L.) OSBECK] GROWN UNDER NORTHERN PARTS OF WEST BENGAL
Arghya Mani 29
96. INFLUENCES OF WEED MANAGEMENT ON QUALITY PARAMETERS IN SUMMER GROUNDNUT (*ARACHIS HYPOGAEA* L.)
Mahendra Choudhary, Sheeshpal Choudhary*, Chouthu Ram Hakla** and Shiv Prasad Daroga 29
97. ROLE OF DIFFERENT FACTOR IN DISTRIBUTION OF TOP BORER (*SCIRPOPHAGA NOVELLA*)
Anil Kumar 29
98. ESTIMATION OF HETEROISIS AND INBREEDING DEPRESSION FOR YIELD AND ITS CONTRIBUTING CHARACTERS IN WHEAT (*TRITICUM AECTIVUM* L.)
Bijendra Kumar, D.N. Bharadwaj, Lokendra Singh, Rajendra Yadav, 30
99. HYDROPONICS IN FRUIT CROPS
Abha Kumari and Ruby Rani 30

100. MAJOR INSECT PESTS OF STORAGE PULSES AND THEIR MANAGEMENT S. K. Khinchi, K.C. Kumawat and Upendra Singh*	30	124. ENHANCEMENT OF YIELD COMPONENTS AND SEED QUALITY PARAMETERS BY GROWTH REGULATORS IN LENTIL (<i>LENS CULINARIS</i> MEDIK.)	37
101. EFFECTIVE MANAGEMENT PRACTICES FOR IMPROVING SOIL ORGANIC MATTER FOR INCREASING CROP PRODUCTIVITY OF INDIA Mamta, Manish Kumar*, Abha Kumar*, Asheesh Chaurasiya	31	125. CHARACTER ASSOCIATION OF YIELD COMPONENTS AND SEED QUALITY PARAMETERS IN CHICKPEA (<i>CICER ARIETINUM</i> L.)	38
102. SCREENING OF SOYBEAN GENOTYPES AGAINST STEM FLY, MELANAGROMYZA SOJAE (ZEHTNER) J. Upadhyay, A. K. Saxena AND S. B. Das	31	126. EFFECT OF FOLIAR SPRAY OF BIOREGULATORS ON THE VEGETATIVE GROWTH OF BROCCOLI (<i>BRASSICA OLERACEA</i> VAR. <i>ITALICA</i>)	38
103. INTEGRATED EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON GROWTH, YIELD AND YIELD ATTRIBUTES OF RADISH CV. KALYANPUR SAFED Umesh Kumar Verma, Rajeev Kumar, Sanjeev Kumar and Anil Kumar	31	127. EFFECT OF SALINITY STRESS ON CHLOROPHYLL CONTENT IN OKRA GERMPLASM Gayarti Bhadana and Pavitra Dev*	38
104. EFFECT OF VARIOUS LEVELS OF NITROGEN ON GROWTH, YIELD AND QUALITY OF FODDER MAIZE Rajeev Kumar*, Sanjeev Kumar, Anil Kumar, B. B. Singh, Ravendra Singh* and Pradeep Kumar*	31	128. INCREASED IMPORTANCE OF INTEGRATED PEST MANAGEMENT Sushil Kumar and Gaurav Kumar	39
105. ANTIOXIDANT POTENTIAL OF <i>MOMORDICA CHARANTIA</i> FRUIT IN FOUR DIFFERENT <i>IN-VITRO</i> ASSAYS. Preeti Kumari, R. B. Verma, Wasim Siddiqui*, Nisha Rani and Rahul Kumar Verma**	32	129. BIOLOGY AND POPULATION DYNAMICS OF SORGHUM SHOOT FLY, <i>Atherigona soccata</i> RONDANI Keerthi, M. C. and Somasekhar	39
106. EFFECT OF FERTILITY LEVELS AND BORON ON GROWTH, YIELD AND QUALITY OF CAULIFLOWER (<i>BRASSICA OLERACEA</i> VAR. <i>BOTRYTIS</i> L.) Atma Ram Meena, Upendar Kumar Bagri, Sukhdev Singh, Rajendra Jat, Jitendra Tak	32	130. EFFECT OF SULPHUR, ZINC & FYM ON GROWTH OF FRENCH BEAN Pawan Kumar Singh, Shashank Srivastav and Kshitij Parmar	39
107. SCREENING OF LACCASE PRODUCING LIGNOCELLULOLYTIC MICROBES FOR RICE STRAW BIODEGRADATION Roshan M Shinde, V.S. Shinde, Toshy Agrawal and A. S. Kotasthane	32	131. STUDIES ON CORRELATION AND PATH ANALYSIS IN CHRYSANTHEMUM (<i>DENDRANTHEMA GRANDIFLORA</i> TZVELEV Atul Prakash	39
108. ENGINEERING INTERVENTIONS FOR REDUCING POSTHARVEST LOSSES IN FOOD GRAINS IN BIHAR Ashok Kumar, Satish Kumar, Sanoj Kumar, Prasanta Kalita* and Kent Rausch*	33	132. IMPROVEMENT OF SUGAR CANE SEED –AN APPROACH Ved Prakash, N.K. Pruthi*, S.K.Singh*, Viresh Singh and Joginder Singh	40
109. MANAGEMENT AND ECONOMICAL ANALYSIS OF SHOOT AND FRUIT BORER IN BRINJAL (<i>SOLANUM MELONGENA</i> LINN) FOR KOSHI REGION IN BIHAR Ajay Kumar Das, Kamleswary Prasad Singh*, Shivnath Das** and Wajid Hasan	33	133. STATUS OF PHOSPHINE RESISTANCE AND BIOCHEMICAL CHARACTERIZATION IN KHAPRA BEETLE, <i>TROGODERMA GRANARIUM</i> (EVERTS) STRAINS COLLECTED FROM FIVE STATES Sunil Kumar Yadav and Chitra Srivastava	40
110. EFFECT OF MICRONUTRIENTS ON GROWTH, YIELD AND QUALITY OF TOMATO (<i>SOLANUM ESCULENTUM</i> MILL.) CV. NAVODYA Sukhdev Singh and Upendar Kumar Bagri	33	134. CUMULATIVE EFFECT OF <i>FUSARIUM MANGIFERAE</i> INFECTION AND ETHYLENE CONTENT IN MANGO FLOWER BUD IN RELATION TO MALFORMATION UNDER LOW TEMPERATURE STRESS CONDITION Mohammad Wahid Ansari, Zahid Hameed*, Zahid Khorshid Abbas**, Amit Verma***, Anil Kumar, Ratnum K Wattal, Gurdeep Bains* and Ramesh Chandra Pant*	40
111. EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE YIELD PARAMETERS OF BOTTLE GOURD [<i>LAGENARIA SICERARIA</i> (MOL.) STANDL.] Babar Malik, Jitendra Kumar and Pavitra Dev	34	135. ROLE OF AGRO-FORESTRY IN AGRICULTURE AND LIVESTOCK MANAGEMENT Mahipat Singh	41
112. IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND QUALITY ATTRIBUTES OF TOMATO (<i>Lycopersicon esculentum</i> Mill.) CV. PUSA ROHINI Pavitra Dev and Jitendra Kumar	34	136. INSECTICIDAL ACTIVITY OF SOME PLANT EXTRACTS AGAINST CABBAGE APHID, <i>BREVICORYNE BRASSICAE</i> (L.) Shweta Patel and C. P. Singh	41
113. EFFECT OF ENRICHED MATERIAL (TATA GEO GREEN) & FYM ALONG WITH GRADED LEVEL OF CHEMICAL FERTILIZER ON THE QUALITY AND YIELD OF POTATO (<i>SOLANUM TUBEROSUM</i> L.) Neeraj Kumar Tiwari, Neeraj Kumar and Atik Ahamad	34	137. EFFICACY OF FUNGICIDES AND BIOCONTROL AGENTS FOR THE MANAGEMENT OF CHICKPEA WILT (<i>FUSARIUM OXYSPORUM</i> F.SP. <i>CICERI</i>) Praful kumar and Pappu Lal Bairwa	42
114. EFFECT OF BAP AND NAA ON <i>IN VITRO</i> PLANT REGENERATION OF BANANA (<i>MUSA PARADISIACA</i> L.) VARIETY GRAND NAINA Shardulya Shukla, Jagraj Singh, Pushkar Dixit and Babloo Patel	35	138. IMPACT OF FOLIAR SPRAY OF BIOREGULATORS ON THE YIELD OF BROCCOLI (<i>BRASSICA OLERACEA</i> VAR. <i>ITALICA</i>) Pavitra Dev and Gayarti Bhadana	42
115. ESTIMATION OF STABILITY PARAMETERS FOR SEED YIELD AND ITS COMPONENTS IN TRITICALE AND WHEAT GENOTYPES UNDER OPTIMUM AND STRESS ENVIRONMENTS A. G. Singh and A. K. Sharma	35	139. IMPACT OF SYNERGIST PIPERONYL BUTOXIDE (PBO) WITH CHLOROPYRIFOS IN <i>CNAPHALOCROCIS MEDINALIS</i> (GUENEE) Sudhanshu Bala Nayak* and R. P. Soundararajan	42
116. MANAGEMENT OF MUSTARD APHID <i>LIPAPHIS ERSYMI</i> (KALT.) WITH NSKE AND CHEMICAL FORMULATIONS IN COMBINATION WITH THIMET 10 G IN MUSTARD. Nazrussalam, Ekhlake Ahmad and D. N. Singh	35	140. APPRAISAL'S GENOTYPES ON WATER ABSORPTION, TRANSPIRATION LOSS AT SENESCENCE STAGE AND GENETIC CORRELATION OF <i>CHRYSANTHEMUM MORIFOLIUM</i> Manpreet Kaur, D. S. Dahiya, Sonu Kumar, Prince and Gulshan Yadav	42
117. INFLUENCE OF DIFFERENT ORGANIC ADDITIVES (PLUSES FLOUR) ON MYCELIUM GROWTH (SPAWN) OF OYSTER MUSHROOM (<i>PLEUROTUS</i> <i>DJAMOR</i>) Satpal Singh, Gopal Singh and Shoraj Singh*	35	141. PLANT PARASITIC NEMATODES AND THEIR INTERACTIONS WITH HOST Bindhya Chal Yadav and Kalpana Singh	43
118. SCREENING OF BER CULTIVARS / GERMPLASM AGAINST <i>OIDIIUM</i> <i>ERYSIPHIOIDES</i> F. SP. <i>ZIZIPHII</i> , CAUSING POWDERY MILDEW Meera Choudhary, R.P. Ghasolia, Lalita Lakhran and Tejpal Bajaya	36	142. EFFECT OF ORGANIC, INORGANIC & BIOFERTILIZERS ON ECONOMY OF CABBAGE (<i>Brassica oleracea</i> var. <i>capitata</i>). Madan Kumar Jha, Bharti Jha*, and Manju Rani Sahu	43
119. CORRELATION AND PATH ANALYSIS FOR SEED YIELD ITS CONTRIBUTING TRAITS AND OIL CONTENT IN AJWAIN (<i>TRACHYSPERMUM AMMI</i> L.) Monika Meena, N. S. Dodiya, Baudh Bharti, Rajani Verma, Bharat Lal Meena	36	143. EFFECT OF DIFFERENT RECIPES OF LIME BLENDED Bael SYRUP ON STORAGE N. R. Kadge, S. R. Dalal*, P. L. Deshmukh and Anjana Kholia	43
120. IMPACT OF POTASSIUM HUMATE AND BIO-INOCULANTS ON COWPEA PRODUCTIVITY, SOIL MICROBES AND SOIL HEALTH Pradip Tripura	36	144. NEPHROPROTECTIVE ACTION OF TAURINE AND GARLIC EXTRACT AGAINST COPPER SULPHATE INDUCED RENAL TOXICITY IN <i>CLARIAS</i> <i>GARIEPINUS</i> Adil Wani and Malvika Sikdar	44
121. WILT DISEASE (<i>FUSARIUM OXYSPORUM</i> F. SPP. <i>CICER</i>) INFECTING CHICKPEA (<i>CICER ARIETINUM</i>) Shahnashi Hashmi, Mehjabi Hashmi and Harpal Singh	36	145. ANALYSIS OF PLANT GROWTH PROMOTING ACTIVITY, BIO-CONTROL AND ABIOTIC STRESS TOLERANCE OF FLUORESCENT <i>PSEUDOMONAS</i> STRAINS, ISOLATED FROM RHIZOSPHERE OF VEGETABLE CROPS Keshawanand Tripathi	44
122. STUDIES ON THE EFFECT OF CYTOKININ AND AUXIN ON CALLUS FORMATION AND SHOOT MULTIPLICATION OF STRAWBERRY (<i>FRAGARIA X ANANASSADUCH</i>) UNDER <i>IN VITRO</i> CONDITION Sumit Tomar, Jagraj Singh, Shardulya Shukla, Govind Rajbhar, Manoj Kumar and Yogesh Prasad Rajbhar	37	146. POSTHARVEST MANAGEMENT OF OKRA Ashu Malik and Pavitra Dev	44
123. CORRELATION AND PATH ANALYSIS IN GROUNDNUT (<i>ARACHIS</i> <i>HYPOGAEA</i> L.) Surbhi Jain, P. B. Singh and P. P. Sharma	37	147. ISOLATION AND CHARACTERIZATION OF THE HALOTOLERANT CYANOBACTERIUM <i>ANABAENA</i> GA1 FROM RANN OF KUTCH FOR MYCOSPORINE LIKE AMINO ACID PRODUCTION Yattapu Prasad Reddy, Ravindra Kumar Yadav, Keshawanand Tripathi and G. Abraham	45
		148. STUDY OF THE FARM STRUCTURE, CROPPING PATTERN AND CROPPING INTENSITY ON PULSE GROWING SAMPLE FARMS IN AZAMGARH DISTRICT OF UTTAR PRADESH INDIA Rajeev Singh, Rajeev Kumar, Gyan Prakash Singh, Santosh Kumar Mishra, Prince Kumar, Harendra Pratap Singh Choudhary, and Chandan Singh	45

149.	EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS ON YIELD, QUALITY AND NUTRIENTS UPTAKE BY MUSTARD (<i>BRASSICA JUNCEA</i> L.) Sanjay Kumar	45	174.	MANAGEMENT OF COWPEA WEB BLIGHT WITH COMBINED TREATMENT OF BIOCONTROL AGENT Priyanka, Dr. S.L. Godara, Dr. Anand Kumar Meena, Dinesh Choudhary*	53
150.	A REVIEW: EFFECT OF MALTING & FERMENTATION ON THE FUNCTIONAL & RHEOLOGICAL PROPERTIES OF SORGHUM FLOUR Gawande A.V. and Babar K.P.	45	175.	EFFECT OF ZINC AND THIOUREA APPLICATION ON GROWTH AND YIELD OF GREENGRAM [<i>VIGNA RADIATA</i> (L.) WILCZEK] Priyanka Bhadru, S.S.Yadav H.P.Verma I.r. yadav, Neelam Yadav and Raju Devi Kantwa	54
151.	STUDY THE MORPHOLOGICAL CHARACTERS OF OKRA GERMPLASM FOR SALINITY TOLERANCE IMPACT OF SULPHUR ALONE AND COMBINATION WITH FYM ON YIELD AND METHIONINE CONTENT IN MUSTARD CROP Vaishali Sharma, B. L. Sharma, G.D. Sharma, A. Dubey and A. Suryawanshi	46	176.	NUTRIENT CONTENT AND UPTAKE AS A INFLUENCED BY FOLIAR APPLICATION OF IRON ON CLUSTERBEAN VARIETIES R. B. Solanki, L. R. Yadav, H. P. Verma, S. S. Yadav Roshan Kumawat and Saroj Kumari Yadav	54
152.	VEGETABLES AS PROTECTIVE FOOD FOR HUMAN HEALTH – A REVIEW Ashu Malik and Pavitra Dev	46	177.	THE EFFECT OF ZINC ON GROWTH AND YIELD OF OKRA [<i>ABELMOSCHUESCULENTUS</i> (L.) MOENCH] Raunak Sharma*, Kumari Lata*, Deepika Sharma*, Ratan Lal Sharma** and Anita Sharma**	54
153.	WHEAT IMPROVEMENT IN INDIA: CURRENT STATUS AND FUTURE STRATEGIES Rohit Kumar Saini, RamrajSen and S.A. Kerkhi	47	178.	SURVIVAL OF <i>APHELENCHOIDES BESSEYI</i> IN PROSOMILLET (<i>PANICUM MILLACEUM</i>) Ratan Lal Sharma, S.P. Tiwari, Suresh Kumar Dotasara* and Naresh Parashar*	55
154.	INFLUENCE OF INSECTICIDES ON YIELD OF TOMATO IN MANAGEMENT OF <i>TUTA ABSOLUTA</i> UNDER PROTECTED CULTIVATION Ramesh K. B., P. R. Zanwar, Tukaram A. Nikam*, H Sunil Naik, Niranjana G. N.47	47	179.	RESPONSE OF CLUSTERBEAN VARIETIES TO FERTILITY LEVELS AND AGRO-CHEMICALS ON YIELD AND QUALITY PARAMETERS Rekha Yogi, O.P. Sharma, H.P. Verma	55
155.	EFFECT OF NITROGEN AND POTASSIUM ON AVAILABLE NUTRIENTS STATUS OF SWEET POTATO (<i>IPOMOEA BATATAS</i> L.) IN VERTISOLS OF MAHARASHTRA Pushpalatha*, M., Vaidya**, P. H. Sunil B. H. and Adsul, P. B.	47	180.	RESPONSE OF URDBEAN[<i>VIGNA MUNGO</i> (L.) HEPPEL] TO PHOSPHORUS FERTILIZATION AND THIOUREA Sanju Choudhary, O.P. Sharma, H.P. Verma, I.r. yadav and S.S.Yadav	55
156.	SURVEY CITRUS INSECT PESTS AND THEIR MANAGEMENT IN SUB ZOBAKEREN AND HAMELMALO, KEREN, ERITREA Huma Naz, Adugna Haile, Zineb Idris, Habitu Kifleariam, Mical Tesfay	48	181.	GROWTH RESPONSE OF MAIZE TO <i>PARTHENIUM</i> WEED MANURES D. R. Chamle and D. A. Dhale	55
157.	PHOTOSELECTIVE SHADE NETTING IN VEGETABLE CROPS P. Pawar, Y. R. Parulekar*, B. J. Patle and S. V. Bhavar	48	182.	EFFECT OF DIFFERENT FUNGICIDES AGAINST <i>PYRICULARIA GRISEA</i> AT BOOTING STAGE IN BASMATI RICE Vipin Kumar, Yachna Gupta, Sandeep Kumar*, Avinesh kumar** and Bharti Singh	56
158.	INTEGRATED NUTRIENT MANAGEMENT STUDIES IN BOTTLE GOURD B. J. Patle, A. P. Wagh*, N. R. Kadge, P. L. Deshmukh	48	183.	ROLE OF CYANOBACTERIA IN NITROGEN FIXATION Gaurav Yadav	56
159.	ESTIMATION OF THE EFFECT OF DROUGHT ON YIELD AND YIELD CONTRIBUTING TRAITS IN CORIANDER GENOTYPES(<i>CORIANDER SATIVUM</i> L.) MamtaBajya*, B.L.Kakralya, Kamlesh Jangid, Anita Burdak and Kamal Singh Chouhan	48	184.	BREAKDOWN OF THE BT GENE RESISTANCE AGAINST LEPIDOPTERAN INSECTS IN COTTON Kuldeep Jangid and Omender Sangwan	56
160.	EFFECT OF MULTINUTRIENT BRIQUETTES ON SEED COTTON YIELD AND FIBRE QUALITY IN BT COTTON Sunil B. H.* V. D. Patil**, Pushpalatha, M., Basavaprasad V.M.	49	185.	MANAGEMENT OF NEWLY EMERGED BLAST (<i>PYRICULARIA GRISAE</i>) DISEASE IN WHEAT Vipin Kumar, Raju*, Sandeep Dhillon, Harjot Pal kaur and Sonu Kumari	57
161.	GROWTH AND YIELD OF SESAME AS INFLUNCED BY INTEGRATED NUTRIENT MANAGEMENT L.R. Yadav, H. P.Verma, S.S.Yadav, Rajesh Kumar, Arjun Lal Yadav and Krishna Yadav	49	186.	ROOT-MEDIATED ALLELOPATHIC INTERFERENCE OF <i>NICOTIANA PLUMBAGINIFOLIA</i> VIV. ON <i>SETARIA VIRIDIS</i> . Waseem Mushtaq and M.B. Siddiqui	57
162.	SUGARCANE PRODUCTION: AN APPROACH FOR ENHANCING INCOME IN WESTERN UTTAR PRADESH H. L. Singh and O. P. Maurya*	49	187.	MILLETS AS CLIMATE RESILIENT CROPS G.D. Umadevi and V. Sumathi	57
163.	EFFECT OF FERTILITY LEVELS AND BIO-ORGANICS ON GROWTH AND YIELD OF MUNGBEAN [<i>VIGNA RADIATA</i> (L.) WILCZEK] Ganshi Ram Kantwa, balwan, I.r. yadav, H. P.Verma and S. S.Yadav	50	188.	ON THE TRAIL OF INDIGENOUS MEDICINES AND ITS ROLE IN DEVELOPMENT OF MODERN MEDICINE D. A. Dhale and Mayuri C. Rathod*	57
164.	YIELD AND NUTRIENT STATUS IN COWPEA AS A INFLUENCED BY NITROGEN AND PHOSPHORUS H. P. Verma, P. K. Chovatiya, O. P. Sharma, I. r. yadav, S. S.Yadav, A. C. Shivran and S. P. Singh	50	189.	SOIL FERTILITY MANAGEMENT TO SUSTAIN PRODUCTION AND COMPARISON OF THREE METHODS FOR SOIL FERTILITY QUALITY SPATIAL SIMULATION WITH UNCERTAINTY ASSESSMENT Rahul Kumar Verma	58
165.	PRODUCTIVITY AND PROFITABILITY OF WHEAT (<i>TRITICUM AESTIVUM</i> L.) AS INFLUENCED BY IRRIGATION SCHEDULING AND ORGANIC MANURES UNDER SEMI-ARID EASTERN PLAIN ZONE OF RAJASTHAN H. P. Verma, O. P. Sharma, Anshul Gupta, Sushila Kanwar, Meena Choudhary and R. B. Solanki	50	190.	CHARACTERIZATION AND FIELD PERFORMANCE OF STRAWBERRY (<i>FRAGARIA X ANNANASA DUTCH</i>) GERMPLASM FOR GROWTH, YIELD AND QUALITY ATTRIBUTES Amit Kumar, M.K.Sharma, Angrej Ali*, Jagdeesh Prasad Rathore and F A Bandyaj	58
166.	EFFECT OF SALICYLIC ACID TO MITIGATE THE HIGH TEMPERATURE STRESS IN WHEAT GENOTYPES Kamal Singh Chouhan, B.L. Kakralya, MamtaBajya and H.P.Verma	51	191.	IPM AN EFFECTIVE SOLUTION FOR LESS USE OF PESTICIDES AND THEIR DRASTIC THREAT TO ENVIRONMENT Mehnigar Hamid, Angrez Ali*, Amit Kumar and SumayaMumtaz	58
167.	GROWTH AND YIELD OF SESAME AS INFLUNCED BY INTEGRATED NUTRIENT MANAGEMENT Kishor Kumar Bunker, H. P.Verma A. C. Shivran and Balwan	51	192.	EFFICACY OF GROWTH RETARDANTS (PROHEXADIONE CALCIUM AND PACLOBUTRAZOL) ON STORAGE LIFE OF PEAR CV. "CLAPP'S FAVOURITE" ManmohanLal, M.M. Mir, Umar Iqbal and Amit Kumar	59
168.	WEED CONTROL THROUGH HERBICIDE AND PHOSPHORUS MANAGEMENT AS INFLUENCED YIELD AND QUALITY PARAMETER OF CLUSTERBEAN Kishor Kumar Bunker, H. P.Verma A. C. Shivran and Balwan	51	193.	UNDERUTILIZED FRUIT VARSITY OF NORTHERN HIMALAYAN REGION OF INDIA Jagdeesh Prasad Rathore, Amit Kumar and M K Sharma	59
169.	PRODUCTIVITY AND PROFITABILITY OF FENNEL AS A INFLUENCED BY MICRO- IRRIGATION AT EASTERN PLAIN ZONE OF RAJASTHAN M. L. Jat, A. C. Shivran, H. P. Verma and B. L. Dudhwal	52	194.	NEW MODIFIED RATIO ESTIMATOR FOR POPULATION MEANS USING TWO AUXILIARY VARIABLES IN STRATIFIED SAMPLING *Mir Subzar, S. Maqbool, T A Raja, Mohit Husain ¹ and Zubair Ahmad Dar	59
170.	PROFITABILITY AND PRODUCTIVITY OF FENNEL AS A INFLUENCED BY IRRIGATION AND MOISTURE CONSERVATION PRACTICES Madhuri Meena, L. R. Yadav, H. P. Verma, Sarita Hansa Choudhary and Suresh Kumar Chedwal	52	195.	RECENT ADVANCES IN MOLECULAR BREEDING IN POMEGRANATE AnkitaMantri and Jagdeesh Prasad Rathore ¹	59
171.	EFFECT OF SULPHUR AND MOLYBDENUM ON PRODUCTIVITY OF FENUGREEK IN SEMI EASTERN PLAIN ZONE OF RAJASTHAN M. S. Manohar, A. C. Shivran, H. P. Verma, B. L. Dudhwal and Bhagwati Choudhary	52	196.	CHARACTERIZATION OF <i>RHIZOBIUM</i> STRAINS FROM <i>VIGNAMUNGO</i> (L.) HEPPEL, <i>CICERARIETINUM</i> LAND <i>VIGNARADIATA</i> (L.) IN MUZAFFARNAGAR REGION OF UTTAR PRADESH AnkurTyagi, Purushottam, Vijay Kumar and Gurvinder Singh	60
172.	DEVELOPMENT OF BAKERY PRODUCTS BY USING <i>SPIRULINA PLATENSIS</i> POWDER THEIR EFFECT OF STORAGE ON FAT ACIDITY Vatsala Saharan and Sudesh Jood*	53	197.	EFFECT OF DIFFERENT BIO-CONTROL AGENTS ON ROSE POWDERY MILDEW UNDER GREENHOUSE CONDITIONS Vijay Kumar, SunitaChandel, AnkurTyagi and Gurvinder Singh	60
173.	POPULATION DYNAMICS OF ORIENTAL FRUIT FLY, <i>BACTROCERA DORSALIS</i> HENDEL (TEPHRITIDAE: DIPTERA) ON CUSTARD APPLE, <i>ANNONA SQUAMOSA</i> L. H. Sunil Naik, K. S. Jagadeesh*, B. S. Basavaraju and K. B. Ramesh	53	198.	INCREASING IMPORTANCE OF BIOLOGICAL CONTROL OF PLANT DISEASE Surendra Kumar* Anupam Kumar Sushil Kumar	60
			199.	UNFRUITFULNESS IN ARID AND SEMI-ARID ZONE FRUIT CROPS:CAUSES AND REMEDIES Sagar ^{1*} , Narendra Singh ²	61

200. FRUIT CROPS BASED DIVERSIFIED CROPPING SYSTEMS FOR ARID AND SEMI-ARID REGIONS OF INDIA
Narendra Singh¹, Poonam Saini¹, Sagar 61
201. EFFICACY OF FUNGICIDES AGAINST STEM GALL DISEASE OF CORIANDER CAUSED BY *PROTOMYCESMACROSPORUS*
Sandeep Kumar^{*1}, Krishna Kumar², Vipin Kumar³and Deepak Baboo 61
202. EFFECT OF IRRIGATION SCHEDULING ON TOMATO YIELD (*LYCOPERSICON ESCULENTUM*) AND WATER USE EFFICIENCY UNDER DRIP IRRIGATION
Ram Kumar^{*} and Gurcharan Singh 61
203. SCREENING OF POTATO GENOTYPES FOR FOLIAR AND TUBER RESISTANCE AGAINST *PHYTOPHTHORA INFESTANS* CAUSING LATE BLIGHT OF POTATO UNDER SUBTROPICAL PLAINS OF INDIA
Mehi Lal, S K Luthra, V K Gupta and Saurabh Yadav 62
204. TAXONOMIC STUDY OF SOME SPECIES OF OEDIPODINAE (ORTHOPTERA: ACRIDIDAE) OF ROHILKHAND REGION, UTTAR PRADESH, INDIA
Sahar Mobin and Mohd. Kamil Usmani 62
205. EVALUATION OF MYCOACARICIDES AGAINST TWO SPOTTED SPIDER MITE, *TETRANYCHUSURTICAE* KOCH ON JASMINE (*JASMINUMSAMBACAIT.*)
Raghavendra K.V.¹, Chinniah C.¹ and Gowthami R. 62
206. NATURAL RESOURCES CONSERVATION
Manish Kumar*, Govind Ram Choudhary* and Radhe Shyam Kherwa 63
207. CHEMICAL WEED CONTROL IN URDBEAN (PHASEOLUS MUNGO L.)
Satish Kumar* Anupama k.**and Shish Ram Jakhar 63
208. STATUS OF INSECTICIDE RESISTANCE AND LEVEL OF CARBOXYLESTERASE IN COTTON LEAFHOPPER *AMRASCABIGUTTULABIGUTTULA* (ISHIDA)
vrunda s. Thakare, p. W. Nemade, s. A. Shendage 63
209. THE POTENTIAL PRODUCER OF NOVEL ENDOPHYTIC ACTINOMYCETES ARE MEDICAL PLANTS OF WEST BENGAL, INDIA
Sahana Yasmin & Debudul Banerjee 64
210. EFFECT OF SEED SIZE ON YIELD AND SEED QUALITY TRAITS IN SOYBEAN (*GLYCINE MAX L. MERRILL*)
S. N. Devkule¹, A. D. Autade² and A. H. Kadao 64
211. PRADHAN MANTRI JAN DHAN YOJNA (PMJDY) – A NEW WAY FOR MAINSTREAMING THE FINANCIALLY EXCLUDED
Dheerendra Kumar*, A.S.Maurya and Gaurav Kumar 64
212. PARABIOLOGICAL CONTROL IS A BIORATIONAL APPROACH FOR THE CONSERVATION OF EGG PARASITOID, *TRICHOGRAMMA CHILONIS* AND CONTROL OF A LEPIDOPTERAN PEST, *SPODOPTERA LITURA* (FAB.)
R. K. Seth¹ and Manas K Dhal 65
213. ALLELE MINING: A NEW TRENDS IN CROPS IMPROVEMENT
Pavan Devesh, Pandurang Arsode And Munnes Kumar 65
214. ELICITATION OF RESISTANCE RESPONSES IN GRAPEFRUIT AND LEMON FRUITS TREATED WITH A POMEGRANATE PEEL EXTRACT
Anita Jat¹ and Hansraj Dhakar 65
215. POTASSIUM FORMS AND THEIR RELATIONSHIP WITH PHYSICO-CHEMICAL PROPERTIES OF VERTISOL IN THE MALWA REGION OF MADHYA PRADESH
Anupama K. *, K.S. Bangar and Shish Ram Jakhar 66
216. ROLE OF ABIOTIC FACTORS ON THE INCIDENCE OF FRUIT FLY, *BACTROCERA ZONATA* IN GUAVA
Sandeep Singh and Akhilesh Tripathi¹. 66
217. EFFECT OF AMBIENT WEATHER ON POPULATION DYNAMICS OF MAJOR INSECT PESTS OF TAMARIND
Akhilesh Kumar, Manoj Kumar Painkra 66
218. CONIDIUM PRODUCTION BY ENTOMOPATHOGENIC FUNGUS *VERTICILLIUM LECANII*
Mahesh Kumar, Varun Kumar Tomer, Pravesh Jain and Pradip Kumar Sharma 66
219. MANAGEMENT PRACTICES FOR ROOT - KNOT NEMATODE (*MELOIDOGYNE GRAMINICOLA*) IN RICE CROP.
Dushyant Kumar, Kamal Khilari, Sachin Kumar Jain and Sonit Kumar 67
220. EFFECT OF STRESS MITIGATING CHEMICALS ON CORIANDER VARIETIES IN IRRIGATED SEMI-ARID EASTERN PLAIN ZONE OF RAJASTHAN
Rajveer Singh¹, A.C. Shivran², Jitendra Singh Bamboriya^{3*} and Deshray Singh Suman 67
221. EFFECT OF DIFFERENT SPACING ON GROWTH AND YIELD OF LIMA BEAN
Sweta S. Gawande, Ekta P. Ningot, P. K. Nagre and C. G. Nikam 67
222. STUDIES ON *BRYOPHYLLUM PINNATUM* LEAVES POWDER AND ITS FORTIFICATION IN SNACK PRODUCT
*Pawar S.R. & **Dabhade S.B. 67
223. NTEGRATED WEED MANAGEMENT: A OVERVIEW
Mukesh Danga^{1*}, Vijay Laxmi Yadav², Anjali Jingar³and Manisha Verma 68
224. MICROORGANISM AS A BIOWEAPONS FOR DEGRADATION OF XENOBIOTIC COMPOUNDS IN ARABLE LAND FOR SUSTAINABLE AGRICULTURE PRODUCTION
Narayan Prasad Verma^{*}Dhanidevi, and Anjulata Suman Patry 68
225. INTEGRATED PEST MANAGEMENT AND INTEGRATED NUTRIENT MANAGEMENT IN HORTICULTURAL CROPS.
Jyoti Singh¹, A.k.Dwivedi², Shreya Sinha 68
226. MODIFIED ATMOSPHERE PACKAGING OF INDIAN JUJUBE (*ZIZIPHUS MAURITIANA* LAMK.) FRUIT: EFFECT OF ATMOSPHERE ON PHYSIOLOGY AND CHILLING INJURY
Laxman Jat*, Suman Gathala and Sunil Pareek 69
227. RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON TURNIP(*BRASSICA RAPAL.*) CV. PURPLE TOP WHITE GLOBE.
Nikhil Jhariya, VishwaNath Mishra, Brijesh Kumar and Roshan kushwah 69
228. ESTIMATION OF HETEROSIS FOR SEED COTTON YIELD AND BIOCHEMICAL PARAMETERS IN GENETIC MALE STERILE BASED HYBRIDS OF *GOSSYPIMUM ARBOREUM* L.
R.D. Vekariya*, S. Nimbal, R.S. Sangwan, S. Mandhanian, O. Sangwan and S.R. Pundir 69
229. EVALUATION OF NEWER FUNGICIDE FOR MANAGEMENT OF EARLY BLIGHT OF TOMATO
Prahla¹ Hansraj Dhakar¹ and Dinesh kumar 69
230. EFFECT OF DIFFERENT DOSES OF HERBICIDES AND MECHANICAL WEEDING ON YIELD ATTRIBUTES AND GRAIN YIELD OF DIRECT SEEDED RICE (*ORYZA SATIVA* L.) VARIETIES IN CHHATTISGARH PLAIN
Paramjeet Singh, G. K. Shrivastava, A. K. Verma, Indrapaal Singh Paikra, Sujeet Singh Kanwar, and Jayant Kumar Paikra 70
231. INFLUENCE OF SEED INOCULATION WITH CARRIER AND LIQUID-BASED *RHIZOBIUM* CULTURES AND PHOSPHORUS LEVELS ON NUMBER OF RHIZOBIA IN SOIL AND YIELD OF SOYBEAN
Shish Ram Jakhar*, N.G. Mitra and Varsha Namdeo 70
232. BEST MEDIA PREPARED FOR CALLUSING OF A MEDICINAL PLANT VASAKA (*ADHATODA VASICA* NEES)
Sonal Tolwani and P.D. Gaikwad 70
233. STUDIES ON POWDERY MILDEW OF RAPESEED-"MUSTARD (*BRASSICA JUNCEA* L.) CAUSED BY *ERYSIPTHECUCIFERARUM* OPIZ. EX. JUNELL. AND ITS MANAGEMENT
Sonit Kumar, Rajendra Prasad, Satguru Parsad Yadav and Dushyant Kumar 71
234. SECONDARY METABOLISM IN *PENICILLIUM EXPANSUM*: EMPHASIS ON RECENT ADVANCES IN PATULIN RESEARCH
Suresh kumar¹, Dinesh Kumar¹, Hansraj Dhakar¹, and Parhla¹ 71
235. VEGETABLE CROPS FOR FOOD AND NUTRITIONAL SECURITY
Neerja Sharma 71
236. CROP DIVERSIFICATION AND PROTECTED CULTIVATION: POWERFUL TOOL FOR MANAGING CLIMATE CHANGE
Neerja Sharma 72
237. BIODEGRADATION OF ENDOSULFAN AND IMIDACLOPRID USING INDIGENOUS FUNGAL ISOLATES OF AGRICULTURE FIELDS OF KUMAUN REGION OF UTTARAKHAND
Ashish Kumar, Saurabh Gangola, Anita Sharma 72
238. DIVERSITY OF CULTURABLE BACTERIA ASSOCIATED WITH THE RHIZOSPHERE OF INDIAN WESTERN HIMALAYAN RED KIDNEY BEANS
Deep Chandra Suyal, Saurabh Kumar, Prasenjit Debbarma, Divya Joshi, Reeta Goel 72
239. CORRELATION AND PATH COEFFICIENT ANALYSIS OF SEED YIELD AND YIELD RELATED TRAITS OF LINSEED (*LINUM USITATISSIMUM* L.)
Devender Sharma*, Satish Paul and Ranjana Patial 73
240. ROLE OF NATIVE ALGAL SPECIES IN BIOREMEDIATION OF CYPERMETHRIN, FIPRONIL AND HEAVY METALS UNDER LABORATORY CONDITIONS
Divya Joshi, Pankaj Bhatt, Govind Kumar, Priyanka Khatri, Anita Sharma 73
241. EFFECT OF FOLIAR NUTRITION ON PRODUCTIVITY AND PROFITABILITY OF SOYBEAN [*GLYCINE MAX* (L.) MERRILL]
Indrapal Singh Paikra¹, and R. Lakpale², Paramjeet Singh³, Vijay Paikra 73
242. SUSTAINABLE AGRICULTURAL DEVELOPMENT THROUGH INNOVATIVE BIOTECHNOLOGICAL APPROACHES
Kavita Gururani and Dinesh Pandey 74
243. EFFECT OF DIFFERENT PACKAGING MATERIAL AND CONCENTRATIONS OF CaCl₂ ON SHELF LIFE AND FRUIT QUALITY OF PEACH (*PRUNUS PERSICA*) CV. SHAN-E-PUNJAB
Manpreet Singh Preet¹, Amit Jasrotia², Parshant Bakshi², Rakesh Kumar², 74
244. EFFECTS OF PRE- AND POST-EMERGENCE HERBICIDES ON PHOSPHATE SOLUBILIZING BACTERIA (PSB) AND *RHIZOBIUM LEGUMINOSARUM* IN GRAM (*CICER AERITINUM* L.)
Prasenjit Debbarma^{*1}, C.D. Deokar¹, Saurav Das 74
245. HIGH DENSITY PLANTING: BOOSTING PRODUCTION AND PRODUCTIVITY OF FRUIT CROPS
Rajat Sharma, P.N. Singh and D.C. Dimri 75
246. LOW COST RIPENING CHAMBER IN MANGO: A NEW VISTA TO ENHANCE QUALITY AND SHELF LIFE
Maggidi Spandana¹ Vishal Nirgude² and Nilesh Nirgude 75
247. TOLERANCE AND COMPATIBILITY OF *TRICHODERMA VIRIDE* AGAINST COMMON PESTICIDES
Narender Kumar, S. K. Singh* and Mohan Lal 75
248. AN INTRODUCTION TO LAKOOCHA (*ARTOCARPUS LACUCHA* ROXB.)
Vikash Kumar¹ and Vishal Nirgude 75
249. VERTICAL FARMING: SCOPE IN INDIAN HORTICULTURE
Vishal Nirgude¹, Maggidi Spandana² and Nilesh Nirgude 76

250.	AUGMENTING GROWTH, PHYSIOLOGICAL AND BIOCHEMICAL ACTIVITIES AND ESSENTIAL OIL PRODUCTION IN <i>M. SPICATA</i> L. THROUGH FOLIAR APPLICATION OF IRRADIATED CARRAGEENAN Ajmat Jahan, M. Masroor A. Khan, Hassan Jaleel, Bilal Bhat, Yawar Sadiq and Asfia Shabbir	76	275.	PRESENT AND FUTURE PROSPECT OF WHEAT IMPROVEMENT IN INDIA Arun Kumar and Jitendra Kumar	83
251.	TO ASSESS THE SCOPE OF SUMMER MOONG (<i>VIGNA RADIATA</i> L.) IN TERMERIC (<i>CURCUMA LONGA</i> L.) Balvir Kaur, Paramjit Kaur Sraw and Kuldeep Singh	76	276.	ETHNOBOTANICAL INVESTIGATION OF SOME HERBAL DRUGS SOLD BY VENDORS TO CURE COMMON DISEASES Ahirrao Y.A.* and Patil D.A	84
252.	EFFECT OF FOLIAR APPLICATION OF NITROGEN ON GROWTH AND YIELD OF VEGETABLE PEA (<i>PISUM SATIVUM</i> L.) CV.KASHI UDAI Raj Pandey , Vishwanath and Yatendra Kumar	77	277.	LUPEOL: SUPERFICIAL TRITERPENOID FROM HORTICULTURE CROPS Prabhugouda Patil* and Basavaraj Shellikeri	84
253.	IMPACT OF BIOFERTILIZER ON GROWTH, YIELD AND QUALITY OF CAULIFLOWER (<i>BRASSICA OLERACEA</i> L. VAR. BOTRYTIS) CV. PUSA SNOWBALL K-1 Bhag Chand, M.L. Meena, Saurabh Kishore, D C Meena, Sachin kisore and B L Meena	77	278.	EFFECT OF INSECTICIDES INCLUDING A NOVEL MOLECULE, TRIFLUMEZOPYRIM ON RICE PLANT HOPPERS SubhashChander, Brij Mohan, Namita Poddar and Srinivasan	84
254.	EFFECT OF NITROGEN AND PLANT GROWTH REGULATORS ON ECONOMIC OF AJWAIN (<i>TRACHYSPERMUM AMMI</i> L. SPRAGUE) Sheeshpal Choudhary*, Mahendra Choudhary* and Chouthu Ram Hakla	77	279.	SUGARMILL EFFLUENT INDUCED HISTOLOGICAL CHANGES IN LIVER OF <i>CHANNAPUNCTATUS</i> (BLOCH.) Suman Prakash and Ajay Capoor	85
255.	A STUDY ON THE MEDICINAL WEEDS OF KANNAUJ DISTRICT OF U.P. S.K. Verma and R.B. Yadav	78	280.	GROWTH AND FLOWERING OF <i>JASMINUM SAMBAC</i> (L.) AS INFLUENCED BY TIME AND DIFFERENT LEVELS OF PRUNING Sushma Lokhande, Neha Chopde, Ashvini Gaidhani and Disha Patil	85
256.	ISOLATION AND CHARACTERIZATION OF ENDOCHITINASE (<i>ECH42</i>) GENE FROM <i>TRICHODERMAHARZIANUM</i> Sorabh Chaudhary*, Sushma Sagar*, Mukesh Kumar* and Akash Tomar	78	281.	EXTENSION STRATEGIES FOR INCREASING PULSE PRODUCTION IN GRIDIH DISTRICT OF JHARKHAND Madhukar Kumar* and Maya Kumari	85
257.	DETERMINATION AND DEMARCATION OF SUITABLE AREA FOR ARTIFICIAL RECHARGE AND RAINWATER HARVESTING USING GIS Jhalesh Kumar, Omprakash Patel, Nirmal Kumar and Sugat bagde	78	282.	EFFECT OF ORGANIC, INRGANIC & BIOFERTILIZERS ON ECONOMY OF CABBAGE (<i>BRASSICA OLERACEA</i> VAR. <i>CAPITATA</i>). Madan Kumar Jha*, Bharti Jha**, and Manju Rani Sahu	86
258.	EFFICACY OF EDIBLE COATING ON SHELF LIFE AND QUALITY OFGUAVA FRUITS (<i>PSIDIUMGUAJAVA</i> L.) Pankaja B.D*, C. Indu Rani**, S. Elain Apsara* and Lokesh Bora	78	283.	EFFECT OF DIFFERENT DOSES OF SULPHUR ON YIELD AND SHELF LIFE OF ONION. N.A.Ganai, Zahoor Ahmed, Tahir Saleem and S.A.Hakeem	86
259.	A NOVEL METHOD TO MANAGE SHEATH BLIGHT OF RICE Omkar Singh, Mahantesh and Vishwanath	79	284.	EVALUATION OF SEED QUALITY OF THE RICE GENOTYPES Nitin Vikram*, R. N. Kewat*, Raja Husain** and Kunvar Gyanendra	86
260.	EFFECT OF SOWING DATES AND CULTIVARS ON GROWTH AND YIELD VARIABILITY IN SOYBEAN Vinod kumar mehra*, Manish bhan* and R.K. nagar	79	285.	COMPARATIVE BIOEFFICACY OF NATIVE ENTOMOPATHOGENIC NEMATODE AGAINST <i>GALLERIA MELLONELLA</i> . Om Datta	86
261.	STUDIES ON VARIABILITY AND SCOPE OF SELECTION FOR YIELD AND YIELD ATTRIBUTES IN TOMATO (<i>SOLANUM LYCOPERSICON</i> (MILL.)WETTSD) Rohit Kumar Bajpai and G.C. Yadav	79	286.	DETERIORATION IN QUANTITATIVE PARAMETERS OF SUGARCANE DUE TO <i>EUCALYPTUS GRANDIS</i> INTERCULTURE IN WESTERN U.P. Archana*, Viresh Singh* and B.L. Sharma	87
262.	EFFICACY OF SOME ESSENTIAL OILS AGAINST THE GREATER WAX MOTH (<i>Galleria mellonella</i> L.) UNDER STORAGE CONDITION Kalpana Bisht*, Sunil Verma* and N. N. Singh	80	287.	IMPACT OF PRUNING INTENSITIES ON PRODUCTIVITY OF TURMERIC UNDER <i>DALBERGIA SISSOO</i> ROXB. BASED AGROFORESTRY SYSTEM Vijay Bagare, K. K. Jain and Atul Singh	87
263.	CRISPR/CAS SYSTEM: A GENOME EDITING TOOL FOR CROP IMPROVEMENT Tabassum, Anand Singh Jeena, Deepankar Pandey	80	288.	INFLUENCE OF SEEDLING AGE AND PLANT HORMONES ON YIELD ANDVARIOUS TREATMENTS ON ECONOMICS OF ONION CULTIVATION (<i>ALLIUMCEPA</i> L.) Desh Raj Choudhary and Satesh Kumar	87
264.	EFFECT OF MANURES AND NITROGEN LEVELS ON SOIL FERTILITY, NUTRIENT CONTENT AND UPTAKE OF PEARLMILLET UNDER SEMIARID CLIMATIC CONDITIONS Manjeet, Parveen Kumar and Harender	80	289.	PROCESSING AND VALUE ADDITION IN RICE Ritesh kumar parihar ^{1*} , vikram kumar ¹ ,anoop kumar deveedee ¹ and Sunil verma ²	
265.	HYDROPONICS: AN ALTERNATIVE TECHNOLOGY FOR PROFITABLE HORTICULTURE IN ADVERSE CLIMATIC SITUATIONS Nidhi Tyagi* and Brij B Pandey	81	290.	EFFICACY OF OIL CAKES EXTRACTS AGAINST LARVAL MORTALITY OF RICE ROOT KNOT NEMATODE (<i>MELOIDOGYNE GRAMINICOLA</i>). Abhishek kumar, kamal khilari, amit kumaryadav, jaskaran singh, satish chand rampal verma and anupam kumar.	88
266.	NOTES ON <i>ADORETUS</i> SPP. (COLEOPTERA: SCARABAEIDAE: RUTELINAE) FROM RAJASTHAN, INDIA Padala Vinod Kumar and Kolla Sreedevi	81	291.	EVALUATION OF SOME INSECTICIDES AGAINST CITRUS PSYLLA, <i>DIAPHORINA CITRI</i> KUWAYAMA ON SWEET ORANGE Naveen Singh, G.S.Yadav and Meenakshi Devi	88
267.	PERFORMANCE OF DIFFERENT NITROGEN LEVELS ON GROWTH, SEED YIELD AND QUALITY OF GUM CLUSTER BEAN GROWN UNDER SUMMER CONDITIONS Chanchal Nikam, P.K. Nagre, V. S. Kale and Sweta Gawande	81	292.	SUPPORT VECTOR MACHINES AND THEIR APPLICATIONS IN AGRICULTURE Mujahid Khan* and B.K. Hooda	89
268.	MANAGEMENT OF INSECT PEST OF RICE THROUGH BIOLOGICAL AGENT Sushil Kumar, Vinod Kumar	81	293.	EFFICACY OF <i>TRICHODERMA HARZIANUM</i> CA-07 IN COMBINATION OF <i>PSEUDOMONAS FLUORESCENS</i> AND FUNGICIDE AGAINST ANTHRACNOSE OF CHILLI Abhishek Mishra, Ved Ratan, Supriya Dixit, Shubha Trivedi, Saurav Govind Rao and Gautam Veer Chauhan	89
269.	STUDIES ON CANOPY MANAGEMENT PRACTICES ON NPK STATUS OF LEAVES IN HIGH DENSITY PLANTING OF GUAVA (<i>PSIDIUM GUAJAVA</i> L.) CV. HISAR Shashank singh, Devi singh and Vijay H.M.	82	294.	PRODUCTION POTENTIAL, NUTRIENT UPTAKE AND ECONOMIC FEASIBILITY OF DROUGHT TOLERANT RICE (<i>ORYZA SATIVA</i> L.) VARIETIES UNDER VARIOUS CROP ESTABLISHMENT METHODS AND MOISTURE CONSERVATION TECHNIQUES Rajendra Kumar and Adesh Singh	89
270.	SHELF LIFE OF SOME PLANT EXTRACTS AGAINST TWO STAGES OF MUSTARD APHID, <i>LIPAPHIS ERYSIMI</i> Shikha Rohila and C. P. Singh	82	295.	MICROBE MEDIATED FERTI-FORTIFICATION OF ZINC IN RICE-WHEAT CROPS FOR INCREASED PRODUCTIVITY AND QUALITY Anoop Kumar Devedee*, Ritesh Pariha ¹ , , Vikram Kumar ² Sunil Verma	90
271.	TO STUDY ON GROWTH PARAMETERS AND YIELD ATTRIBUTS THE INTERCROPPING OF MUSTARD, LINSEED AND CHICKPEA WITH WHEAT IN RAISED BED AND FLAT BED SYSTEM UNDER INNER WHEEL PATTERN IN DIFFERENT RATIO Shivani Singh*, Girish Goyal* and Raj Kumar*	82	296.	<i>PYRACANTHA CRENULATA</i> LEAF EXTRACT MEDIATED SYNTHESIS OF ZNO NANOPARTICLES AND THEIR ANTIBACTERIAL ACTIVITY Goutam Kumar* and PP Badoni	90
272.	IMPORTANT OF PULSES CROP AND THEIR ROLE OF CLASSICAL BREEDING METHODS Girish Goyal*, Shivani Singh* and Raj Kumar	83	297.	NEW EMERGING MOLECULES OF INSECTICIDES AND THEIR ROLE IN IPM ALONG WITH ITS FUTURE CHALLENGES Deepak Kumar Jaiswal ^{1*} , Devu Rakshith Roshan ¹ , S. Ramesh babu ^{1*} Kamal Ravi Sharma ¹ and Prateek singh	90
273.	INFLUENCE OF TEN ROOTSTOCKS ON FRUIT QUALITY AND FOLIAR NUTRIENT STATUS OF KINNOW MANDARIN Pandey Kuldeep, Rattanpal H.S and Singh Jagveer	83	298.	STUDY OF LOCAL MAIZE (<i>ZE A MAYS</i> L.) GENOTYPES OF NORTH-EAST INDIA AT DIFFERENT LEVELS OF NITROGEN. Tirkey A. E ¹ ., Barua N. S.	91
274.	EFFECTS OF POTASSIUM LEVELS ON CONVENTIONAL AND MINI-TUBERS OF POTATO (<i>SOLANUM TUBEROSUM</i> L.) ON GROWTH AND TUBER YIELD Kanu Sarkar, R. K. Gupta, Satesh Kumar, Desh Raj Choudhary and Sonam Spaldon	83	299.	CORRELATION AND PATH COEFFICIENT ANALYAIS IN BRINJAL (<i>SOLANUM MELONGENA</i> L.) Omkar Singh ¹ , B. Singh ² , Sanjay Kumar ² and Sheeshpal Singh	91
			300.	MULCHING EFFECTS TO CONTROL WEEDS IN ORGANIC POTATO CROP Dr. Varsha Gupta ¹ , Dr. Ekta Joshi ¹ and Dr. D.S. Sasode	91
			301.	SUITABILITY OF <i>CRAMBE ABYSSINICA</i> IN SUPPORTING OF GROWTH AND DEVELOPMENT OF MUSTARD APHID <i>LIPAPHIS ERYSIMI</i> (KALT.) Wajid Hasan ¹ and C.P. Singh	92

302.	IMPACT OF WEATHER ON TRAP CATCHES OF APHIDS INFESTING WHEAT ¹ Namita Poddar*, ² Subhash Chander and ³ Dinesh Kumar	92	329.	EVALUATION OF DIFFERENT VARIETIES OF ONION COMAPAERED WITH LOCAL VARIETY IN KHARIF SEASON Megha Vibhute ¹ , Dr Ajeet Singh ² , Amol Deshmukh ¹ , Rahul Satarkar ³ and Sandeep rathod	101
303.	DEVELOPMENT OF TRICHODERMA BASED NOVEL BIO-FORMULATIONS WITH INCREASED SHELF LIFE FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS Shubha Trivedi ¹ , Mukesh Srivastava ² , Ved Ratan ³ , Abhishek Mishra ⁴ , Supriya Dixit, ⁴ and Yatindra Srivastava	92	330.	INTEGRATED PEST MANAGEMENT AND INTEGRATED NUTRIENT MANAGEMENT IN HORTICULTURAL CROPS. Jyoti Singh ¹ , A.k.Dwivedi ² , Shreya Sinha	101
304.	AN ECOLOGICALLY BASED SUSTAINABLE IPM APPROACH AGAINST POD BORER <i>HELICOVERPA ARMIGERA</i> IN CHICKPEA Ajaykumara K. M. ¹ , Ruchira Tiwari ² and Rukesh Pramod K. N.	93	331.	INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT IN BRINJAL (<i>SOLANUM MELONGENA</i> L.) Bajpai, R., Patidar, P., Pyasi, R. and Gangele, P.	101
305.	MANAGEMENT OF PIGEONPEA WILT CAUSED BY <i>FUSARIUM UDUM</i> BUTLER THROUGH INTEGRATED APPROACHES Balkishan Chaudhary and Sanjeev Kumar	93	332.	PHYLOGENY OF <i>STEINERNEMA ABBASI</i> (RHABDITIDA: STEINERNEMATIDAE) AND ITS VIRULENCE AGAINST <i>GALLERIA MELLONELLA</i> Aashaq Hussain Bhat, Aasha and Ashok Kumar Chaubey	101
306.	SYNTHESIS OF POLICIES AMONG STAKEHOLDERS TO COMBAT ANTIMICROBIAL RESISTANCE IN LIVESTOCK ANIMALS: INDIAN PERSPECTIVE Vikash Kumar	94	333.	ISOLATION OF BACTERIAL ENDOPHYTES FROM MEDICINAL PLANT <i>ALOE VERA</i> HAVING ANTIMICROBIAL AND PGPR ACTIVITY Samiksha Joshi, Damini Maithani	102
307.	BORER'S MANAGEMENT THROUGH TRICHO-CARDS (<i>TRICHOGRAMMACHILONIS</i>) IN SUGARCANE CROP AT NICRA ADOPTED VILLAGE BAGHPAT VikasBaliyan, Sanjay kumar. S.P.Singh, Gajendra pal	94	334.	RESPONSE OF URDBEAN [<i>VIGNA MUNGO</i> (L.) HEPPEY] TO PHOSPHORUS FERTILIZATION AND THIOUREA ON YIELD, QUALITY, NUTRIENT CONTENT AND UPTAKE Sanju Choudhary ¹ , O.P. Sharma ² , Lali Jat ³ and pankaj kishanawat	102
308.	PLANT GRAFTING: INSIGHTS INTO TISSUE REGENERATION Rajaram Bunker ¹ , Munesh Kumar ³ , Ravindra kumar ² And Babita Kumari	94	335.	A STUDY ON STATISTICAL MODELS FOR PRE-HARVEST FORECASTING OF WHEAT YIELD BASED ON WEATHER VARIABLES IN DISTRICT BARABANK Sarvesh Kumar. K.K.Mourya. Ravi Prakash Gupta. Krishnakant, and Purshouttam	102
309.	NEW TRENDS AND STRATEGIES FOR DEVELOPING GREEN SUPER RICE Babita Kumar ¹ , Ravindra kumar ² , and Rajaram Bunker	95	336.	GUAVA SOFTWOOD GRAFTING: A NOVEL APPROACH FOR PLANT MULTIPLICATION Anjana Kholia ^{1*} , Kuntal Satkar ² and Nishant Kadge	103
310.	PLANT GRAFTING: A NEW FRONTIER APPROACHES IN FRUIT CROP IMPROVEMENT S. K. Meena ^{1*} Rajaram Bunker ¹ , Munesh Kumar ² and Ravindra kumar	95	337.	STUDIES ON POWDERY MILDEW OF RAPESEED-"MUSTARD (<i>BRASSICA JUNCSEA</i> L.) CAUSED BY <i>ERYSIPHECRUCIFERARUM</i> OPIZ. EX. JUNELL. AND ITS MANAGEMENT" Sonit Kumar, Rajendra Prasad, Satguru Parsad Yadav and Dushyant Kumar	103
312.	MICRO PROPAGATION: CHALLENGES AND OPPORTUNITIES IN HORTICULTURAL CROPS Omprakash, Rajaram Bunker and Ravindra kumar	95	338.	ENHANCING THE PRODUCTIVITY OF RICE AND SOIL HEALTH THROUGH NUTRIENT MANAGEMENT IN RICE-WHEAT CROPPING SYSTEM Shubham Kumar ¹ , Yogesh Kumar ¹ , Rohit Kumar ² and Adesh Singh	103
313.	NEW EMERGING MOLECULES OF INSECTICIDES AND THEIR ROLE IN IPM ALONG WITH ITS FUTURE CHALLENGES Deepak Kumar Jaiswal ^{1*} , Devu Rakshit Roshan ¹ , S. Ramesh babu ¹ Kamal Ravi Sharma ¹ and Prateek singh	96	339.	MICROBIAL EXOPOLYSACCHARIDES: APPLICATION FACETS IN PLANT GROWTH PROMOTION Tahmish Fatima and Naveen Kumar Arora	104
314.	CULTIVATION OF CAPEGOOSEBERRY (<i>PHYSALIS PERUVIANA</i> L.) UNDER SOUTH-EAST RAJASTHAN CONDITIONS Yogendra Kumar Sharma and Jitendra Singh	96	340.	VEGETABLE CROPS AS A NUTRACEUTICALS Ashutosh Kumar*, Shani Kumar Singh	104
315.	ZINC FERTILIZATION APPROACHES FOR AGRONOMIC BIO-FORTIFICATION AND FIND OUT HUMAN BIOAVAILABILITY OF ZINC IN MAIZE GRAIN Deepak Kumar, U P Shahi, Umashankar Singh Yadav	96	341.	EFFECT OF BIOREGULATORS ON GROWTH OF GREEN GRAM (<i>Vignaradiata</i> (L.) Wilczek.) V. S. Shinde ¹ , V. M. Devgun ² , D. B. Deosarkar ² S. S. Shinde	105
316.	DIFFERENTIAL EXPRESSION OF BLAST DISEASE AT YOUNG AND MATURITY STAGES IN RICE (<i>ORYZA SATIVA</i> L.) Varsha Gayatonde* ¹ and P. Mahadevu	97	342.	BALANCED USE OF NUTRIENTS FOR HIGH CROP YIELD AND QUALITY OF RICE (<i>ORYZA SATIVA</i> L.) IN CENTRAL ALLUVIAL SOIL OF UTTAR PRADESH Vivek Kumar Trivedi, M. R. Pandey and Gautam Veer Chauhan	105
317.	QUANTIFICATION OF PHYSIOLOGICAL TRAITS AND MECHANISMS IN PIGEONPEA [<i>CAJANUS CAJAN</i> (L.) MILLSP.] GENOTYPES AFTER RECOVERY FROM WATERLOGGING K. C. Meena ^{1*} , Ajay Haldar ¹ , D.K. Patidar ¹ , Nitin Soni ¹ and K.N. Nagaich	97	343.	WILT AND PYTHIUM DISEASE MANAGEMENT IN GREENHOUSE Nisha Jangre ¹ , Anjit Jangre ² , Pappu Lal Bairwa ¹ , Bhanupratap Jangde ¹ .	105
318.	STUDY ABOUTTHE KNOWLEDGE OF ICTSAMONG THE FARMERS OF SOUTHERN RAJASTHAN Jeevan Ram Jat*, N. K. Punjabi, Ranjeet Singh,H. L. Bugaliaand B. S. Bhati	97	344.	A REVIEW ON ECOLOGICAL IMPORTANCE OF INTEGRATED WEED MANAGEMENT YaminiRaut	105
319.	TOPIC: MANAGEMENT PRACTICES FOR ROOT - KNOT NEMATODE (<i>MELOIDOGYNE GRAMINICOLA</i>) IN RICE CROP. Dushyant Kumar, Kamal Khilari, Sachin Kumar Jain and Sonit Kumar	97	345.	EDIBLE OIL AND ITS EFFECT ON HUMAN HEALTH Ratnesh Kumar*, Suresh Chandra, Samsher, Rahul Kumar and Balwant Singh	106
320.	IMPACT OF BIOFERTILIZER AND BIOAGENTS ON LATE BLIGHT OF POTATO Morajdhwaj Singh*, S.K. Biswas and Devesh Nagar	98	346.	A REVIEW:-STUDIES ONBRYOPHYLLUM PINNATUMLEAVES POWDER AND ITS FORTIFICATION IN SNACK PRODUCT *Pawar S.R. & **Dabhade S.B.	106
321.	EVALUATION OF TOMATO (<i>SOLANUM LYCOPERSICON</i> L.) HYBRIDS FOR FRUIT YIELD AND ITS CONTRIBUTING CHARACTERS IN HILL REGION OF UTTARAKHAND Shivani Dhyani ¹ , A.C. Misra ¹ and Leela Bhatt	98	347.	EFFECT OF PLANTING METHODS, ORGANIC NUTRIENT SOURCES AND BIO-FERTILIZERS ON PHYSIOLOGICAL CHARACTERS AND ECONOMICS OF <i>KHARIF</i> ONION (<i>ALLIUM CEPA</i> L.) Jitendra Singh Gurjar ¹ , Kamlesh Ahirwar ² , P.K.S. Gurjar ³ and Lal Singh	106
322.	ENHANCING VASE LIFE OF GLADIOLUS VAR. PETER PEARS THROUGH EXOGENOUS APPLICATION OF CARBOHYDRATE SOLUTION Zahoor Ahmed, R A Lone and N A Ganai	98	348.	EFFECTS OF SUB-LETHAL CONCENTRATIONS OF <i>ASPERGILLUS NIGER</i> ON THE MORTALITY AND IMMUNOLOGICAL CHARACTERISTICS OF <i>DYSDERCUS KOENIGII</i> (HETEROPTERA : PYRRHOCORIDAE) Soni Kumari and Dinesh Kumar	107
323.	EVALUATION OF POST HARVEST TECHNIQUES FOR MANAGEMENT OF GLADIOLUS CORMS Zahoor Ahmed, N A Ganai and R A Lone	99	349.	EFFICACY OF <i>TRICHODERMA HARZIANUM</i> CA-07 IN COMBINATION OF <i>PSEUDOMONAS FLUORESCENS</i> AND FUNGICIDE AGAINST ANTHRACNOSE OF CHILLI Abhishek Mishra, Ved Ratan, Supriya Dixit, Shubha Trivedi, Saurav Govind Rao and Gautam Veer Chauhan	107
324.	INTEGRATED NUTRIENT MANAGEMENT IN <i>KHARIF</i> SORGHUM (<i>Sorghum bicolor</i> L.) Lalita verma ^{1*} ,S.C.Sallawar ¹ and Maya yadav	99	350.	EFFECT OF ORGANIC MANURE AND BIO-FERTILIZER ON GROWTH, YIELD AND QUALITY OF TOMATO (<i>SOLANUM LYCOPERSICUM</i> L.) UNDER PROTECTED CONDITION Prof. (Dr.) V. M. Prasad ¹ Gaurav Pratap Singh	107
325.	BIOSURFACTANTS PRODUCED BY RHIZOSPHERIC MICROBES AND THEIR ROLE IN PLANT GROWTH PROMOTION Isha Mishra and Naveen Kumar Arora	99	351.	EFFECT OF MALATHION ONESTERASE AND STRESS ENZYMES (SOD AND CATALASE)ACTIVITYIN A FRUIT FLY, <i>BACTROCERA CUCURBITAE</i> Deepak Verma and Dinesh Kumar	108
326.	MANAGING DISEASES IN THE GREENHOUSE Jaskaran Singh, Kamal Khilari, Ravindra Singh and Abhishek Kumar	100	352.	BIO-INSECTICIDAL PROPERTIES OF <i>HETERORHABDITIS INDICA</i> (DH ₁₆) AGAINST LEPIDOPTERON INSECT PESTS Aasha*, Aashaq Hussain Bhat and A. K. Chaubey	108
327.	EFFECT OF FOLIAR SPRAY OF UREA AND ZINC SULPHATE ON GROWTH AND YIELD OF GUAVA (<i>PSIDIIUM GUAJAVA</i> L.) CV. LUCKNOW- 49" Solanki, K., Barholia, A. K., Jatav, R. And Vasure, N.	100	353.	EFFECT OF TILLAGE AND NUTRIENT LEVELS ON GROWTH AND YIELD OF SOYBEAN BASED CROPPING SEQUENCE S.K.Nayak, W.N.Narkhede, D.N.Gokhale and U.N.Alse	108
328.	EFFECT OF NITROGEN MANAGEMENT UNDER DIFFERENT LAND CONFIGURATION AND MOISTURE REGIMES ON HERB AND OIL YIELD OF MENTHA (<i>MENTHA ARVENSIS</i> .) Kairovin Lakra ¹ ,Sanjeev Singh	100			

354. EFFECT OF VARIOUS PLANT SPACING AND NUTRIENT LEVEL ON GROWTH AND YIELD OF *KHARIF* SOYBEAN [*GLYCINE MAX* (L.) MERRILL]”
M.W.Rathod, A.K.Gore and S.K.Nayak 108
355. EFFECT OF PLANT SPACING ON DIFFERENT GENOTYPE OF PIGEON PEA (*Cajanus cajan* (L.) Millisp) 109
356. INFLUENCE OF NITROGEN, PHOSPHORUS AND ZINC ON GROWTH, YIELD ATTRIBUTES, YIELD AND NUTRIENT UPTAKE BY MAIZE CROP (*ZEAMAYS* L.)
W.N. Narkhede, S.K.Nayak and D.D.Dahe 109
357. EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD, ECONOMICS AND NUTRIENT UPTAKE OF WHEAT
W.N.Narkhede, S.K.Nayak and A.M.Mule. 109
358. EFFECT OF MICRONUTRIENTS ON YIELD, QUALITY AND STORAGE OF ONION (*ALLIUM CEPA* L.) IN NORTH BIHAR
Yadav, L. M., Prasad, S. S., Kumar, Jitendra and Singh, Yamuna Prasad 109
359. SIGNIFICANCE OF CARBOHYDRATES FOR THE DEVELOPMENT OF BISCUITS
Amit Kumar^{*1}, S. K. Goyal², Vishal Kumar³ and Munesh 110
360. RESPONSE OF GCA AND SCA ON GROWTH, YIELD AND ITS CONTRIBUTING TRAITS IN SPONGE GOURD [*LUFFA CYLINDRICA* (ROEM) L.]
Yamuna Prasad Singh^{*}, V.B. Singh and Pramila 110
361. EFFECT OF DIFFERENT PHYTOEXTRACTS AGAINST BLAST OF RICE CAUSED BY *PYRICULARIAORYZAE*
Manish Kumar and Shabbir Ashraf 110
362. CULTURAL AND MORPHOLOGICAL VARIATIONS AMONG THE ISOLATES OF *SCLEROTINIA SCLEROTIIORUM* (LIB.) DE BARY CAUSING STEM ROT OF MUSTARD IN INDIA
Asma Naz and R. U. Khan 111
363. EFFECT OF SODIUM NITROPRUSSIDE (SNP) ON MORPHO – PHYSIOLOGICAL AND BIOCHEMICAL CHANGES IN DIFFERENT CROP PLANT INDUCED BY DIFFERENT ABIOTIC STRESS
Saurabh Kumar Singh, Shashank Gupta, 111
364. CORRELATION AND PATH COEFFICIENT ANALYSIS IN BRINJAL (*SOLANUM MELONGENA* L.)
Omkar Singh¹, B. Singh², Sanjay Kumar² and Sheespal Singh 111
365. BIOFUEL (ETHANOL) FROM SUGARCANE- NEED OF THE FUTURE FOR SUSTAINING CANE PRODUCTIVITY
Dr. Ram Ji Lal, 112
366. MALE MEIOTIC STUDIES IN SOME MEMBERS OF GENUS *LACTUCA* FROM THE COLD DESERTS OF LADAKH DIVISION OF JAMMU AND KASHMIR.
Younas Rasheed^{*}, Vijay Kumar Singhal and Raghbir Chand Gupta 112
367. EFFECT OF DIFFERENT PRUNING INTENSITIES ON WOOD PRODUCTION AND YIELD OF LATE SOWN WHEAT VARIETIES UNDER DALBARGIA SISSOO BASED AGRISILVICULTURE SYSTEM
Rahul Dongre and M. L. Sahu 113
368. EFFECT OF DIFFERENT DOSES OF FERTILIZERS AND CROP GEOMETRY ON NUTRIENT UPTAKE OF INDIAN MUSTARD (*BRASSICA JUNCIA* L.)
Naveen Rathi, Bikram Singh, Harender and Pankaj Kumar Sharma 113
369. ATTITUDE OF FARMERS TOWARDS MAIZE FARMING
Nandita Kumari (subject matter specialist, Home Science) 113
370. DEVELOPMENT OF TRICHODERMA BASED NOVEL BIO-FORMULATIONS WITH INCREASED SHELF LIFE FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS
Shubha Trivedi^{1*}, Mukesh Srivastava², Ved Ratan³, Abhishek Mishra⁴, Supriya Dixit⁴ and Yatindra Srivastava 114
371. STUDIES ON CANOPY MANAGEMENT PRACTICES ON NPK STATUS OF LEAVES IN HIGH DENSITY PLANTING OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR
Shashank Singh^{*}, Devi Singh^{*} And Vijay H.M^{*}. 114
372. STUDIES ON THE EFFECT OF GROWTH REGULATORS ON *IN-VITRO* CLONING OF *CARICA PAPAYA* L. THROUGH SHOOT TIP AND INFLORESCENCE
Mr. Anuj Pal 115
373. EFFECTS OF SUB-LETHAL CONCENTRATIONS OF *ASPERGILLUS NIGER* ON THE MORTALITY AND IMMUNOLOGICAL CHARACTERISTICS OF *DYSDERCUS KOENIGII* (HETEROPTERA : PYRRHOCORIDAE)
Soni Kumari and Dinesh Kumar 115
374. ROLE OF BOTANICAL INSECTICIDES IN IPM
M. Sreedhar and Megha G 115
375. BIOLOGICAL CONTROL OF LEAF SPOT DISEASE OF GROUNDNUT
Dibya Singh^{*}, Krishna Kumar and Ravi Prakash Gupta 116
376. DEEP FAT FRYING
Ankur Mahendra Arya^{*}, Suresh Chandra, Samsheer, Jaivir Singh, Neelesh Chauhan & Tarun Kumar 116
377. EFFECT OF SUBSTRATES ON *TRICHODERMA VIRIDE* CONIDIA PRODUCTION ON DIFFERENT GRAINS UNDER SOLID STATE FERMENTATION CONDITION
Mahesh Kumar, Reeta Devi^{*}, Sushil Kumar Singh^{**} and Pradip Kumar Sharma 116
378. ECONOMICS ANALYSIS OF RED WAL (*DOLICHUS SPP.*) IN RAIGAD DISTRICT OF MAHARASHTRA
P.D. Salukhe, D.B. Malave, S.C. Phuge^{*}, V. N. Anap and J.M. Yadav 117
379. EFFECT OF SOWING TIMES ON YIELD AND ECONOMICS OF DIFFERENT RICE GENOTYPES UNDER KONKAN CLIMATIC CONDITION OF MAHARASHTRA
P.D. Chendge^{*}, S.A. Chavan, Ashwini Patil and Shalu Kumar 117
380. EFFECT OF SUPPLEMENTATION OF ASHWAGANDHA (*WITHANIA SOMNIFERA*) AND SELENIUM ON GROWTH, MEAT QUALITY AND HAEMATO-IMMUNOLOGICAL RESPONSES OF BROILER CHICKENS
V.P.Singh¹, D.S.Sahu^{1*}, Shalu Kumar², Harendra Singh Chauhan¹, P.D. Chendge³ and B.G. Desai² 117
381. ENHANCING VASE LIFE OF GLADIOLUS VAR. PETER PEARS THROUGH EXOGENOUS APPLICATION OF CARBOHYDRATE SOLUTION
Zahoor Ahmed, R A Lone and N A Ganai 117
382. EVALUATION OF POST HARVEST TECHNIQUES FOR MANAGEMENT OF GLADIOLUS CORMS
Zahoor Ahmed, N A Ganai and R A Lone 118
383. GROWTH AND FLOWERING OF *JASMINUM SAMBAC* (L.) AS INFLUENCED BY TIME AND DIFFERENT LEVELS OF PRUNING
Sushma Lokhande, Neha Chopde, Ashvini Gaidhani and Disha Patil 118
384. IMPORTANCE OF STRAWBERRY CULTIVATION IN TARAI REGIONS OF UTTAR PRADESH AND UTTARAKHAND
Jagraj Singh and Shardulya Shukla 118
385. INVESTIGATION OF DIFFERENT LEVELS OF AZOLLA (*AZOLLA PINNATA*) ON PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKS
P.N. Shinde¹, N.N. Prasade¹, Shalu Kumar^{1*}, B.G. Desai¹, J.S. Dhekele² and R.G. Burte 119
386. STUDIES ON VALUE ADDITION OF PINEAPPLE CHEESE
Kinker Singh¹ and Saket Mishra 119
387. EFFECT OF ORGANIC TREATMENTS ON GROWTH AND YIELD OF FENUGREEK
Krishna Kumar^{*1}, Sandeep Kumar², Sarvesh Kumar³, Vinay Kumar⁴ and Ravi Prakash Gupta 119
388. MODIFIED ATMOSPHERE PACKAGING OF FRESH PRODUCE
Ankur Mahendra Arya^{*}, Sweta Singh, B.R. Singh & Tarun Kumar 120
389. TO STUDY OF THE MIXED FRUIT JUICE RTS BEVERAGE AND STORAGE STUDY AT ROOM TEMPERATURE STORAGE CONDITIONS
Munesh^{*1}, S. K. Goyal², Amit Kumar¹ and Vishal Kumar 120
390. DEHYDRATION OF MORINGA OLEIFERA LEAVES BY USING DIFFERENT METHOD & ITS UTILIZATION IN PARATHA
Shinde S.M. * and Babar K.P. 120
391. PHYLOGENY OF *STEINERNEMA ABBASI* (RHABDITIDA: STEINERNEMATIDAE) AND ITS VIRULENCE AGAINST *GALLERIA MELLONELLA*
Aashaq Hussain Bhat^{*}, Aasha and Ashok Kumar Chaubey 120
392. RESPONSE OF ZERO TILLAGE WITH RESIDUE MULCH ON YIELD AND ECONOMICS OF *KHARIF* MAIZE
Rajbir Singh Khedwal^{*}, Dharam Bir Yadav, V.S. Hooda, Seema Dahiya and Mohinder Singh 121
393. PROFITABILITY AND PRODUCTIVITY OF FENUGREEK (*TRIGONELLA FOENUM-GRACUM* L.) INTERCROPPING WITH FENNEL (*FOENICULUM VULGARE MILL.*) UNDER VARYING LEVELS OF ZINC
Santosh Kanwar, A.C. Shivran, H.P. Verma, B.L. Dudwal and Krishna Kanwar 121
394. RESPONSE OF SULPHUR AND ZINC ON YIELD, NUTRIENTS CONTENT AND QUALITY OF RICE (*ORYZA SATIVA* L.)
*Sateesh Kumar, D.D. Tiwari, Ripudaman Singh, ** Hemant Kumar** Ruchi Yadav*** and Dharmendra Kumar 121
395. EFFECT OF SULPHUR, ZINC AND INSECTICIDES ON YIELD AND UPTAKE OF NUTRIENTS IN RICE (*ORYZA SATIVA* L.)
*Sateesh Kumar, D.D. Tiwari, Ripudaman Singh, ** Hemant Kumar** Ruchi Yadav*** and Dharmendra Kumar 122
396. SUPERIMPOSITION OF ORGANIC SOURCES OF MANURES TO ENHANCE GROWTH, YIELD ATTRIBUTES AND YIELD OF SCENTED RICE (*ORYZA SATIVA* L.) AND ITS IMPACT ON SOIL HEALTH
M. Saquib, Ripudaman Singh, Hemant Kumar, Ruchi Yadav, M. P. Yadav and Naushad Khan 122
397. SUPERIMPOSITION OF ORGANIC SOURCES OF MANURES TO ENHANCE YIELD AND QUALITY PARAMETERS OF SCENTED RICE (*ORYZA SATIVA* L.) IN INDO-GANGETIC PLAIN ZONE
M. Saquib, Ripudaman Singh, Hemant Kumar, Ruchi Yadav, M. P. Yadav, and Naushad Khan 122
398. AGROBACTERIUM-MEDIATED TRANSFORMATION AND IN VITRO REGENERATION OF RICE (*ORYZA SATIVA*) PLANTS
Shilpy Singh, Pushpendra Kumar, Vivek Rana and Aastha 123
399. NITROGEN RELEASE PATTERN AND USE EFFICIENCY OF NEEM COATED UREA UNDER DIFFERENT APPLICATION SCHEDULE IN RICE (*ORYZA SATIVA* L.)
Shriman Kumar Patel, Yogesh Kumar, Atin Kumar 123
400. STUDY OF SOCIO-PERSONAL, ECONOMIC CHARACTERISTICS, KNOWLEDGE LEVEL AND CONSTRAINTS FACED BY VEGETABLE GROWERS IN MAU DISTRICT OF UTTAR PRADESH, INDIA
Ramvinay Pal^{1*}, D.K. Singh², Ankit Singh Yadav², Angad Prasad³, Shalu Kumar⁴, P.D. Chendge⁴ and B.G. Desai 123
401. PROBLEM AND STRATEGIES OF SUMMER VEGETABLE CULTIVATION IN INDIA
S. V. Bhavar^{*}, A. P. Wagh and S. G. Thakare 124

402.	NOODLES PROCESSING AND ITS NUTRITIONAL PROPERTIES Sunil*, Neelash Chauhan, Samsheer, Jaivir Singh, Suresh Chandra, R.S. Sengar	124	427.	DEVELOPMENT OF TRANSGENIC CHICKPEA (<i>CICER ARIETINUM</i> L.) PLANTS WITH <i>OSRUVB</i> GENE FOR SALT STRESS TOLERANCE Preeti and Pushpa Kharb	131
403.	UTILIZATION OF DISTILLERY EFFLUENT FOR AGRICULTURAL PURPOSE OF MUNGBEAN (<i>VIGNA RADIATA</i> CV TYPE-44) Neeraj Pal Malik and Naresh Kumar	124	428.	RESPONSE OF ZERO TILLAGE WITH RESIDUE MULCH ON YIELD AND ECONOMICS OF <i>KHARIF</i> MAIZE Rajbir Singh Khedwal, Dharam Bir Yadav, V.S. Hooda, Seema Dahiya and Mohinder Singh	131
404.	UTILIZATION OF GINGER (<i>ZINGIBER OFFICINALE</i> L.) JUICE IN THE MANUFACTURE OFFLAVOURED MILK Balasaheb M. Waghmode., Poonam Naik* and V. S. Dandekar	125	429.	INFOCHEMICALS INVOLVED IN PEST MANAGEMENT: A REVIEW Aijaz Ahmad Sheikh, Iram Khurshed, M. Jamal Ahmad	132
405.	"BALANCED USE OF NUTRIENTS FOR HIGH CROP YIELD AND QUALITY OF RICE (<i>ORYZA SATIVA</i> L.) IN CENTRAL ALLUVIAL SOIL OF UTTAR PRADESH" Vivek Kumar Trivedi, M. R. Pandey and Gautam Veer Chauhan	125	430.	APPLICATION OF BIOENERGY FOR ENERGY OR MATERIALS: FUTURE PERSPECTIVE THROUGH ENERGY EFFICIENCY Abdeen Mustafa Omer	132
406.	EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON PERFORMANCE OF DIRECT SEEDED RICE AND SOIL HEALTH IN RICE - WHEAT ROTATION Robin kumar, Vivak kumar and Ashish Driwedi	125	431.	AGRICULTURAL RESIDUES FOR FUTURE ENERGY OPTION IN SUDAN: AN ANALYSIS Abdeen Mustafa Omer	132
407.	EFFECT OF LEAF EXTRACTS ON GROWTH OF <i>MYROTHECIUM RORIDUM</i> <i>CAUSES LEAF SPOT OF COTTON</i> . S.K.Arsia and Mukesh Dongre	126	432.	ROLE OF AGRICULTURE IN ENVIRONMENTAL DISTRESS C.K. Dotaniya, R.K. Bairwa, S.K. Pipliwal, R.K. Dautaniya,	132
408.	EFFECT OF DIFFERENT SPACING ON SNAPDRAGON (<i>ANTIRRHINUM</i> <i>MAJUS</i> L.) CV. AFRICAN MIX Ram Lakhan Maurya, Ashok Kumar, Vivak Ujjwal and Manoj Kumar	126	433.	SOIL WATER CONSERVATION FOR SUSTAINABLE DRY LAND AGRICULTURE Om Prakash and Jitendra Kumar	133
409.	IN VITRO EFFICACY OF DIFFERENT BIO AGENT AND PLANT EXTRACT MANAGEMENT OF WILT CAUSING PATHOGENS OF CHICKPEA DISEASE Satish Chand, Kamal Khilari, Sachin Kumar Jain, Mukesh, and Abhishek Kumar	126	434.	LAND-USE PRACTICES AFFECT THE METHANOTROPHIC POPULATION DENSITY IN DRY TROPICAL REGION Shashank Tiwari, Chhatrapal Singh and Jay Shankar Singh	133
410.	TECHNO-ECONOMIC EVALUATION OF DIFFERENT SEEDING TECHNIQUES FOR WHEAT CROP IN RICE-WHEAT CROPPING SYSTEM Vivak Kumar ¹ , Jaivir Singh ² and Robin Kumar	126	435.	METHANOTROPHS: AN EMERGING AND ECO-FRIENDLY TOOL IN BIOREMEDIATION OF ORGANOCHLORINE PESTICIDES Siddharth Boudh and Jay Shankar Singh	133
411.	MANAGEMENT OF RICE ROOT KNOT THROUGH PLANT EXTRACTS Mukesh, sunil kumar arsia, satish chand, sachin kumar jain	127	436.	ENVIRONMENTAL WASTEWATER POLLUTION TREATMENT THROUGH MICROBIAL AND NANO-REMEDICATION Sumit Kaushal and Jay Shankar Singh	134
412.	STUDIES ON SELECTION PARAMETERS FOR YIELD IMPROVEMENT IN TUBEROSE (<i>POLIANTHUS TUBEROSA</i> LINN.) Mohit Chaudhary, Sunil Malik, Vivak Ujjwal, Manoj Kumar Singh and Ashish Kumar,	127	437.	CONSERVATION OF NATURAL RESOURCES FOR SUSTAINABLE DEVELOPMENT Binod Kumar	134
413.	ROLE OF CLUSTER FRONT LINE DEMONSTRATION ON TRANSFER OF KULTHI (HORSE GRAM) PRODUCTION TECHNOLOGIES IN KOREA DISTRICT OF CHHATTISGARH Sandeep Sharma and R.S.Rajpoot	127	438.	RESILIENCE THINKING: SUSTAINING INDIAN AGRICULTURE IN A CHANGING CLIMATE Sachin Shinde, Minakshi Neware, Priya Pardeshi, Swapnil Tayade and Nandan Tayade	134
414.	BIOTOXIC IMPACT OF HEAVY METALS ON GROWTH, OXIDATIVE STRESS AND MORPHOLOGICAL CHANGES IN ROOT STRUCTURE OF WHEAT (<i>TRITICUM AESTIVUM</i> L.) AND STRESS ALLEVIATION BY <i>PSEUDOMONAS AERUGINOSA</i> STRAIN CPSB1 Asfa Rizvi, Mohd. Saghir Khan	127	439.	NO-TILL AGRICULTURE: GOOD FOR THE SOIL CONSERVATION Suneeta Pant	135
415.	RESPONSE OF NITROGEN, PHOSPHORUS AND POTASSIUM ON GROWTH, FLOWERING AND BULB YIELD OF TUBEROSE (<i>POLIANTHUS</i> <i>TUBEROSA</i> L.) CULTIVAR SINGLE Virendra Pal*, Naveen Chandra*, Anant Kumar* Ashish Tyagi** and Omvir Singh	128	440.	CLIMATE CHANGE EXACERBATE GLOBAL WARMING Suneeta Pant	135
416.	EFFECT OF CHEMICALS ON POSTHARVEST LIFE AND QUALITY OF CUT ROSES (<i>ROSA HYBRID</i> L.) CULTIVAR FIRST RED Naveen Chandra*, Vikas Waliya*, Virendra Pal ² , Anant Kumar ³ and Sunil Malik	128	441.	ROLE OF CONSERVATION OF AGRICULTURE IN SUSTAINABLE DEVELOPMENT Rashmi Nigam*, Joginder Singh and A.K. Sharma	135
417.	RESPONSE OF PRUNING IN CANOPY MANAGEMENT & HIGH DENSITY PLANTING IN GUAVA ORCHARD UNDER WESTERN UTTAR PRADESH CONDITION. Virendra Pal*, Naveen Chandra*, Anant Kumar** and Mukesh Kumar	128	442.	MITIGATION OPTIONS OF CO ₂ EMISSION IN INDIA Asheesh Chaurasiya, Durgesh singh, Ashutosh Kumar* and Abha Kumari	135
418.	MANAGEMENT OF CERCOSPORE LEAF SPOT OF GREENGRAM BY USING DIFFERENT FUNGICIDES Praveen, B*, Adinarayana, M.** , I. Venkatesh	129	443.	FOREST ECOSYSTEM - MORE THAN JUST TREES Vishnu, K. Solanki	136
419.	SCREENING OF DIFFERENT GREENGRAM GENOTYPES AGAINST CERCOSPORE LEAF SPOT DISEASE Praveen, B*, Adinarayana, M** and I. Venkatesh	129	444.	RHIZOSPHERE BIOREMEDIATION - A TECHNOLOGY FOR HEAVY METALS REMOVAL FROM ELECTRONIC WASTE CONTAMINATED SOIL Pankaj Kumar	136
420.	EFFECT OF PLANT HEIGHT UNDER PROTECTED CULTIVATION: ADAPTATION TO CLIMATE CHANGE Ansul*, V.K. Batra* and Davinder Singh	129	445.	PAN-EVAPORATION ESTIMATION IN TARAI REGION OF UTTARAKHAND, INDIA Anurag Malik, Anil Kumar and Ram Kumar	136
421.	TOMATO CROP PRODUCTION UNDER PROTECTED CULTIVATION: ADAPTATION TO CLIMATE CHANGE Ansul*, V.K. Batra*, Parveen Kumar** and Davinder Singh	130	446.	THE SCENARIO OF CLIMATIC CHANGES AND ITS ADVERSE IPACT ON AGRICULTURE OF THE NORTH BIHAR Sumarkant Kumar Bharati	137
422.	RELATIVE PERFORMANCE OF SUGARCANE VARIETIES UNDER ALKALINE SOIL CONDITION IN EASTERN UTTAR PRADESH Pal K., Singh K.K., Singh I.S. and Sharma B.L.	130	447.	IMPACT OF AIR POLLUTION ON HUMAN HEALTH Suresh Kumar	137
423.	AGRONOMIC FORTIFICATION FOR QUALITY PRODUCE IN RELATION TO NUTRITIONAL SECURITY Devendra Dambiwal, Kaluram Kumawat and Todar Mal	130	448.	GLOBAL WARMING IMPACT ON THE EARTH Kalpana Singh and Hariom Katiyar	137
424.	SUITABILITY OF CUT CORMS AS PLANTING MATERIAL ON GROWTH AND YIELD IN DIFFERENT GLADIOLUS (<i>GLADIOLUS GRANDIFLORUS</i> L.) VARIETIES Swapnil Bharti, Urfi Fatmi, Upesh Chandrakar and V.Priyadarshini	130	449.	RAINFALL RUNOFF MODELLING USING RRL AWBM MODEL IN SHIPRA RIVER BASIN Ayushi Trivedi, S. K Pyasi and Ravi Galkate	138
425.	VARIABILITY STUDIES FOR FODDER YIELD AND ITS RELATED TRAITS IN FORAGE SORGHUM Ashok Kumar Dehinwal* and S. K. Pahuja	131	450.	CLIMATE CHANGE: A VITAL ROLE IN SPREADING DISEASES Priyanka Swami, Ramniwas, M. L.Khichar, Praveen Kumar*, Anupam Maharshi	138
426.	ANTHROPOMETRIC MEASUREMENT OF RURAL SCHOOL CHILDREN AGED 6-12 YEARS Ruchi Pandey*, Rajesh Singh**, Sadhna Singh*, Dipti Giri	131	451.	EXTENT OF GLOBAL WARMING AND ITS PREVENTION Indu Singh	138
			452.	A PRECISION FARMING TOOL FOR SMALL HOLDER CONSERVATION IN AGRICULTURE Devesh Kumar, Ashok Tripathi*, Uday Veer Singh, Manish kumar, Surendra Pal	139
			453.	CLIMATE CHANGE AND GLOBAL WARMING Beer Bhadra Yadav	139
			454.	CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE Chongtham Allaylay Devi, Brij B. Pandey* and Pappu Lal Meena	139
			455.	ENVIRONMENTAL CONSERVATION & PROTECTION OF NATURAL RESOURCES Amit Singh	139
			456.	UNDERSTANDING POTENTIAL OF LEAF LITTER IN REJUVENATION OF DEGRADED LANDS IN TROPICS Apurva Rai, Nandita Ghosal*, Nandita Singh	140
			457.	CLIMATE CHANGE VS VEGETABLES Vinod Kumar and S.K.Tehlan	140

458.	ASSESSMENT OF PRODUCTION TECHNOLOGY OF VEGETABLE CROPS UNDER CHANGING CLIMATE WITH REFERENCE TO ABIOTIC STRESSES Davinder Singh* and Rajkumar	140	486.	Rakesh Kumar Meena, Sanjay Kumar, Ram Vilas and Rajesh Kumar Meena EFFECT OF LONG-TERM FERTILIZER TREATMENTS ON SOIL P ^{HI} , ELECTRICAL CONDUCTIVITY ORGANIC CARBON AND PRODUCTIVITY OF RICE-WHEAT SYSTEM	149
459.	SOIL AND WATER CONSERVATION: OUR HISTORY AND FUTURE CHALLENGES Jeetendra Kumar	141	487.	S.K. Tripathi RICE STRAW DEGRADING MICRO-BIOMES WHO HELP IN SOIL FERTILITY AND ENVIRONMENT PROTECTION	149
460.	CLIMATE CHANGE AND FOOD SECURITY Pappu Lal Bairwa, Brij B. Pandey* and Mukesh Kumar Bairwa	141	488.	Shravan Kumar*, Asha Singh*, Mithaleshwari*, Shweta Meshram** and Shrishti Lingwal	149
461.	RESOURCE MANAGEMENT IN VEGETABLE CULTIVATION UNDER POLYHOUSES Parveen Kumar, Nitin Tanwar*, Ramesh Tripathi** and Ansul	141	489.	Shivam Chinyoti and S.Sharma BIOAMELIORATION OF THE MODERN FARMING SYSTEM THROUGH UNDERWATER FARMING	150
462.	IMPACT OF CLIMATE CHANGE ON RURAL DEVELOPMENT OF INDIA Sanjeev Kumar Morya	141	490.	Shivam Chinyoti and S.Sharma STUDY OF SOLUTE-SOLVENT INTERACTION OF O-BENZO QUINONE WITH AQUEOUS SOLVENT (T.H.F)	150
463.	ENVIRONMENTAL POLLUTION: IT'S EFFECT ON HUMAN BEING AND ITS REMEDIES Shikha Yadav	142	491.	Santosh Kumar THE EFFECT OF AIR POLLUTANTS ON HUMAN HEALTH AND THEIR MECHANISMS OF CELLULAR ACTION	150
464.	SPATIAL DISTRIBUTION OF BASIC EXCHANGEABLE CATIONS UNDER DIFFERENT LAND USES IN SOILS OF HAMELMALO, ERITREA Million Weldetensae, Huma Naz*, Shah Nawaz and Balwan Singh	142	492.	Dinesh Kumar Sharma IMPORTANCE OF SOIL AND WATER CONSERVATION Arjun Singh Rajput*, Rajneesh** and Shubham Mishra	151
465.	NEED OF SOIL AND WATER CONSERVATION Vivek Singh, Brij B. Pandey* and Pappu Lal Meena	142	493.	Arjun Singh Rajput*, Rajneesh** and Shubham Mishra CLIMATE CHANGE: MITIGATION AND ADAPTATION IN AGRICULTURE Sumitra Devi Bamboriya*, Shanti Devi Bamboriya**, Jitendra Singh Bamboriya***, Keshar Mal Choudhary	151
466.	SYSTEM OF RICE (<i>ORYZA SATIVA</i> L.) INTENSIFICATION FOR BETTER PRODUCTIVITY AND RESOURCE MANAGEMENT – A CRITICAL REVIEW Shiv Prasad Vishwakarma	143	494.	Radhe Shyam Kherwa*, Amit Kumar* and Bhag Chand Shivan EFFECT OF IRRIGATION METHODS, MOISTURE REGIMES AND NITROGEN MANAGEMENT IN POTATO (<i>SOLANUM TUBEROSUM</i> L.)	151
467.	RESPONSE OF WHEAT [<i>TRITICUM AESTIVUM</i> (L.) EMEND. FIORI & PAOL] VARIETIES TO ANTITRANSPIRANTS AND FERTILITY LEVELS balwan, I. r. yadav, H. P. Verma, S. S. Yadav, Arjun Lal Yadav, Dinesh Panwar and Saroj Kumari Yadav	143	495.	Sanjeev Singh*, Kairovin Lakra**, Awadhesh K. Singh EFFECTS OF CLIMATE CHANGE AND GLOBAL WARMING IN INDIA Shubham Mishra*, Rajneesh**, Arjun Singh Rajput** and Ritu Rathore	152
468.	EFFECT OF DRIP IRRIGATION AND MULCHING ON WATER PRODUCTIVITY, WATER USE EFFICIENCY AND BENEFIT COST RATIO OF MANGO CV. PANT SINDURI Rashmi Upreti, V. P. Singh and C. P. Singh	143	496.	Shubham Mishra*, Rajneesh**, Arjun Singh Rajput** and Ritu Rathore FLOATING RAFT- A INNOVATIVE PHYTOREMEDIATION METHOD FOR WASTEWATER RECYCLING	152
469.	CONTINGENCY PLANNING: DEVELOPING ROAD MAP TO TACKLE IMPACTS OF CLIMATE CHANGE Kaluram Kumawat, Devendra Dambiwal and Todermal Punia	144	497.	Praveen Solanki ¹ *, Maitreyi Narayan ¹ and R. K. Srivastava SOIL PROPERTIES IN RELATION TO RESOURCE CONSERVATION TECHNOLOGIES	152
470.	CLIMATE CHANGE: IMPACT AND MITIGATION ON TEMPERATE FRUIT CROPS Mohammed Tauseef Ali, Amit Kumar and Rafiya Mushtaq	144	498.	D. C. Kala RECENTLY EMERGED TECHNOLOGY: CONSTRUCTED WETLAND COUPLED WITH MICROBIAL FUEL CELLS FOR WASTEWATER TREATMENT AND ENERGY PRODUCTION	153
471.	SKUAST-KASHMIR DEMONSTRATES TECHNOLOGY FOR HIGH DENSITY APPLE ORCHARDING IN KASHMIR VALLEY Rafiya Mushtaq, Ashaq Pandit, Mohammed Tauseef Ali, Amit Kumar and M.K. Sharma	144	499.	Maitreyi Narayan ¹ *, Hina Khatoun ² , Amit Kumar Rabha ³ , Pushpa Yadav ⁴ and R.K. Srivastava SOIL BIOLOGICAL PARAMETERS AND THEIR MANAGEMENT FOR SOIL HEALTH AND CROP PRODUCTION. A REVIEW	153
472.	EFFECT OF CLIMATE CHANGE AND GLOBAL WARMING ON TEMPERATE HORTICULTURE Mehrnigar Hamid, Angrez Ali*, Sumaya Mumtaz, Shabnam Ahad and Shahida Ashraf	145	500.	Pushpa Yadav ¹ * and Maitreyi Narayan CHALLENGES OF LAND DEGRADATION AND STRATEGIES OF THEIR MANAGEMENT	154
473.	RAINFALL- RUNOFF MODELLING AND GROUND WATER FLUCTUATION OF GONDA DISTRICT UTTAR PRADESH Dinesh Kumar Vishwakarma and Rohitashw Kumar	145	501.	Shiv Singh Meena and Vineet Kumar AVAILABILITY OF SOME MACRO AND MICRONUTRIENTS AND THEIR CORRELATION WITH SOME PHYSICO-CHEMICAL PARAMETERS IN MOLLISOLS SOIL OF UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND	154
474.	TILLAGE SYSTEMS FOR BIOLOGICAL SOIL CONSERVATION Kalay Khan ¹ * S.C. Moses	145	502.	Vineet Kumar and Shiv Singh Meena DEGRADED SOILS, THEIR PROBLEMS AND MANAGEMENT FOR ENHANCING CROP PRODUCTION	154
475.	GENOTOXICITY EVALUATION OF WASTEWATER IN THE VICINITY OF AN OIL REFINERY Khalida Khatoun and Abdul Malik	146	503.	Sukanya Ghosh ¹ *, Navneet Pareek, and K.P. Raverkar UTILIZATION OF AGRICULTURAL WASTES FOR ENVIRONMENTAL SUSTAINABILITY	155
476.	POTENTIAL ROLE OF AGROFORESTRY IN MITIGATING CLIMATE CHANGE ON FARMERS FIELD Govind, Ravindra Kumar Dhaka* and V. M. Prajapati	146	504.	Hina Khatoun and Maitreyi Narayan CONSERVATION AGRICULTURE- OPPORTUNITIES AND LIMITATION FOR SUSTAINABLE AGRICULTURE IN INDIAN CONTEXT: *S.C. Verma, **Ajay Kumar Shukla, ***Kaushal Singh, ****Veeru Chaurasiya, ***Pankaj Kumar and **Mukesh Yadav	155
477.	E- WASTE: CONSTRAINTS, CHARACTERISTICS AND MANAGEMENT Mohsina Anjum ¹ , Hanuman Singh Jatav	146	505.	Jyoti Singh ¹ and A.K. Dwivedi SOIL AND WATER CONSERVATION IN HORTICULTURE.	146
478.	DEVELOPMENT AND MANAGEMENT OF ECOLOGICAL NICHE Tanuja Pandey* and Ranjeet Singh	147	506.	Alka Vyas and Rakhi Dwivedi SOLID WASTE MANAGEMENT IN INDIA: RECENT SCENARIO A REVIEW	156
479.	EFFECTS OF CLIMATE CHANGE AND GLOBAL WARMING ON WEEDS AND DISEASES Manisha Verma ¹ *, Anjali Jingar ² and Vijay Laxmi Yadav	147	507.	Arshi Naaz, Ravinder Kaur, K.G. Rosin and Khajanchi Lal IMPACT OF CLIMATE CHANGE ON SOIL PROPERTIES AND THEIR QUALITY IN INDIAN CONTEXT	156
480.	DELINEATION OF WATERSHED BOUNDARIES AND ASSESSMENT OF SOIL EROSION POTENTIAL IN HEAVY RAINFALL AREA Daniel Prakash Kushwaha ¹ *, Vijay Kumar Singh, Sachin Kumar Singh	147	508.	Jalendra Bairwa ¹ *, S. K. Meena ² , Rajaram Bunker ² and Ravindra kumar THE CHALLENGE OF RISING FOOD PRICES AND CLIMATE CHANGE	157
481.	ROLE AND PARTICIPATION OF CHILDREN (DIFFERENT AGES) IN WASTE MANAGEMENT, CONSERVING RESOURCES AND SAVING ENVIRONMENT Ankita Vyas, Paridhi Chaudhary ¹⁴⁸	148	509.	Ravindra kumar, Omprakash And, Rajaram Bunker CONSERVATION OF NATURAL RESOURCES AND TRADITIONS OF INDIA	157
482.	EFFECT OF RAINFALL INTENSITY ON SEDIMENT OUTFLOW AND RUNOFF UNDER DIFFERENT LAND SLOPES CONDITIONS Sachin Kumar Singh ¹ *, P.S. Kashyap ² and Daniel Prakash Kushwaha	148	510.	Aadil Gulzar, Ishfaq Nabi Shah, Gowhar Ramzan Bhat and Rouff Ahmad Ganie CONSERVATION AGRICULTURE: A PRECISION FARMING TOOL FOR SMALLHOLDERS	157
483.	BIODEGRADATION AND DETOXIFICATION OF CYPERMETHRIN BY LIGNOLYTIC ENZYMES ESTERASE AND LACCASE PRODUCING BACTERIA <i>BACILLUS SPP.</i> Saurabh Gangola, Pankaj Bhatt, Priyanka Khatri, Hemant Dasila	148	511.	Princy Jain and K.K. Agrawal CONSERVATION OF NATURAL RESOURCES AND ENVIRONMENTAL ISSUES	158
484.	MANAGEMENT OF EMERGING WEED SPECIES IN CONSERVATION AGRICULTURE AN OVERVIEW Akhilesh Chandra Singh,	148	512.	Arvind Kumar	158
485.	NATURAL RESOURCES AND CONSERVATION IN INDIA Ram Vilas, Sanjay Kumar, Rakesh Kumar Meena and Rajesh Kumar Meena	149			
486.	CLIMATE CHANGE AND GLOBAL WARMING SIGNIFICANT EFFECT ON ENVIRONMENT				

518. NATURAL RESOURCES CONSERVATION Mitra Pal Singh,	159	545. DAIRY FARMERS PERCEPTION TOWARDS CLIMATE VARIABILITY IN KARNATAKA STATE Parameswaranaiik J ¹ , Verma A. P and Sawant M. N	168
519. ENVIRONMENTAL CHALLENGES AND SUSTAINABLE DEVELOPMENT Tanuja Pandey	159	546. CHEMICAL WEED MANAGEMENT UNDER CLIMATE CHANGE Arun kumar, Vivak kumar and Robin Kumar	168
520. ADVANCEMENT IN MEMBRANE TECHNOLOGY FOR WATER PURIFICATION OkbagaberAndom Keleta ¹ , Huma Naz ² , Balwant Singh	159	547. EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON NUTRIENT REMOVAL UNDER RICE WHEAT ROTATION Robin kumar, Vivak kumar and Ashish dwivedi	169
521. IMPACT OF CLIMATE CHANGE ON VEGETABLE CROP PRODUCTION VIS A VIS MITIGATION AND ADAPTATION STRATEGIES Sunidhi Mishra ^{1*} and Versha kumari	160	548. HEAT SHOCK PROTEIN: MASTER PLAYERS FOR HEAT STRESS TOLERANCE IN PLANTS DURING CLIMATE CHANGE Anu Yadav, Madhuri gupta and Shivani Khanna	169
522. IMPACT OF CLIMATE CHANGE ON ARID LANDS AGRICULTURE Kedar Gurjar ^{1*} , ShyamLalBui ¹ Kapil Nagar ² AndLakhanLal Bairwa	160	549. CALIBRATION AND VALIDATION APSIM-WHEAT MODEL FOR SUB HUMID REGION OF WESTERN HIMALAYAS FOR CLIMATE CHANGE STUDY Smita Gupta ¹ , R.K.Singh ¹ , Ajit Singh ² , Sumana Roy ¹ And U.P.Shahi	169
523. RELATIVE POLLUTANT REDUCTION EFFICIENCY OF MACROPHYTE COMBINATIONS IN SUB-SURFACE FLOW EXPERIMENTAL WETLANDS OF IARI Poonam, Ravinder Kaur, Ashutosh Tripathi, Jagdish Prasad and Ram Kishan Rahul Kshetti ¹ , Dr. Ajay	160	550. DIVERSITY THROUGH GENETIC VARIABILITY AND CORRELATION IN CHRYSANTHEMUM (<i>CHRYSANTHEMUM MORFOLIUM</i> RAMAT) GENOTYPES Sunil kumar and Niki dewan	169
524. ISSUES IN NATURAL RESOURCE CONSERVATION AND SUSTAINABLE DEVELOPMENT Rajesh Kumar	161	551. BIODIVERSITY OF ANIMAL BREED AND THEIR CONSERVATION Pramod Prabhakar	170
525. EFFECT OF GLOBAL CLIMATE CHANGE ON INSECT LIFE Rakesh Kumar ¹ , Kiran Negi ¹ and Poonam Srivastava	161	552. GENETIC DIVERSITY ANALYSIS FOR YIELD CONTRIBUTING AND QUALITY TRAITS IN ADVANCE BREEDING LINES OF RICE (<i>ORYZA SATIVA</i> L.) Mahendar Singh, Bhinda and M. K. Karnwal	170
526. CONSERVATION AGRICULTURE (CA) IN MAIZE BASED CROPPING SYSTEMS R. N. Maurya ^{1*} , Jay Kumar Yadav ¹ , Rajmani ³ , U. P Singh ¹ , and Girish Goyal	161	553. ALLELIC VARIATION AT LOCI CONTROLLING STRIPE RUST RESISTANCE IN ADVANCED LINES AND GENOTYPES OF WHEAT Reema Rani, R.S. Beniwal [*] and Neelam R. Yadav	170
527. STUDY OF THERMAL PERFORMANCE FOR PACKED BED SOLAR AIR HEATER USING V-CORRUGATED ABSORBER PLATE Saurabh	162	554. EFFECT OF GEO-CLIMATIC VARIABLES, DIFFERENT FOREST TYPES AND POPULATIONS ON DRUPE TRAITS OF TEAK (<i>TECTONA GRANDIS</i> L.F.) IN INDIA Ravindra Kumar Dhaka and Suman Kumar Jha	171
528. IMPACT OF WEATHER FLUCTUATIONS ON FRUIT PRODUCTION Ravina Pawar ¹ , Chiranjeev Kumawat ² and Gargi Sharma	162	555. IMPORTANCE AND APPLICATION OF PLANT BIOTECHNOLOGY Gayatri Kumawat and Pooja Khinchi	171
529. SEASONAL FLUCTUATIONS IN THE MICROBIAL COMPOSITION OF MULBERRY RHIZOSPHERE UNDER KASHMIR CLIMATIC CONDITIONS. Saima khursheed, M.R., Mir, Z.A. Baba*, M.F. Baqual, S. Noor – ul – din and S.A Mir	163	556. ADEQUATE USE OF NANOTECHNOLOGY IN AGRO ECOSYSTEM: IMPLICATIONS ON PLANT PRODUCTIVITY AND ITS SOIL ENVIRONMENT Shoraj Singh and Vinay Dua	171
530. INFLUENCE OF SEASONS ON PHYSICOCHEMICAL CHARACTERISTICS OF MULBERRY SOILS UNDER TEMPERATE CLIMATIC CONDITIONS OF KASHMIR. Saima khursheed and M.R.Mir.	163	557. IMPACT OF BIOCHAR ON METHANOTROPHS DIVERSITY IN PADDY ECOSYSTEM Chhatarpal Singh, Shashank Tiwari, Vikas Kumar [*] , Atul Mishra ^{**} , and Jay Shankar Singh	172
531. PRODUCTION POTENTIAL OF SOYBEAN BASED CROPPING SEQUENCE UNDER RESOURCE CONSERVATION TECHNOLOGIES S.K.Nayak, W.N.Narkhede, B.V.Asewar and U.N.Alse	163	558. EFFECTS OF DIETARY INCLUSION OF PROBIOTIC ON GROWTH PERFORMANCE OF BROILER CHICKENS Ngangkham James Singh and Ajit singh	172
532. IMPACT OF CLIMATE CHANGE ON THE POPULATION DYNAMICS OF INSECT-PESTS SPECIES AND THEIR NATURAL ENEMIES Kamal Ravi Sharma ^{1*} , Deepak Kumar Jaiswal ¹ , D. Rakshith Roshan ¹ and Rashmirekha Singh	163	559. CONSERVATION OF AGRICULTURAL BIODIVERSITY IN THE ERA OF CLIMATE CHANGE Anupam Adarsh, Ashutosh Kumar, Neetunand and Randhir Kumar	172
533. EFFECT OF POTASH MANAGEMENT THROUGH GLIRICIDIA GREEN LEAF MANURING ON SOIL FERTILITY AND NUTRIENT BALANCE IN VERTISOLS OF MAHARASHTRA V. H. Jadhao and V.V. Gabhane	164	560. DISTRIBUTION DIVERSITY USES OF CULTIVATED AND WILD OKRA Anirudha Kr.Sharma , Rashmi Nigam* J. Singh and M. Singh	173
534. “SUPERIMPOSITION OF ORGANIC SOURCES TO ENHANCE YIELD AND QUALITY PARAMETERS OF SCENTED RICE (<i>ORYZA SATIVA</i> L.) IN INDO- GANGETIC PLAIN ZONE.” Mohammad Saquib, M.P. Yadav, Ripudaman Singh, Hemant Kumar and Ruchi Yadav	164	561. STUDIES ON CHARACTER ASSOCIATION, PATH ANALYSIS AND GENETIC DIVERGENCE IN PEA (<i>PISUM SATIVUM</i> L.) Archi Gupta, M.K. Singh, Mukesh Kumar, S.K. Singh, Hariom Katiyar, and Vipin Kumar	173
535. CONSERVATION AGRICULTURE BASED PRACTICES FOR IMPROVING RESOURCE USE EFFICIENCY- REVIEW A.V. Dahiphale*, Sanjeev Kumar Kashyap, Hari Singh, Sandeep Kumar, Vikram Kumar	164	562. STUDY ON THE EFFECT OF CADMIUM CHLORIDE ON HISTOPATHOLOGICAL CHANGES IN FRESH WATER FISH CHANNA PUNCTATUS Ramesh P. L. and M. Ramachandramohan	173
536. SOLID WASTE MANAGEMENT IN INDIA: RECENT SCENARIO Dr.Alka Vyas*, Dr.Rakhi Dwivedi	165	563. ROLE OF HONEY BEES IN POLLINATION OF MUSTARD PRODUCTION G. C. Jat, Ratan Lal Sharma [*] , Swati ^{**} , Naresh Kumar ^{***} and Raj Mal Jat	174
537. AGRONOMIC BIO-FORTIFICATION OF CEREALS WITH ZINC AND IRON FOR MICRONUTRIENTS MINERAL NUTRITIONAL SECURITY Todar Mal ^{1*} , Kaluram Kumawat ² and Devendra Dambiwal	165	564. PHENOTYPING AND GENETIC ANALYSIS OF JNPT LINES IN RICE FOR YIELD AND QUALITY TRAITS. Lakshman Gupta [*] , Hausila Prasad Singh, Prahlad Masurkar ^{**} , Aashima Batheja	174
538. EFFECTS OF FOLIAR SPRAY OF GA ₃ , ZN ²⁺ AND MH(MALEIC HYDRAZIDE GROWTH COMPONENTS OF CAJANUS CAJAN CV MANIK (PIGEON PEA) AND VIGNA UNGUICULATA CV PUSA KOMAL Dr.SaritaRani	165	565. DEVELOPMENT AND CHARACTERIZATION OF TRANSGENIC PIGEON PEA (<i>CAJANUS CAJAN</i> L.) PLANTS WITH MARKER FREE PS P68 GENE FOR SALINITY TOLERANCE Neha and Pushpa Kharb	174
539. CONSERVATION AGRICULTURE BASED PRACTICES FOR IMPROVING RESOURCE USE EFFICIENCY- REVIEW A.V. Dahiphale*, Sanjeev Kumar Kashyap, Hari Singh, Sandeep Kumar and vikramkumar	166	566. COMPOSITIONAL QUALITIES OF FRESH RAW MILK AS INFLUENCED BY STAGE OF LACTATION AND MILK PRODUCTION OF CROSSBREED COWS AT SHUATS DAIRY FARM ¹ Aditya Kumar, P. Kumar, Neeraj, Gaurav Jain, and Ng. James Singh	175
540. DEVELOPMENT AND MANAGEMENT OF ECOLOGICAL NICHE Tanuja Pandey* and Ranjeet Singh	166	567. ASSESSMENT OF GENETIC DIVERSITY USING MICROSATELLITE (SSR) MARKERS IN <i>LABEO ROHITA</i> (HAMILTON, 1822) FROM TWO HATCHERIES LOCATED IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND Mohd Danish and I J Singh	175
541. EFFECTS OF ENVIRONMENTAL CARBON DIOXIDE IN INSECT LIFE Satyapriya Singh ^{1*} and Subramanian S	167	568. STANDARDIZATION OF EMBRYO RESCUE TECHNIQUE FOR SHORTENING OF BREEDING CYCLE IN MANGO Jyoti Kumari, Suparna Sinha, Abha Kumari	175
542. FOOD IRRADIATION AND IT'S APPLICATIONS Vikrant kumar*, Jaivir singh, Samsher, Neelash Chauhan, Suresh Chandra, M.K. Yadav	167	569. GENETIC VARIATION FOR SEEDLING CHARACTERS IN LENTIL GENOTYPES UNDER SALINITY STRESS Kana Ram Kumawat and D. K. Gothwal	176
543. EFFECT OF AIR POLLUTION ON HUMAN HEALTH Kiran Kumari ¹ , Atin Kumar ² , Shriman Kumar Patel ² and Manoj Kumar	167		
544. NATURAL RESOURCES CONSERVATION Dr. Y.K.Singh ¹ , Nipun Kumar Pandey ² , Beena Singh	168		

570. ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.)
Madhu Choudhary, Dr. D. K. Gothwal, Ravi Kumawat and Kana Ram Kumawat 176
571. GENETIC DIVERSITY FOR YIELD AND ITS CONTRIBUTING TRAITS IN GUAR (*CYAMOPSIS TETRAGONOLoba* (L.)TAUB.)
Kumar Pawan, Singh Jhabar*, Vishnoi Geeta and Garg D. K. 176
572. GENETIC DIVERSITY ANALYSIS IN LENTIL (*LENS CULINARIS* MEDIK.) GERMPLASM
Ram Kunwar, S. R. Maloo, Ramesh Kumar, Pawan Kumar, Rajani Verma 177
573. EXPLOITATION OF GENETIC VARIABILITY FOR YIELD AND QUALITY PARAMETERS IN QUALITY PROTEIN MAIZE (QPM) GERMPLASM (*Zea mays* L.)
Ramesh Kumar, R. B. Dubey, Ram Kunwar, Rajani Verma and Gurudatt Solanki 177
574. ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN CORIANDER (*CORIANDRUM SATIVUM* L.) GENOTYPES
Ravi Kumawat, Dharendra Singh, Kana Ram Kumawat, Sarla Kumawat, Madhu Choudhary 177
575. E-LEARNING FOR AGRICULTURE EDUCATION IN INDIA
S. Maurya, Sarju Narain* and Gaurav Kumar 178
576. ROLE OF INFORMATION & COMMUNICATION TECHNOLOGY (ICT) IN AGRICULTURAL EXTENSION IN INDIA
Prerana Kaushal* and A. S. Maurya 178
577. STUDIES ON EFFECT OF CLONAL MULTIPLICATION OF GUAVA THROUGH SOFTWOOD GRAFTING UNDER CONTROLLED CONDITION
Pushkar Dixit and Vikash Yadav 178
578. SKILL DEVELOPMENT IN INDIAN AGRICULTURE: OPPORTUNITIES FOR JOBS
S. K. Goyal, Shree Ram Singh and A. Vaishapayan 178
579. SOME HORMONAL FISH REPRODUCTIVE BIOMARKERS IN GINGTHOUKHONGJAM SORANGANBA
I. J. Singh* and Mohd Danish 179
580. E – LEARNING
S. Maurya, Kshitij Parmar and Gaurav Kumar 179
581. TELOMERES: THE STRANDS OF TIME
Deep Rashmi 179
582. PRECISION BREEDING AND SUSTAINABLE CROP IMPROVEMENT
Banshidhar and Priyanka Jaiswal* 180
583. SDS-PAGE BASED PROTEIN PROFILING AND DIVERSITY ASSESSMENT OF INDIGENOUS GERMPLASMS OF CUCUMBER (*CUCUMIS SATIVUS* L.)
Chandan Singh Ahirwar and D. K. Singh 180
584. IDENTIFICATION OF ADULTERATION IN GENETICALLY MODIFIED SEED USING BIOTECHNOLOGICAL PRACTICES
Yogendra Singh 180
585. KISAN CALL CENTRE IN INDIA
Satendra Kumar, Gaurav Kumar and Anurag Verma 181
586. CYTOLOGICAL STUDIES IN HYBRID BETWEEN *C. AQUATICA* ROXB. AND *C. GIGANTEA* (2N =14)
Shrimant D. Raut and Chamle D. R* 181
587. BIONANOTECHNOLOGY AND ITS RELEVANCE TO AGRICULTURE
Brij B. Pandey, Nidhi Tyagi* and Nutan Singh 181
588. APPLICATION OF GENOMICS IN PLANT BREEDING
Ramraj Sen and Rohit Kumar Saini 181
589. IMPACT OF GENETICALLY MODIFIED CROPS AND SOME OTHER STRATEGIES IN AGRICULTURAL BIOTECHNOLOGY
Gargi Shukla 182
590. GENE PYRAMIDING IN VEGETABLE CROPS
Nisha Rani, Randhir Kumar, Shirin Akhtar and Preeti Kumari 182
591. DEVELOPMENT OF HYBRID RICE IN INDIA: CURRENT STATUS AND FUTURE STRATEGIES
Rohit Kumar Saini, Ramraj Sen and S.A. Kerkhi 182
592. STUDIES ON THE DIRECT AND INDIRECT EFFECT OF DIFFERENT CHARACTERS ON YIELD IN CORIANDER (*CORIANDRUM SATIVUM* L.) GENOTYPES
Akshay Jain, V. P. Pandey and Rajneesh Shukla 183
593. GENETIC VARIABILITY AND PATH ANALYSIS IN CARROT (*DAUCUS CAROTA* L.)
Suresh Kumar Teli, R. A. Kaushik, Virendra Singh, M. R. Choudhary, Akshay Chittora, Shashi and Bhuvnesh Nagar 183
594. INTEGRATED AQUACULTURE: A BETTER WAY TO UTILIZE AVAILABLE RESOURCES
Ranjeet Singh, Rathod Vishal, Tarang Kumar Shah and Dinesh Mohan 183
595. GENETIC DIVERSITY ASSESSMENT IN CHERRY TOMATO (*SOLANUM LYCOPERSICUM* L. VAR. *CERASIFORME*) GENOTYPES USING SSR MARKERS
Kiran Kumar, D. Sharma and Vikrant Kumar Sahu 184
596. A REVIEW: FISH BIODIVERSITY AND ITS CONSERVATION
Tarang Kumar Shah, Vishal Rathod and Rajinder Kaur 184
597. BIOFORTIFICATION IN MAIZE: DEVELOPING A ROADMAP FOR REDUCING HIDDEN HUNGER AND DELIVERING NUTRIENT-RICH FOOD
Munnesh Kumar, J. P. Shahi, Varsha Gayatonde and Anima Mahato 184
598. BIOTECHNOLOGICAL METHODS UTILIZED IN *CUCUMIS* RESEARCH
P. R. Panchbhair and P. L. Deshmukh 185
599. ROLE OF BIOTECHNOLOGICAL TOOLS FOR GENETIC IMPROVEMENT IN HORTICULTURAL CROPS
P. R. Panchbhair*, P. L. Deshmukh and S. D. Deshmukh 185
600. ROLE OF BIOTECHNOLOGY IN GERMPLASM CONSERVATION OF HORTICULTURAL CROPS - AN OVERVIEW
P. L. Deshmukh, P. R. Panchbhair*, S. D. Patil**, S. D. Deshmukh, N. R. Kadge and B. J. Patle 185
601. SCREENING AND EVALUATION OF UNRIPE MANGO GENOTYPES FROM TRIBAL AREAS OF SATPUDA HILLS FOR VALUE ADDED PRODUCT-AMCHUR
P. L. Deshmukh*, S. D. Patil**, B. B. Dhakare and Laxmipriya Swain 185
602. NANOTECHNOLOGIES IN AGRICULTURE – NEW TOOLS
Ankita Trivedi, Prafull Kumar and R.S.Sengar 186
603. ANALYSIS OF GENETIC VARIATION IN DIFFERENT GENOTYPES OF BANANA (*MUSA SPECIES*) USING RANDOM AMPLIFIED POLYMORPHIC DNAs (RAPDs)
Ankita Trivedi, Prafull Kumar and R. S.Sengar 186
604. GREEN SYNTHESIS OF NANOPARTICLES USING DIFFERENT PLANT LEAF EXTRACT
S. D. Deshmukh, S. R. Patil* and P. L. Deshmukh 186
605. IMPORTANCE OF QTLs IN PLANT BREEDING
Shivendra Pratap Singh and Pooran Chand 187
606. STATUS OF TEMPERATE FRUITS IN JAMMU & KASHMIR AND THEIR ROLE IN BIODIVERSITY
M.K. Sharma, Amit Kumar*, A.S. Sundouri, Nowsheen Nazir and Aroosa Khalil 187
607. ROLE OF NUT CROPS IN THE BIODIVERSITY OF JAMMU AND KASHMIR
M.K. Sharma, Amit Kumar*, A.S. Sundouri, Rifat Bhat and Jagdeesh Prasad Rathore 187
608. PHENOLOGICAL EVALUATION OF EXOTIC PLUM CULTIVARS UNDER KASHMIR CONDITIONS
S.K. Verma, A.S. Sundouri*, M.K. Sharma, F.A. Banday, Amit Kumar & Aroosa Khalil 188
609. BIODIVERSITY CONSERVATION OF UNDERUTILIZED VEGETABLE CROPS FOR THEIR GENETIC IMPROVEMENT
Pooja 188
610. INDUCED MUTAGENESIS INCREASED CAPSAICIN IN MUTANTS OF *CAPSICUM ANNUUM* L.
M. Gulfishan¹, R.A. Mir², Ajmat Jahan 188
611. STUDIES ON GENETIC DIVERGENCE FOR QUANTITATIVE TRAITS IN RICE (*ORYZA SATIVA*)
Neha Singh*, O.P. Verma 188
612. EFFECT OF MAGNETIC FIELD AND DIETS ON *CORCYRA CEPHALONICA*
Puja Chandrawanshi, Dr. S. K. Aherkar, S. A. Shendage, Vrunda S. Thakare 189
613. DIVERSITY OF GUT BACTERIA ASSOCIATED WITH THE GUT OF *ANTHERAEA ASSAMENSIS* (MUGA SILKWORM)
Sakshi Gandotra^{1,2}, Archana Kumar¹ and S. Subramanian 189
614. DIVERSITY FOUND IN BLACK GRAM'S GENOTYPES IN MADHYA PRADESH CLIMATIC CONDITION USING D² – STATISTIC
Nitesh Kumar Panwar¹, Indu Swarup¹, Mayank Jain¹ and Lokesh Gour 189
615. STUDY OF GENETIC VARIABILITY IN BREAD WHEAT (*TRITICUM AESTIVUM* L.) THROUGH INDUCED MUTAGENESIS BY GAMMA RADIATION.
Geeta Kumari* and S. Marker 190
616. NUCLEIC ACID-BASED PATHOGEN DETECTION IN APPLIED PLANT PATHOLOGY
Hansraj Dhakar¹, Dinesh Kumar¹, Suresh Kumar¹ and Parhlad 190
617. ROLE OF ICT IN RURAL AREAS FOR WOMEN EMPOWERMENT
Annu Devi Gora and Rashmi Bhinda 190
618. EFFECT OF PRE-TREATMENTS ON THE PHYSICO-CHEMICAL PROPERTIES AND SENSORY QUALITY OF IMF PAPAYA SLICES
Akanksha Shrivastava, I.N. Doreappa Gowda and Anish M 190
619. ASSESSMENT OF GENETIC DIVERSITY IN GARLIC GENOTYPES BASED ON SSR MARKERS
Rakesh S. Vinukonda*,¹ Sunil Malik¹, Mukesh Kumar¹ and Anil Sirohi 191
620. PLASMA TECHNOLOGY- AN INNOVATION IN FIELD OF FOOD PRESERVATION
Akanksha Shrivastava and Anish M 191
621. CRISPR-CPF1: A NEW TOOL FOR PLANT GENOME EDITING
Renu Yadav, Gayatri Kumawat and Manish Kumar Choudhary 191
622. FOREST BIODIVERSITY, THREATENED SPECIES AND CONSERVATION IN RAJASTHAN
Bhupendra Singh¹, Ravindra Kumar Dhaka², P. S. Chauhan³, S. B. S. Pandey⁴ and Jitendra Singh Rawat 192
623. INDIGENOUS TECHNICAL KNOWLEDGE OF FARMERS OF KANDI BELT OF JAMMU REGION
¹ Neerja Sharma, ²R.K. Arora, ³Pawan Sharma, ¹Vinod Gupta, ¹Sanjay Khajuria, ¹Amit Mahajan, ¹Shalini Khajuria 192
624. GENETICALLY MODIFIED VEGETABLE CROPS: NEW ASPECT OF CROP IMPROVEMENT
Nilesh Nirgude¹, Vishal Nirgude² and Maggidi Spandana 192
625. THE ROLE OF NANOTECHNOLOGY IN POST-HARVEST MANAGEMENT OF HORTICULTURAL CROPS
Syed Khudus and Vishal Nirgude 193

626.	IMPORTANCE OF QTLS IN PLANT BREEDING Shivendra Pratap Singh and Pooran Chand	193	DIALLEL MATING DESIGN Akanksha, Jaiswal H K	203
627.	IN VITRO INDUCED POLYPLOIDY IN ACID LIME (<i>CITRUS AURANTIFOLIA</i> SWINGLE) SHOOT TIPS USING ANTI-MITOTIC AGENT Lokesh Bora*, R. M. Vijayakumar*, M. Ganga** and Suganya Angannan	193	656.	ANALYSIS OF GENE EFFECTS UNDER NORMAL AND LATE SOWN IRRIGATED CONDITION FOR GRAIN YIELD AND ITS COMPONENTS IN BREAD WHEAT (<i>TRITICUM AESTIVUM</i> L.) MUNESH KUMAR KUSHWAH AND V S KANDALKAR
628.	DEPLETION OF BIODIVERSITY IN THE COASTAL ZONE OF INDIA Yogesh Pathak and Bhumika Arora	194	657.	UTILIZATION OF PLANT GENOME SEQUENCING IN CROP PLANTS Kumar Nishant Chourasia and Deepak Koujalagi
629.	GENETIC DIVERGENCE ANALYSIS OF CULTIVATED GENOTYPES OF BOTTLE GOURD [<i>LAGENARIA SICERARIA</i> (MOL.), STANDL.] Ipsita Panigrahi and D.S. Duhan	194	658.	ROLE OF BIO-NANOTECHNOLOGY IN SUSTAINABLE AGRICULTURE DEVELOPMENT Prabha Banjarey* and Sarla Kumawat
630.	SCANNING ELECTRON MICROSCOPIC STUDIES IN MUTANTS OF PERIWINKLE (<i>CATHARANTHUS ROSEUS</i> L.) CV. LOCAL K. Kannabiran*, K. Rajamani* and Lokesh Bora	194	659.	GENETIC CHARACTER VARIABILITY STUDIES IN DESI CHICKPEA (<i>CICER ARIETINUM</i> L.) GENOTYPES Alka Dev ¹ , Preeti Verma
631.	RESYNTHESIS OF <i>B. JUNCEA</i> FOR INCREASING THE GENETIC VARIABILITY AND SEARCH FOR NEW PLANT TYPES Mahesh Rao*, Rohit Chamola*, Naveen Singh**, N.C. Gupta*, S.R. Bhat** and R.C. Bhattacharya	195	660.	DIVERSITY ANALYSIS IN A CORE COLLECTION OF INDIAN BREAD WHEAT (<i>TRITICUM AESTIVUM</i> L.) Vivek Sharma ^{1,2} , Ashwani kumar
632.	MOLECULAR MARKERS AND QTL ANALYSIS IN CROP PLANTS Jitendra Kumar and Arun Kumar	195	661.	STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN OA Charupriya Chauhan and S.K. Singh
633.	MOLECULAR BREEDING METHOD FOR CROP IMPROVEMENT Jitendra Kumar and Arun Kumar	195	662.	COMBINING ABILITY IN OAT (<i>AVENA SATIVA</i> L.) Charupriya Chauhan and S.K. Singh
634.	RESPONSE OF TUBEROSE GENOTYPES TO YIELD AND QUALITY PARAMETERS Ashvini Gaidhani, Shalini Badge, Sushma Lokhande and Disha Patil	196	663.	HETEROSIS FOR YIELD AND YIELD COMPONENTS IN OAT (<i>AVENA SATIVA</i> L.) Charupriya Chauhan and S. K. Singh
635.	STUDIES ON GENETIC DIVERGENCE IN PEA (<i>PISUM SATIVUM</i> L.) Archi gupta	196	664.	ASSESSMENT OF INDUCED MUTAGENESIS BY INDIVIDUAL AND COMBINATION TREATMENTS OF EMS, GAMMA RAYS AND THEIR COMBINATION TREATMENT Tariq Ahmad Bhat
636.	EFFECT OF MUTAGENS AND CHEMICALS ON PLANTS Dattesh Tamatam, Bijendra Kumar, Ravi Nagda, Amandeep Kaur	196	665.	NANOTECHNOLOGY: A WAY TO ACHIEVE SUSTAINABILITY IN AGRICULTURE SECTOR Jayashri Barcchiya and Diksha Manware
637.	PLANKTON DIVERSITY AND THEIR DISTRIBUTION PATTERNS WITH VARIOUS ABIOTIC FACTOR IN NAINITAL LAKE Dinesh Mohan*, M. Das Trakroo*, Shivangi*, Rathod Vishal** and Ranjeet Singh	196	666.	COMPARATIVE STUDY ON PHYSIOCHEMICAL QUALITY OF RAW MILK SAMPLES COLLECTED FROM DIFFERENT VILLAGES OF ALLAHABAD Sujeet kumar Yadav and Ajit Singh
638.	BACTERIA MEDIATED SYNTHESIS OF MAGNETIC NANOCRYSTALS AND THEIR POTENTIAL AS PLANT MICRONUTRIENT Kedar Ahire*, Shraddha Joshi*, S. R. Shiraodkar	197	667.	EXOTIC GENETIC LIBRARY: TOOL FOR PLANT BREEDING IMROVEMENT Neha, Deepankar Pandey
639.	ANALYSIS OF THE GENETIC DIVERSITY OF CANDIDA ISOLATES OBTAINED FROM CLINICAL SAMPLES FROM A TERTIARY CARE HOSPITAL Megha Y. Pawar*, Kedar Ahire**, Rabindra Nath Misra	197	668.	GENE ACTION FOR QUALITY AND QUANTITATIVE CHARACTERS IN LINSEED (<i>LINUM USITATISSIMUM</i> L.) Shikha Tripathi
640.	ROLE OF POTASSIUM SOLUBILIZING MICROBES IN PLANT NUTRITION Alka Arya	197	669.	BIODIVERSITY CONSERVATION Ankur Mahendra Arya*, Sweta Singh, B.R. Singh & Tarun Kumar
641.	BASIC INTENTS, STRATEGIES AND METHODS INVOLVED IN CONSERVATION OF BIODIVERSITY Dan Singh Jakhar, Rajesh Singh and Saket Kumar	198	670.	INSECTS BIODIVERSITY IN INDIA V.K. Mishra, Sambhrant Kumar and Piyanka
642.	FEEDING PRACTICE OF DAIRY ANIMALS P. K. Madke and Anant Kumar	198	671.	HAEMATOLOGICAL ANALYSIS OF KONKAN KANYAL GOATS REARED UNDER SEMI-INTENSIVE MANAGEMENT SYSTEM B.G. Desai*, Shalu Kumar and R.G. Burte, Hemant Kumar, Ripudaman Singh, D. D. Yadav, Ruchi Yadav, M. Saquib and R.K. Yadav
643.	PLANT BREEDING IN ORGANIC AGRICULTURE Anil Kumar* Twinkle Kumari Bhagat	198	672.	HUMAN-WILD BOAR CONFLICT IN THE JOSHIMATH FOREST RANGE OF THE NANDA DEVI NATIONAL PARK, UTTARAKHAND, INDIA Vijay Kumar Yadav, D.S. Chauhan, P.C. Lakhera and Priyanka Negi
644.	EFFICIENCY OF DIFFERENT LIGHT SOURCES IN LIGHT TRAPS IN MONITORING INSECT DIVERSITY Beerendra Singh ¹ and Vijay Kumar	199	673.	NANOTECHNOLOGY IN AGRI-FOOD PRODUCTION AND BIODIVERSITY CONSERVATION Monika Gupta, Rajesh Singh Tomar, Raghendra Kumar Mishra
645.	ESTIMATION OF GENETIC VARIANCE ON QUALITATIVE AND QUANTITATIVE IMPROVEMENT THROUGH BIOMETRICAL APPROACH HALF DIALLEL ANALYSIS IN (<i>TRITICUM AESTIVUM</i> . L) ¹ Bijendra Kumar, ¹ D.N. Bharadwaj, ² Lokendra Singh, Sarvendra Kumar Gupta	199	674.	STABILITY ANALYSIS FOR SEED YIELD AND ITS COMPONENTS OF SOYBEAN IN DIFFERENT CLIMATIC CONDITIONS IN MADHYA PRADESH REGION Nidhi Dubey ¹ , H. A. Avinash ² and A. N. Shrivastava
646.	ROLE OF BIOTECHNOLOGY IN VEGETABLE CROPS Bhanupratap Jangde, Pappu Lal Bairwa, Nisha Jangre, Preetesh Kumar Pandey	199	675.	COMPARATIVE PERFORMANCE OF F ₁ HYBRIDS OF OKRA (<i>Abelmoschus esculentus</i> L. Moench) UNDER NATURALLY VENTILATED POLYHOUSE, SHADENET HOUSE AND OPEN FIELD CONDITIONS B. N. Hindalekar, P. C. Haldavanekar and S. V. Bhavar
647.	NANOTECHNOLOGY: TRENDS AND APPLICATION FOR INSECT PEST MANAGEMENT Suresh Kumar Sabal*, Rajaram Bunker And Ravindra kumar	200	676.	AN AVIAN DIVERSITY OF FATEHNAGAR TOWN, UDAIPUR FOREST DIVISION, RAJASTHAN Vijay Kumar Yadav ¹ , P.S. Chauhan ² , D.S. Chauhan ¹ and Rathiesh P.
648.	GENE PYRAMIDING: AN ADVANCE STRATEGIES FOR DEVELOPMENT OF DISEASE RESISTANCE IN CROPS Mohit Kumar ^{1*} , Munness Kumar ³ , Ravindra kumar ² And Rajaram Bunker	200	677.	MOLECULAR DIAGNOSTIC TECHNIQUES FOR DETECTION OF PLANT PATHOGENS Shameem Ahmad*, Prashant Mishra, Sandeep Kumar, Sonam Singh Chandel and Jaskaran Singh
649.	COMPARATIVE PERFORMANCE OF DIFFERENT VARIETIES OF CHICKEN (VANRAJA AND GRAMPRIYA) UNDER BACKYARD SYSTEM OF REARING IN TRIBAL AND RURAL AREA OF BIJAPUR DISTRICT, C.G. Arvind K. Nandanwar, Amit Sinha and S. S. Chandravanshi	200	678.	NANOTECHNOLOGY AND ITS APPLICATIONS VivekRana, Pushpendra Kumar, Aastha and Shilpy Singh
650.	MARKER ASSISTED RECURRENT SELECTION: AN INNOVATIVE APPROACH Deepak Koujalagi and Kumar Nishant Chourasia	201	679.	RECENT ADVANCES IN GENETICS AND BREEDING OF RAPESEED MUSTARD Rajendra Kumar ¹ , Brijesh Kumar Maurya ¹ , Sahadev Singh ² ,
651.	FOOD IRRADIATION AND ITS APPLICATIONS Vikrant kumar*, Jaivir singh, Samsher, Neelash Chauhan, Suresh Chandra, M.K. Yadav	20	680.	GENOMICS RESEARCH AND ITS ROLE IN PLANT BREEDING Brijesh Kumar Maurya ¹ , Rajendra Kumar ¹ , Sahadev Singh ² ,
652.	GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE STUDIES FOR DIFFERENT CHARACTERS ON GREEN FODDER YIELD IN OAT (<i>AVENA SATIVA</i> L.) MONICA JYOTI KUJUR ^{1*} , S. K. BILAIYA ² AND A. K. MEHTA	201	681.	STUDIES ON GENETIC DIVERGENCE AND HERITABILITY IN TUBEROSE (<i>POLIANTHES TUBEROSE</i> LINN.) Vivak Ujjwal ¹ , Manoj Kumar Singh ¹ , Sunil Malik ¹ , Mohit Chaudhary ¹ , Ashish Kumar ¹ , Saurabh Tomar ² , Sonam Sharma ³ and Shalini Singh
653.	PRODUCTION, REPRODUCTION AND NUTRITIONAL STATUS OF CROSS-BRED COWS AND MURRAH BUFFALOES IN ACHHANERA BLOCK OF AGRA DISTRICT (U.P.) M.L.Bhaskar	202	682.	COMPUTATIONAL ANALYSIS OF CHITINASE GENE IN TRITICUM AESTIVUM Reetu Gour*, Bhaskar Tripathi*, Ajay K. Shukla*, Amar P.Garg
654.	IOSAFETY OF FEED INGREDIENTS AND ITS IMPACT ON MILK QUALITY Dr. P. K. Madke, Dr. Anant Kumar	202		
655.	GENETICS OF SOME YIELD AND QUALITY TRAITS IN BASMATI RICE (<i>ORYZA SATIVA</i> L.) TO IDENTIFY HETEROTIC COMBINATIONS, USING			

683.	AGRO-MORPHOLOGICAL CHARACTERIZATION AND SELECTION OF SUPERIOR GENOTYPES OF JACKFRUIT (<i>ARTOCARPUS HETEROPHYLLUS</i> LAM.) R. Mohammed Aseef*, M. Kavino*, R. M. Vijayakumar* and N. Meenakshiganesan	212	711.	Mohd Shahanbaj Khan and S. Hemalatha APPLICATIONS OF PRECISION AGRICULTURE IN HORTICULTURAL CROPS Ankit Kumar Pandey, Kirti Gupta, Mukesh Kumar Bairwa and Kuldeep Pandey	221
684.	ASSESSMENT OF GENETIC VARIABILITY INDUCED BY CADMIUM [CD(NO ₃) ₂] IN <i>LENS CULINARIS</i> MEDIK. Durre Shahwar, M.Y.K. Ansari, Sana Choudhary, Nusrat Jahan	212	712.	THE ROLE OF ICT ON WOMEN EMPOWERMENT S. Chaturvedi, Dan Singh, V. B. Singh and Gargi Paliwal	221
685.	GENETIC DIVERSITY OF ELITE GERMPLASM LINES OF WHEAT (TRITICUM AESTIVUM L.) BASED ON UPGMA CLUSTER ANALYSIS Prabhat Kumar, V. K. Mishra and B. Sinha	213	713.	ROLE OF MNREGA ON WOMEN EMPOWERMENT S. Chaturvedi, V. B. Singh, Dan Singh, Kshitij Parmar	222
686.	INOCULATION EFFECTS OF FUNGICIDE TOLERANT <i>RHIZOBIUM LEGUMINOSARUM</i> STRAIN RP1 ON <i>PISUM SATIVUM</i> GROWN IN KITAZIN AMENDED SOIL Mohammad Shahid and Mohammad Saghir Khan	213	714.	MUSHROOM CULTIVATION: A PRACTICE FOR EMPLOYMENT GENERATION OF RURAL YOUTH Md Nadeem Akhtar, *Santosh Kumar, **Vimlesh Kumar Pandey, ***Ravindra Kumar Sohane	222
687.	SUSTAINABILITY IN MAXIMUM SUGARCANE AND SUGAR PRODUCTION: OPPORTUNITIES AND LIMITATIONS IN UTTAR PRADESH Shri Prakash Yadav, Sonia Yadav, A. Kumar and B.L. Sharma	213	715.	BLUE REVALUATION IS NEXT REVOLUTION FOR NUTRITIONAL SECURITY IN INDIA Tarang Kumar Shah	222
688.	IMPORTANCE OF INTEGRATED WEED MANAGEMENT (IWM) FOR SUSTAINABLE AGRICULTURE Durgesh Singh, Asheesh Chaurasiya and Ashutosh Kumar	214	716.	A STUDY ABOUT SCALE TO MEASURE THE ATTITUDE OF RURAL WOMEN TOWARDS SELF HELP GROUPS Rajmani, Anurag Singh*, A. K. bbSingh, O. P.Yadav	223
689.	DRIP FERTIGATION SYSTEM: A SUSTAINABLE APPROACH TOWARDS IRRIGATION AND FERTILIZER MANAGEMENT IN AGRICULTURE Ankush, Dharam Pal Singh* and S.K. Sharma	214	717.	TO COMPARE IMPACT OF MNREGA ON SOCIO-ECONOMIC STATUS OF RURAL WOMEN IN UTTAR PRADESH AND BIHAR STATE Anurag Singh, Rajmani* and A. K. Singh	223
690.	OILSEEDS AND ITS PROCESSING: NEED OF DIVERSIFIED APPLICATION, CHALLENGES AND CONSUMPTION EXPECTATION Suresh Chandra, Samsher and Durvesh Kumari	214	718.	ROLE OF MUTATION BREEDING IN SUSTAINABLE AGRICULTURAL PRODUCTION Dhulgande G. S.* and Dhale D. A.	223
691.	ALLEVIATION OF CHILLING INJURY IN FRUITS USING ECOFRIENDLY APPROACHES Pushpa Kumari, M. Feza Ahmad, Md. Wasim Siddiqui*, Kalyan Barman** and Abha Kumari	215	719.	CITRUS IMPROVEMENT THROUGH CONVENTIONAL AND NON-CONVENTIONAL METHODS: CURRENT STATUS AND FUTURE PROSPECT Jagveer Singh, Anirudh Thakur, H. S. Dhaliwal and Kuldeep Pandey	224
692.	INTEGRATED WEED MANAGEMENT FOR SUSTAINABLE AGRICULTURE Vineeta Pandey, O.S. Dahiya and Archana Brar	215	720.	ADVANCES IN AGRICULTURAL AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT Mohit Husain*, Jagdeesh Prasad Rathore and Amit Kumar	224
693.	CLIMATE CHANGE ON IPM FOR SUSTAINABLE INTENSIFICATION OF AGRICULTURE Bhagchand Yadav, Raj Kumar Jakhar and Suman Yadav	215	721.	ORGANIC FARMING- A FARMER FRIENDLY VENTURE. N.A.Ganai, Zahoor Ahmed, Tahir Saleem and S.A.Hakeem	224
694.	AGRARIAN CRISIS AND ITS EMPACT ON INDIAN AGRICULTURE ECONOMY Deepak Kumar, Vandana Tyagi and Swati Thakur	216	722.	ORGANIC FORMULATION TO ENHANCE SEED GERMINATION IN CEREALS S.G. Telkar ¹ , SPS Solanki ² , Kamal Kant ¹ and Rajesh Kumar	225
695.	IMPACT OF SWARNA JAYANTI GRAM SWAROZGAR YOJANA (SGSY) Amit Kumar Mishra	216	723.	PRECISION AGRICULTURE IN CONSERVATION AGRICULTURE SYSTEM (PRECISION AGRICULTURE: A HIGH-TECH AGRICULTURE) Anjali Jingar and Vijay Laxmi Yadav	225
696.	IMPORTANCE OF COMMUNICATION AND MANAGEMENT SKILLS IN RURAL DEVELOPMENT Kshitij Parmar*, N. K. Singh**, D. K.Singh, A. K. Mishra, A. S. Maurya, Roop Kumar & B. P. Singh	216	725.	ATTITUDE OF FARMERS TOWARDS E-CHOUPAL A.P. Verma*, Parameswaranaik J. and M.N. Sawant	225
697.	PRADHAN MANTRI MUDRA YOJANA: MICRO UNITS DEVELOPMENT AND REFINANCE AGENCY Sunil Kumar, Satpal Singh*, Shoraj Singh	217	726.	IMPORTANCE AND CONSTRAINTS OF ORGANIC AGRICULTURE IN INDIA Shanti Devi Bamboriya ¹ , Sumitra Devi Bamboriya ² , Jitendra Singh Bamboriya	226
698.	ROLE PERFORMANCE OF RURAL WOMEN IN AGRICULTURAL ACTIVITIES Mishra Palak and Badodiya S.K.	217	727.	IMPORTANCE OF GREEN MANURING IN SUSTAINING AGRICULTURE K. Sai Krishna Prasad and Shiva Shankar K	226
699.	AGRICULTURAL INNOVATIONS FOR SUSTAINABLE CROP PRODUCTION Kavita, Rahul, Gazal and M. S. Darvhankar	217	728.	INTEGRATED NUTRIENT MANAGEMENT IN KHARIF SORGHUM (<i>Sorghum bicolor</i> L.) Lalita verma ^{1*} S.C.Sallawar ¹ and Maya yadav	226
700.	EFFECT OF NUTRIENT MANAGEMENT PRACTICES AND FOLIAR NUTRITION ON SUSTAINABLE PRODUCTION OF FIELDPEA (<i>PISUM SATIVUM</i>) Baldev Ram, S. S. Punia, Sarfraz Ahmad, J. P. Tatarwal, H. R. Chaudhary and Pratap Singh	218	729.	INTEGRATED NUTRIENT MANAGEMENT IN CABBAGE (<i>BRASSICA OLERACEA</i> VAR. <i>CAPITATA</i> L.) Rakesh Kumar Mavliya*, Dr. R. K. Noralia**, Suresh Kumar Choudhary***, Om Prakash Rolaniya	226
701.	MASS MEDIA IN AGRICULTURE Gaurav Kumar, Satendra Kumar and Sushil Kumar	218	730.	INTEGRATED NUTRIENT MANAGEMENT IN SUSTAINABLE AGRICULTURE BY IMPROVING SOIL FERTILITY, CROP GROWTH AND CROP PRODUCTIVITY Pragati kumar maurya, satendra kumar, Rahul verma	227
702.	GOVERNMENTAL STRATEGIES FOR SKILLING INDIA: FUTURISTIC PROPOSITIONS Anuj Pratap Singh, A.S. Maurya and Kshitij Parmar	218	731.	EFFECT OF ORGANICS AND INORGANICS APPLICATION ON PRODUCTIVITY AND CHEMICAL COMPOSITION OF SOYBEAN GROWN IN SEMI-ARID VERTISOLS Jyoti Bangre* Bharat Singh* and Shish Ram Jakhar**	227
703.	HUMAN RESOURCE MANAGEMENT- EMERGING TRENDS IN INDIA Ashok Kumar Kushwaha and A. S. Maurya	219	732.	RESILIENCE THINKING: SUSTAINING INDIAN AGRICULTURE IN A CHANGING CLIMATE Sachin Shinde ¹ , Minakshi Neware ² , Priya Pardeshi ³ , Swapnil Tayade ⁴ and Nandan Tayade	227
704.	ENHANCEMENT OF SUGARCANE PRODUCTIVITY IN SUBTROPICAL INDIA Ved Prakash, N.K. Pruthi*, S.K.Singh, Viresh Singh and B.L.Sharma.	219	733.	EFFECT OF ORGANIC MANURE ON GROWTH CHARACTERS OF AFRICAN MARIGOLD (<i>TAGETES ERECTA</i> L.) CV. PUSA NARANGI GAINDA Harendra Tiwari	228
705.	POTENTIAL AND PROSPECTS OF FLY ASH IN AGRICULTURE: AN ECO FRIENDLY APPROACH Shalini Singh Visen	219	734.	PRECISION AGRICULTURE IN CONSERVATION AGRICULTURE SYSTEM Govind Ram Choudhary*, Vimal Nagar** and Radhe Shyam Kherwa	228
706.	AQUAPONICS: AS SUSTAINABLE FISH PRODUCTION TECHNIQUES Rathod Vishal, Rajesh, Tarang Kumar Shah and Ranjeet singh	219	735.	INTELLECTUAL PROPERTY RIGHTS IN INDIA Kavita Singh, R.K. Meena and R.V.Gautam	228
707.	BIOTECHNOLOGY IN SUSTAINABLE DEVELOPMENT Kalpana Singh and Bindhya Chal Yadav	220	736.	EFFECT OF ORGANIC MANURES AND MICRONUTRIENT ON GROWTH, YIELD AND QUALITY OF TOMATO (<i>SOLANUM LYCOPERSICUM</i> L.) Bhanu Prakash Singh and Dr. S. Saravanan	229
708.	SUSTAINABLE DEVELOPMENT OF LAND RESOURCES AND ITS MANAGEMENT Mukesh Kumar	220	737.	INDIGENOUS TECHNICAL KNOWLEDGE OF FARMERS OF KANDI BELT OF JAMMU REGION Neerja Sharma*, R.K.Arora**, Pawan Sharma***, Vinod Gupta*, Sanjay Khajuria*, Amit Mahajan*, Shalini Khajuria	229
709.	ECOLOGICAL LITERACY: EDUCATING EVERY ONE FOR A SUSTAINABLE WORLD Preety Agarwal	220	738.	RESPONSE OF VERMICOMPOST AND NITROGEN ON GROWTH, YIELD AND QUALITY IN BOTTLE GOURD [<i>LAGENARIASICERARIA</i> (MOL.) STANDL.] Karshan Kumar*, P.K. Yadav* and Desh Raj Choudhary	229
710.	ARTIFICIAL NEURAL NETWORK AND MOLECULAR BIOMARKERS FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT IN RICE (<i>ORYZA SATIVA</i>) GROWN UNDER SALINE STRESS				

739.	SRI METHOD OF PADDY CULTIVATION: AN ALTERNATIVE ECONOMIC APPROACH Punit Kumar Agarwal, Ajai Kumar Rai, Premchand	230	768.	AshutoshPathak* and Dr. V. C. Pandey ROLE OF AGRICULTURE AND RURAL DEVELOPMENT	239
740.	SUGGESTIONS OF STUDENTS TO IMPROVE RURAL AGRICULTURE WORK EXPERIENCE PROGRAMME IN RAJASTHAN STATE Kailash Chand Jakhar, Rajneesh	230	769.	Aastha, Vaishali, Shilpy Singh and Vivek Rana ADULTERATION IN HORTICULTURAL PRODUCE	239
741.	ORGANIC FARMING- A FARMER FRIENDLY VENTURE N.A.Ganai, Zahoor Ahmed, Tahir Saleem and S.A.Hakeem	230	770.	Amrita Kumari DRUGGERY REDUCTION TECHNOLOGIES FOR FARM WOMEN AND FARM WORKERS - NEED OF THE HOUR	239
742.	SUSTAINABLE DEVELOPMENT OF LAND AND WATER RESOURCES USING REMOTE SENSING & GIS TECHNOLOGY, CHITRAKOOT DISTRICT (U.P.) Nipun Kumar Pandey, Beena Singh	231	771.	Savita Arya*, Satya Prakash**, Sarita Joshi****, Kirti M.Tripathi****, Vinita Singh PRECISION FARMING IN SOLANACEOUS CROPS	240
743.	ROLE OF GREEN MANURING IN SUSTAINABLE CROP PRODUCTION Bsta Ram Chaudhary	231	772.	Debarati Datta* ¹ and Sourav Ghosh PYRETHRUM A POTENTIAL BIOPESTICIDE	240
744.	ENHANCE THE ORGANIC MATTER IN SOIL THROUGH MODERN AGRICULTURAL PRACTICES Manikant Prabhakar	231	773.	Satyapriya Singh*, Varun Saini and Venktesh Y N THE ROLE OF ICT IN INDIA'S AGRICULTURE AND RURAL DEVELOPMENT	240
745.	ORGANIC WEED MANAGEMENT IN FIELD CROPS Bolta Ram Meena	231	774.	Seema Jat ¹ Bheru Lal Kumhar ² and Dr K.C. Sharma VEGETABLE INTERCROPS: A PATHWAY FOR SUSTAINABLE AGRICULTURE	241
746.	ORGANIC AGRICULTURE: WAY TO SUSTAIN LIFE Ardeep	232	775.	Sangeet Kumar*, S.K. Dhankhar and Vinod Kumar ANTHROPOMETRIC MEASUREMENT OF RURAL SCHOOL CHILDREN AGED 6-12 YEARS	241
747.	SMART FERTILIZER FOR SUSTAINABLE CROP PRODUCTION JoginderPabnawa	232	776.	Ruchi Pandey, Rajesh Singh, Sadhna Singh, Dipti Giri EVALUATION OF FAST FOODS PREFERENCES AMONG COLLEGE STUDENTS OF RURAL AND URBAN AREAS	241
748.	SOIL HEALTH MANAGEMENT THROUGH CARBON SEQUESTRATION FOR SUSTAINABLE AGRICULTURE Maneesh Bhatt* and Shiv Singh Meena	232	777.	Jyoti Tiwari, Sadhna Singh, Anjali Yadav SUSTAINABLE AGRICULTURE: NEED OF THE HOUR	242
749.	COW URINE BOON FOR SUSTAINABLE AGRICULTURE Ravindra Kumar and Ashutosh Kumar Arya	233	778.	Alok. K. Sahoo*, Rabeesh K. Verma*, Shantanu Rakshit*, Sunil Sunani ICTs IN DISTRIBUTION AGRICULTURAL MARKETING INFORMATION	242
750.	ITEM-WISE AND SPACE-WISE CONTENT ANALYSIS OF SWACHH BHARAT MISSION IN HINDI NEWSPAPERS Ashma ^{1*} , Rita Goel ¹ and Mujahid Khan	233	779.	Venkata Reddy .I, Nagesh. H, Gopi Krishna.T RELEASE BEHAVIOUR OF BORON IN LOW AND HIGH BORON STATUS SOILS VIS-A-VIS ZINC AND PHOSPHORUS APPLICATION	242
751.	NEWSPAPERS READING FREQUENCY AND READERSHIP PATTERN TOWARDS SWACHH BHARAT MISSION Ashma ^{1*} , Rita Goel ¹ and Mujahid Khan	234	780.	Nidhi Kamboj and R. S. Malik EFFICACY OF <i>TRICHODERMA HARZIANUM</i> AGAINST STEM ROT OF FENNEL CAUSED BY <i>SCLEROTINIA SCLEROTIUM</i> (LIB.) DE BARY	243
752.	READING RESPONSES REGARDING SWACHH BHARAT MISSION IN HINDI NEWSPAPERS Ashma ^{1*} , Rita Goel ¹ and Mujahid Khan	234	781.	Richhpal Kumawat, Jitendra Sharma, Shailesh Godika, V.K. Bairwa and K.K. Jat EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON NUTRIENT REMOVAL UNDER RICE WHEAT ROTATION	243
753.	CONSTRAINTS PERCEIVED BY SELF-HELP GROUPS AND ASSESSING THEIR IMPACT IN PROMOTION OF ENTREPRENEURIAL SKILLS IN MEWAT DISTRICT OF HARYANA Shanki Kamboj ¹ , J.S. Malik ¹ , Pawan Kumar ^{1*} and Mujahid Khan	234	782.	Robin kumar, Vivak kumar and Ashish dwivedi ROLE OF WEATHER PARAMETERS ON BOLLWORMS INFESTATION IN SHEDDING MATERIAL INBT AND NON-BT COTTON GENOTYPES	243
754.	SOCIO-ECONOMIC PROFILE OF SELF-HELP GROUP'S IN MEWAT DISTRICT OF HARYANA STATE Shanki Kamboj ¹ , J.S. Malik ¹ , Pawan Kumar ^{1*} and Mujahid Khan	235	783.	Roomi Rawal and K.K. Dahiya PRODUCTION AND CHARACTERIZATION OF BIOCHAR PRODUCED FROM DIFFERENT FEEDSTOCKS	243
755.	CONSTRAINTS PERCEIVED BY SELF-HELP GROUPS AND ASSESSING THEIR IMPACT IN PROMOTION OF ENTREPRENEURIAL SKILLS IN MEWAT DISTRICT OF HARYANA Shanki Kamboj ¹ , J.S. Malik ¹ , Pawan Kumar ^{1*} and Mujahid Khan	235	784.	Shiv Vendra Singh and Sumit Chaturvedi ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM SUGARCANE	244
756.	IDENTIFICATION OF SECRETS OF HEALTH WHICH EVERY RURAL WOMAN SHOULD KNOW IN WESTERN UTTAR PRADESH Kirti M. Tripathi, Sarita Joshi, Savita Arya and Vinita Singh	235	785.	Kolluri Ramu ¹ , Amit Kumar ² and Shashank Gupta IMPORTANCE OF WILD RELATIVES IN CROP IMPROVEMENT	244
757.	SUCCESS STORY OF ORGANIC TURMERIC PRODUCTION AND PROCESSING: WAY TO ENHANCE SOCIO-ECONOMIC STATUS AND ITS HORIZONTAL EXPANSION IN WESTERN UTTAR PRADESH Kirti M. Tripathi, Omkar Singh, Satish Kumar, Sarita Joshi ¹ , Savita Arya ² and Vinita Singh	236	786.	Deva Ram Meghawal and Ashok Kumar Malav IMPORTANCE OF WILD RELATIVES IN CROP IMPROVEMENT	244
758.	AGRIHOTRA FARMING: A VEDIC FARMING TECHNIQUE TO BUILT INNATE IMMUNITY IN PLANT FOR BETTER CROP PRODUCTION Shivendu Pratap Singh Solanki ¹ , S.G. Telkar ² , Vandana ³ and Kunzang Lamo	236	787.	Deva Ram Meghawal and Ashok Kumar Malav HERBICIDAL POTENTIAL OF ETHOXYLSULFURON AND TRIASULFURON ON SEDGES IN TRANSPLANTED RICE	244
759.	IMPORTANCE OF COMMUNICATION IN AGRICULTURAL DEVELOPMENT Ankit Singh Yadav ¹ , Jagatpal ² Ramvinay Pal ³ , Ashwani kumar Verma ⁴ and Manisha Goswami	236	788.	Samarth Tewari, Rohitashv Singh and Reena Verma RESPONSE OF URDBEAN [<i>VIGNA MUNGO</i> (L.) HEPPER] TO PHOSPHORUS FERTILIZATION AND THIOUREA ON YIELD, QUALITY, NUTRIENT CONTENT AND UPTAKE	245
760.	ICTs IN AGRICULTURAL MARKETING DEVELOPEMENT Venkata Reddy .I ¹ , Nagesh.H	237	789.	Sanju Choudhary ¹ , O.P. Sharma ² , Lali Jat ³ and Pankaj kishanawat EFFECT OF SEED BIO-PRIMING WITH CONSORTIA OF BIOAGENTS <i>TRICHODERMA HARZIANUM</i> AND <i>PSEUDOMONAS FLUORESCENS</i> AGAINST <i>FUSARIUM OXYSPORUM</i> F. SP. <i>LYCOPERSICI</i>	245
761.	ICTs: A PERSPECTIVE OF RURAL DEVELOPMENT Nagesh.H ¹ , Venkata Reddy .I ² , Mukundarao.B	237	790.	Saurav Govind Rao*, Mukesh Srivastava ¹ , Ved Ratan and Shubha Trivedi DAILY SUSPENDED SEDIMENT ESTIMATION USING FL, MLR AND SRC MODELS IN VAMSADHARA RIVER BASIN, INDIA	245
762.	INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE CROP PRODUCTION Giriraj Gupta ¹ , Rekha Sodani	237	791.	Shreya Nivesh ¹ and Pravendra Kumar SCREENING OF PROMISING SUGARCANE GENOTYPES FOR RESISTANCE TO RED ROT DISEASE (<i>COLLETOTRICHUM FALCATUM</i>) IN EASTERN UTTAR PRADESH	246
763.	PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY) Jagatpal ^{1*} , Ankit Singh Yadav ² , Dheerendra Kumar	237	792.	Y. P. Bharti, V.B. Singh, Atul Singh, I.S. Singh and B.L. Sharma EFFECT OF DIFFERENT HERBICIDES ON WEED DYNAMICS OF SEMIDRY RICE	246
764.	ADVANTAGES OF TRADITIONAL AND MODERN TECHNOLOGY IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT Ranjeet Rawat	238	793.	K. Hemalatha and N.R. Sandhya SEASONAL INCIDENCE PATTERN OF MUSTARD APHID, <i>LIPAPHIS ERYSIMI</i> (KALT.) IN TARAI REGION OF UTTAR PRADESH AND UTTARAKHAND	246
765.	VARIOUS DIMENSIONS OF WOMEN'S EMPOWERMENT THROUGH SELF HELP GROUPS Anuradha Ranjan Kumari ¹ , Rajneesh Srivastav ² , Kamlesh Meena ³ and R N Prasad	238	794.	C.P. Singh and Shweta Patel MANAGEMENT OF ROOT-KNOT NEMATODE <i>MELOIDOGYNE INCOGNITA</i> AND <i>FUSARIUM OXYSPORUM</i> F. SP. <i>CUCUMERINUM</i> ON CUCUMBER USING SEED TREATMENT WITH THE BIOAGENTS IN POLYHOUSE	247
766.	A REVIEW ON INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE AGRICULTURE Veena Rathore	238	795.	Jaydeep Patil*, Anil Kumar, Saroj Yadav and S R Goel EVALUATION OF PLANT GROWTH PROMOTING (PGP) TRAITS OF RHIZOBIA NODULATING <i>SESBANIA SESBAN</i> FOR BIOFERTILIZER PRODUCTION RETRIEVED FROM INDIAN SOILS	247
767.	ROLE OF PMGSY IN RURAL TRANSFORMATION AND SUSTAINABLE DEVELOPMENT: A CASE STUDY OF DISTRICT GONDA (U.P.)			Kuldeep Singh*, Jeniffer Christeena Masih and Rajesh Gera	247

796.	SECOND GENERATION BIO-FUEL PRODUCTION FROM INSTITUTIONAL WASTE OR BY PRODUCT. Konika Jain, Malti Chauhan, Vishi,	247	821.	TO ASSESS THE SCOPE OF SUMMER MOONG (<i>VIGNA RADIATA</i> L.) IN TERMERIC (<i>CURCUMA LONGA</i> L.) Balvir Kaur* and Paramjit Kaur Sraw and Kuldeep Singh	255
797.	RESPONSE OF GA ₃ AS FOLIAR SPRAY ON THE PERFORMANCE OF GLADIOLUS VARIETIES (<i>GLADIOLUS GRANDIFLORUS</i> L.) Vishwa Nath, Sheelendra Kumar and Brijesh Kumar	248	822.	EFFECT OF GLUCOSE CONCENTRATION ON GROWTH OF BACTERIAL ISOLATES UNDER ALUMINIUM STRESS Priyanka Arora ¹ *, Geeta Singh ² and Archana Tiwari	255
798.	EVALUATION OF <i>ABELMOSCHUS ESCULENTUS</i> UNDER DIFFERENT ORGANICALLY MANAGED SOIL OF PUNJAB Shelly Sanasam ¹ , Sreeparna Chowdhury ² , Shailesh Kumar Singh ³ , Sanjeev Kumar	248	823.	THE CHEMISTRY OF ROSE OIL Manika Barar ¹ , Anuj Kumar ² and Kaviraj	255
799.	STUDIES ON PHYSIOLOGICAL CHARACTERIZATION OF FIBRE DEVELOPMENT IN COTTON UNDER DROUGHT STRESS CONDITION (<i>Gossypium hirsutum</i> L.) Bonde Shilpa and C. N. Chandrasekhar	248	824.	COMBINED EFFECT OF FLY ASH, ROOT-KNOT NEMATODE AND SIMULATED ACID RAIN ON PUMPKIN (<i>CUCURBITA MOSCHATA</i> .) CROP Gufran Ahmad, Abrar A. Khan & Safiuddin	256
800.	STUDIES ON SEED STORAGE BEHAVIOUR OF <i>MUSA BALBISIANA</i> , A WILD PROGENITOR OF BANANAS AND PLANTAINS Shivani ^{1, 2} , Rajeev Kumar ² , Anuradha Agrawal	248	825.	BIOLOGY AND MORPHOMETRICS OF ONION THRIPS, <i>THRIPS TABACI</i> LINDEMANON CABBAGE, <i>BRASSICA OLERACEA</i> Rabiya Basri and M. Shafiq Ansari	256
801.	SCREENING AND EVALUATION OF RESISTANCE VARIETIES OF <i>CICER ARIETINUM</i> AGAINST <i>FUSARIUM WILT</i> DISEASE Shivani Yadav ¹ , Sanjeev Kumar ² *, Sumant Bindal	249	826.	USE OF TILLING IN PLANT DISEASE MANAGEMENT Anmol Singh Yadav ¹ , Prahlad Masurkar	256
802.	BREEDING FOR BROWN PLANTHOPPER (<i>NILAPARVATA LUGENS</i> Stål.) RESISTANCE: AN INNOVATIVE APPROACH FOR SUSTAINABLE RICE IMPROVEMENT Shoukat Ahmad Rather, Indra Deo and Neha Joshi	249	827.	GROWTH AND YIELD OF IRRIGATED <i>BT</i> COTTON (<i>GOSSYPIMUM HIRSUTUM</i> L.) AS INFLUENCED BY DIFFERENT AGRONOMIC PRACTICES Basavaraj ¹ , B. M. Chittapur ² , A. S. halepyati ³ , A. Ameregouda ⁴ , G. S. yadahalli ⁵ , and M.Y. Ajayakumar	257
803.	POTENTIAL OF ABUSCHULAR MYCORRHIZHAA AGAINST STRESS CONDITION Simranjeet Singh ¹ , Naresh ¹ , Harshal Ashok Avinash ² , Bijendra Kumar	250	828.	EFFECT OF POLYTHENE MULCHING AND PLANTING DENSITY ON YIELD AND ECONOMICS OF <i>BT</i> COTTON (<i>GOSSYPIMUM HIRSUTUM</i> L.) UNDER IRRIGATED CONDITIONS. Basavaraj ¹ , B. M. Chittapur ² , A. S. halepyati ³ , A. Ameregouda ⁴ , G. S. yadahalli ⁵ , and M.Y. Ajayakumar	257
804.	EFFECTS OF SOME MEDICINAL PLANT EXTRACTS AGAINST MULTIDRUG RESISTANCE HUMAN PATHOGENIC BACTERIA Neha pai ¹ , Narendra pratap singh ² , Mayadatt joshi ³ , Ram saxena ⁴ and Dev anand	250	829.	EFFECT OF POLYTHENE MULCHING AND PLANTING DENSITY ON YIELD AND QUALITY OF <i>BT</i> COTTON (<i>GOSSYPIMUM HIRSUTUM</i> L.) UNDER IRRIGATED CONDITIONS. Basavaraj ¹ , Chittapur, B. M., Halepyati, A. S., Ameregouda, A., Yadahalli, G. S., Ajayakumar, M.Y.	257
805.	ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTRIA FROM SUGARCANE Kolluri Ramu ¹ , Amit kumar ² and Shashank Gupta	250	830.	STUDIES ON QUALITY STABILIZATION OF WATER MELON (<i>CITRULUS LANATUS</i>) SQUASH WITH THE INCORPORATION OF XANTHAN GUM Todik Jimmy T. Sangma*, A. K. Banik**, A. K. Chaurasiya, RapungaFlory H*, and Elavena War	257
806.	EVALUATION OF BIOCONTROL AGENTS AGAINST PHYTOPHTHORA BLIGHT IN PIGEONPEA Sunayana, R.S. Sangwan and Sombir Nimbai	251	831.	INDIGENOUS TECHNICAL KNOWLEDGE USED IN PADDY CULTIVATION IN RAJNANDGAON DISTRICT, CHHATTISGARH Leeleesh Kumar Sahu, Mohamed Arshad Ayub and Indra Kumar Kemro	258
807.	STABILITY FOR SEED COTTON YIELD AND ITS COMPONENT TRAITS IN ASIATIC COTTON (<i>GOSSYPIMUM ARBOREUM</i> L.) Sunayana, R.S. Sangwan and Sombir Nimbai	251	832.	TRADITIONAL USE OF MEDICINAL PLANTS BY RURAL INHABITANTS: A CASE OF POKHRA BLOCK IN DISTRICT PAURI GARHWAL Sushma Rawat*, Bhuvnesh Nagar and Munesh Kumar	258
808.	STUDIES ON PHOSPHORUS AND SULPHUR FERTILIZATION IN PIGEONPEA AND ITS RESIDUAL EFFECTS ON SUCCEEDING OATS CROP Jaibir Tomar and Sudhir Kumar	251	833.	WILD EDIBLE MUSHROOM THEIR USES AND IMPORTANCE TO THE PEOPLE Siddarth Nandan Rahul ¹ and Alka Sahrawat	258
809.	STUDY ON THE EFFECTS OF PSB AND RHIZOBIUM WITH THEIR COMBINATIONS ON NUTRIENT CONCENTRATION AND UPTAKE OF CHICKPEA (<i>CICER ARIETINUM</i> L.) Akansha Singh and A.K. Sachan	251	834.	EXPLOITATION OF MALE STERILITY IN VEGETABLE IMPROVEMENT S. G. Thakare *, A. P. Wagh and S. V. Bhavar	259
810.	STUDY THE PATH ANALYSIS OF DIFFERENT ORIGIN FABA BEAN (<i>Vicia faba</i> L.) GENOTYPES Praveen Kumar ¹ , Priyanka Swami, Bhartendu Jain and Rikshita roy	252	835.	STUDIES ON EFFECT OF MAGNETIC TREATMENT ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF PADDY (<i>ORYZA SATIVA</i> L.) Yogita M. Yadav, S.G. Mahadik and S.S. Kamble	259
811.	EFFECT OF SALT STRESS ON GERMINATION, EARLY SEEDLING GROWTH AND PHYSIOLOGICAL PARAMETER OF RICE (<i>ORYZA SATIVA</i> L.) Subhash kumar ¹ , A.H. Khan ¹ , Shashank srivastav	252	836.	EXPLORING POTENTIAL OF SUGARBEET AS AN ALTERNATE SOURCE OF BIO-ETHANOL PRODUCTION IN INDIA Varucha Misra, A. K. Mall* and A. D. Pathak	259
812.	INTEGRATED NUTRIENT MANAGEMENT TECHNIQUES FOR COMPARISON OF MORPHOLOGICAL TRAITS IN RADISH (<i>RAPHANUS SATIVUS</i> L.) Sumant Bindal ¹ , Shivani Yadav ² , Bijendra Kumar ³ , Akashdeep Kamboj	252	837.	A REVIEW ON INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE AGRICULTURE Veena Rathore	260
813.	STUDIES ON THE EFFECT OF SULPHUR, ZINC, BORON AND IRON ON ROOT AND SHOOT DYNAMICS AND PRODUCTIVITY OF WHEAT [<i>TRITICUM AESTIVUM</i> L.] Sunil Kumar and V.K. Verma	253	838.	ASSESSMENT OF FOOD HABITS AND DIETARY INTAKE OF PUNJABI WOMEN Vibhuti Arya and Vinita Singh	260
814.	ASSOCIATIONS AMONG VARIOUS SEED QUALITY PARAMETERS IN FENUGREEK (<i>TRIGONELLA FOENUM-GRÆCUM</i>) Sunil Kumar, Axay Bhuker, Pradeep Singh and V.P.S. Sangwan	253	839.	MAJOR PEST OF PEA AND THEIR INTEGRATED PEST MANAGEMENT Vikrant and D. R. Singh.	260
815.	BIOLOGY AND FEEDING POTENTIAL OF <i>COCCINELLA SEPTEMPUNCTATA</i> (LINNAEUS) ON NATURAL AND ARTIFICIAL DIETS UNDER LABORATORY CONDITION Suraj Kumar ¹ , Rajendra Singh and Sudhir Kumar	253	840.	INFLUENCE OF EXOGENOUSLY APPLIED SALICYLIC ACID ON PHOTOSYNTHETIC PIGMENTS, ANTIOXIDANT ENZYME ACTIVITIES IN MANGO CV. AMRAPALI Vinai Kumar ¹ , S.K. Guru ² , A. K.Gaur ³ , J. Kumar ⁴ and Gurdeep Bains	261
816.	EFFICACY OF PLANT EXTRACTS AGAINST ALTERNARIA ALTERNATA CAUSING ALTERNARIA BLIGHT OF FENNEL Suresh Meena*, R.P. Ghasolia and Jitendra Sharma	253	841.	EFFECT OF DIFFERENT INITIAL POPULATION DENSITIES OF <i>MELOIDOGYNE GRAMINICOLA</i> ON THE PLANT GROWTH OF SORGHUM Vinod Kumar* Anil Kumar and K K Verma	261
817.	EFFECT OF FOLIAR SUPPLEMENTATION ON PRODUCTIVITY OF PEARL MILLET [<i>Pennisetum glaucum</i> (L.)] Surgyan Rundla and R.C. Baiirwa	254	842.	RECENT ADVANCES IN BEE COMMUNICATION AND ORIENTATION Visvash Vaibhav, Rahul Singh, Rajat Deshwal, Anuj Kumar and Nitin Kumar	261
818.	EFFECT OF PHOSPHORUS AND POTASSIUM LEVELS ON HERBAGE AND SEED YIELD OF OAT (<i>AVENA SATIVA</i> L.) Jayanti Tokas ¹ , Surina Bhadu ¹ * and Satpal	254	843.	PER SE PERFORMANCE OF STRAINS AND CORRELATION STUDIES IN BITTER GOURD (<i>MOMORDICA CHARANTIA</i> L.) UNDER SUBTROPICAL CONDITIONS OF GARHWAL HILLS Vivek Singh, D.K. Rana and K.N. Shah	262
819.	SUITABILITY OF CUT CORMS AS PLANTING MATERIAL ON GROWTH AND YIELD IN DIFFERENT GLADIOLUS (<i>GLADIOLUS GRANDIFLORUS</i> L.) VARIETIES Swapnil Bharti, Urfi Fatmi, Upesh Chandrakar and V. Priyadarshini	254	844.	STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF TOMATO CV. PUNJAB CHHUHARA UNDER COLD ARID CONDITIONS OF KARGIL. Tahir Saleem ¹ and N.A.Ganai	262
820.	PATHOGENIC POTENTIAL OF OROBANCHE AEGYPTIACA PERS.ON BRINJAL (<i>SOLANUM MELONGENA</i> L.) Gulwaiz Akhter* and Tabreiz Ahmad Khan	255	845.	EFFECT OF NANOCITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION Parul Chaudhary, Priyanka khati	262
			846.	POSTHARVEST MANAGEMENT OF LOSSES IN HORTICULTURAL CROPS Anuradha*, R.K. Goyal, Arvind Malik	262
			847.	WILT AND PYTHIUM DISEASE MANAGEMENT IN GREENHOUSE Nisha Jangre ¹ , Anjit Jangre ² , Pappu Lal Bairwa ¹ , Bhanupratap Jangde	263

848.	INFLUENCE OF INDOLE-3-BUTYRIC ACID ON ROOTING EFFICACY IN DIFFERENT CARNATION (<i>DIANTHUS CARYOPHYLLUS</i> L.) GENOTYPES UNDER PROTECTED CONDITION Prince ^{1*} , Arvind Mailk ² and Vivek Beniwal	263	874.	M. Swetha, Harmeet Singh Janeja, Mylaru Sravani and K. Rajinesh	271
849.	STUDIES ON BIOFILM DEVELOPMENT AND MULTIFARIOUS PLANT GROWTH PROMOTING ACTIVITIES OF SELECTED RHIZOBACTERIA AND WHEAT ROOT COLONIZATION BEHAVIOR OF BACILLUS SP. Firoz Ahmad Ansari and Iqbal Ahmad	263	875.	COMMERCIAL APPLICATION OF INDIAN UNDERUTILIZED FRUIT AND VEGETABLE CROPS FOR ENVIRONMENT SUSTAINABILITY Ashwani Kumar Gautam	271
850.	INFLUENCE OF ORGANIC FERTILIZERS ON PRODUCTIVITY AND MEDICINAL PROPERTIES OF ALOE VERA Dinesh Kumar Marapi*, Hemant Kumar Jangde and Saurabh Kumar	264	876.	WATERBORNE COATINGS IN ECONOMICS WITH POLLUTION FREE ENVIRONMENT Deepti Shikha & Rita Awasthi	271
851.	EFFECTS OF DIFFERENT INOCULUM LEVELS OF ROOT KNOT NEMATODE, <i>MELOIDOGYNE INCOGNITA</i> ON GROWTH AND YIELDS OF <i>AMMI MAJUS</i> L. Yasar Nishat*, Mohd Danish, Chanchal Chaudhary, Atirah Tauseef, Hisamuddin	264	877.	DECOMPOSITION OF KITCHEN ORGANIC WASTE Pankaj Chhabra	272
852.	INFLUENCE OF SEEDLING AGE AND PLANT HORMONES ON YIELD AND ECONOMICS OF ONION (<i>ALLIUM CEPA</i> L.) Desh Raj Choudhary ^{1*} and Satesh Kumar	264	878.	AGRO PHYSIOLOGICAL CHARACTERISTICS OF QPM GENOTYPES IN DIFFERENT CLIMATIC CONDITION Saket Kumar ^{1*} , Dan Singh Jakhar ² , Pavan Devesh ² , Rajeev Pratap Singh ¹ , Rajesh Singh	272
853.	ISOLATION OF ZINC SOLUBILIZING BACTERIA FROM DIFFERENT REGIONS OF VARANASI AND MIRZAPUR DISTRICTS Indrajeet Kumar Mandal ^{1*} , Jay Sankar Yadav ² and Janardan Yadav	265	879.	ASSESSMENT OF CYTO-GENOTOXICITY CAUSED BY HEAVY METAL (CD) IN <i>LYCOPERSICON ESCULENTUM</i> MILL. Nusrat Jahan and M Y K Ansari	272
854.	PEST INCIDENCE AND PREVALENT CONTROL STRATEGIES IN SOME APPLE ORCHARDS OF CENTRAL KASHMIR IN VOGUE DURING BLOOM AND POST BLOOM. Ishana Qadir and Ayesha Qamar	265	880.	RISK ASSESSMENT IN NANO-FOOD PACKAGING Yogesh Kumar	272
855.	RESOURCE CONSERVING RICE (<i>ORYZA SATIVA</i> L.) PRODUCTION TECHNOLOGIES – A REVIEW Sanjeev Kumar Kashyap*, A.V. Dahiphale, Sandeep Kumar and Hari Singh	265	881.	INNOVATIVE APPROACH FOR SUSTAINABLE AGRICULTURE, LIVELIHOOD AND ENVIRONMENTAL SECURITY Aadil Yousuf Tantray and Altaf Ahmad	273
856.	CLIMATE CHANGE AND IT'S CONSEQUENCES ON HORTICULTURAL PLANTS ¹ Kulveer Singh Yadav, Akhilesh K. Pal, Anil K. Singh, Sandeep K. Mauriya and Sunil K. Maurya	265	882.	BIODIVERSITY AND ITS VALUES Ritu Verma	273
857.	RESPONSE OF ENVIRONMENTAL CHANGES AS STRESS ON PLANTS ¹ Kulveer Singh Yadav, Akhilesh K. Pal, Anil K. Singh, Sandeep K. Mauriya and Sunil K. Maurya	266	883.	GOLD COATED NANOPOROUS MEMBRANE BASED SOLID PLATFORM FOR RAPID DETECTION OF MESOTHELIN AS A POTENTIAL CANCER BIOMARKER Sweeti Ahlawat ¹ , Anuj Nehra ^{1*} , K.P. Singh ^{1,2} , Veena Pande	273
858.	ROLE OF SINGLE CROSS HYBRID MAIZE IN ENSURING FOOD SECURITY IN THE PRESENT CLIMATE SCENARIO Jami Naveen, Guntamukkala Babu Rao and Bollaveni Sathish Kumar	266	884.	BIOCHEMICAL EVALUATION OF <i>OPAQUE2</i> INTROGRESSED LINES IN MAIZE FOR FE, ZN AND TRYPTOPHAN: PARAMOUNT STAPLE FOOD IN CONTEXT TO GLOBAL NUTRITION Shamly Gupta and S. Lata	274
859.	CLIMATE CHANGE AND ITS IMPACTS ON INDIAN AGRICULTURE Sandeep Kumar ¹ , Ram Swaroop Meena, Shishram Jakhar, ² Chetan Kumar Jangir and Pradeep Kumar	266	885.	SMART BREEDING: A NEW PLATFORM FOR CROP IMPROVEMENT Mukesh Kumar ^{1*} , Manish Kr. Choudhary, Ganesh Kr. Koli, Gayatri Kumawat And Renu Yadav	274
860.	CROP RESIDUE MATERIAL RESOURCE MANAGEMENT ROLE OF MODERN AGRICULTURE IN INDIA Sandeep Kumar* Gautam veer Chauhan* Girish Goyal*, Raj Kumar** and Durgesh Patel	267	886.	SOME STEPS TOWARDS GREEN CHEMISTRY Deepshikha	274
861.	ENVIRONMENTAL IMPACTS OF GENETICALLY MODIFIED (GM) CROP Sandeep K. Mauriya, A.K.Pal, Kulveer Singh Yadav, Deeptimayee Sahoo, Sunil K. Maurya	267	887.	PROBLEMS, PROSPECTS AND ADVANTAGES OF TRANSGENIC CROPS Maurya and Shiv prasad	274
862.	MANAGEMENT OF LAND RESOURCE USING PHYTOREMEDIATING PLANT SPECIES Pushpendra ¹ and Subhash Malik	267	888.	STUDIES ON HYBRIDIZATION AND GENETIC DIVERSITY IN COWPEA (<i>VIGNA UNGUICULATA</i> L. WALP.) Puthem Robindro Singh ¹ , Bipramani Nameirakpam	275
863.	PHYTOEXTRACTION OF CADMIUM: AN INNOVATIVE APPROACH FOR LAND RESOURCE MAMANAGEMENT Subhash Malik ¹ Shailly Malik ¹ Reshu Chaudhary ² and Pushpendra	267	889.	NUCLEOTIDE DIVERSITY ANALYSIS OF PATHOGENIC GENES OF <i>FUSARIUM OXYSPORUM</i> F. SP. <i>LYCOPERSICI</i> Supriya Dixit*, Ved Ratan, Mukesh Srivastava, Shubha Trivedi, Abhishek Mishra and Yatindra Kumar Srivastava	275
864.	SOIL AND WATER CONSERVATION Deeptimayee Sahoo, *Sandeep K. Mauriya, and Kulveer Singh Yadav, Amit K. Maurya	268	890.	TRANSCRIPTOMICS TECHNOLOGY Girish Tantuway, Omprakash, Santosh Kumar and Ashish Kumar Maurya	275
865.	SOIL CONSERVATION FOR SUSTAINABLE AGRICULTURE Rita Awasthi* and Deepti Shikha	268	891.	MECHANISM OF INORGANIC, NITRATE AND AMMONIUM TRANSPORT SYSTEM IN PLANTS Pushpendra Singh ¹ , Anand K. Singh ² , Durga Prasad Moharana ¹ , Ashutosh Kumar ¹ and Alka Sai	275
866.	ESSENTIALITY OF SOIL AND WATER CONSERVATION Mahesh Sharma*, P.P. Sharma, Hemlata Sharma, Sarla kumawat	268	892.	GENETIC CORRELATION ANALYSIS IN JATROPHA GENOTYPES BASED ON MORPHOLOGICAL TRAITS Subhash Chand, Lalit Joshi, B.B. Bandyopadhyay and M.K. Nautiyal	276
867.	EFFECT OF GLOBAL WARMING IN AGRICULTURE PRODUCTION Mylaru Sravani ¹ , A. H. Madakemohekar ¹ , M. Swetha ² , K. Rajinesh	269	893.	CYTOKININ REGIME FOR <i>IN VITRO</i> PROPAGATION AND ASSESSMENT OF ANTIOXIDANT ACTIVITIES DURING EX VITRO ESTABLISHMENT OF ANTI DIABETIC PLANT (<i>TECOMA STANS</i> L.). Sheikh Altaf Hussain and Mohammad Ani ⁸	276
868.	BIOCHEMICAL RESPONSES OF RICE (<i>ORYZA SATIVA</i> L.) VARIETIES UNDER SODIC SOIL Sanjay Kumar Tripathi ¹ , A. H. Khan ² , Nikita Nehal ^{*2} and Nitish Sharma	269	894.	ADVANCES IN FOOD AUTHENCITY TEST Satish chand, Navneet kumar, kailash pati tripathi	276
869.	SURVEY ON NATURAL OCCURANCE OF ENDOPHYTES IN MAIZE ECOSYSTEM (<i>Zea mays</i> L.) Bhagyasree, S. N ^{1.} , S. K. Ghosh ² and Sachin S. Suroshe	269	895.	IMPACT OF AGRICULTURE ON BIODIVERSITY Arshi Jamil and Shabbir Ashraf	277
870.	POTASSIUM-SOLUBILIZING BACTERIA AND THEIR IMPORTANCE IN SOIL HEALTH ¹ Radheshyam Jangir, ² Deheraj Kumar Bagri and ³ Sunil Kumar	270	896.	BODY TEMPERATURE, CLOACAL PROTUBERANCE, GONADAL SIZE AND NUPTIAL COLOURATION IN MATING SUCCESSION IN BLACKHEADED MUNIA (<i>LOCHURA MALACCA</i>) Kumar P, Pandey RK, Chhabra R and Bhardwaj SK	277
871.	STRATEGIES TO IMPROVE INTEGRATED WEED MANAGEMENT AND TO MAINTAIN SOIL HEALTH Shivashankar K and K Sai Krishna Prasad	270	897.	GENETIC ENGINEERING ROLE TO IMPROVING QUALITY AND PRODUCTIVITY OF CROPS Vishakha Burman, Khyati Lehari, Aastha, and Vaishali	277
872.	BIOSTIMULANTS: A BOON FOR PLANT AND SOIL HEALTH Suchismita Jena	270	898.	EPIGENOMICS PROJECTS ON CROP PLANTS Gyanika Shukla ¹ , S. S. Gaurav ² , Anju Rani ³ , Raj Singh ⁴ , Rekha Dixit ⁵ and Amit Kumar	278
873.	SULPHUR MANAGEMENT IN MUNGBEAN (<i>Punt mung</i> L.) THROUGH SPLIT APPLICATION OF SULPHUR Arif Majid, Bilal A. Rather, Asim Masood and Nafees A. Khan	270	899.	CONSERVATION EFFORTS IN WHEAT GENETIC RESOURCES AT THE NATIONAL GENE BANK, ICAR- NBPGR Sherry Rachel Jacob ¹ , Sandeep Sharma ² , Arun Kumar MB ² , J Radhamani ¹ and Kalyani Srinivasan	278
	IMPORTANCE OF SOIL AND WATER CONSERVATION		900.	ROLE OF BIO-INDICATORS IN SUSTAINABLE AGRICULTURE Kothakota Ritu and M. S. Darvhankar	278
			901.	ROLE OF GOVERNMENT POLICIES FOR SUSTAINABLE DEVELOPMENT IN AGRICULTURE Seema Rani	278
			902.	IMPROVEMENT OF CROP QUALITY THROUGH SUSTAINABLE HOLISTIC PRODUCTION SYSTEM S S Thori ¹ , Arun kumar ² , S K kakaraliya ³ , M K Jar ¹ and S.L. Khaswan	279

902. SOIL MOISTURE CONSERVATION FOR SUSTAINABLE MANAGEMENT IN THAR DESERT REGION
Shrawan Singh Thori¹, Kapil kumar², Arun kumar³, M K Jat¹ and S.L. Khaswan 279
903. IMPROVEMENT OF CROP QUALITY THROUGH SUSTAINABLE HOLISTIC PRODUCTION SYSTEM
S S Thori¹, Arun kumar², S K kakaraliya³, M K Jat¹ and S.L. Khaswan 280
904. ORGANIC FARMING A KEY OF SUSTAINING SOIL HEALTH
Hemant Kumar Jangde*, Dinesh Kumar Marapi and Saurabh Kumar 280
905. STRATEGIES FOR PROMOTING AND DEVELOPING FARMER-LED-INNOVATIONS
Akanchha Singh¹ and VLV Kameswari 280
906. BIO-COMPOSTING; TAKING OVER FYM
Kabrabam Suraj Jackson, Adesh Kumar, Vipul Kumar, Ishan Raheja, Mohit Kumar, Baby Wangkhem, Dilpreet Singh and Jagraj Singh 281
907. ADVANCES IN SUSTAINABLE AGRICULTURE
Sunil Kumar Malik & Surender Mittal 281
908. NATURAL RESOURCE MANAGEMENT FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT
Pappu lal bairwa, Amit Dixit, Pravin Kumar Sharma and Lav Kumar 281
909. SUSTAINABLE ECONOMIC DEVELOPMENT IN RURAL INDIA BY FINANCIAL INCLUSION
Abbul Hasan Khan 281
910. EXTENT OF PARTICIPATION AND DECISION MAKING OF MAN ALONE AND JOINTLY WITH WOMEN IN DIFFERENT AGRICULTURAL ACTIVITIES.
Anuradha Ranjan Kumari¹, Maya Kumari² Laxmikant³ and Kamlesh Meena 282
911. EFFECT OF DIFFERENT HOST CROPS ON THE BIOLOGICAL PARAMETERS OF *HENOSEPILOCHNA VIGINTIOCTOPUNCTATA* (F.) (COLEOPTERA: COCCINELLIDAE) UNDER LABORATORY CONDITIONS
Muntaha Qamar and Masarrat Haseeb 282
912. EFFECT OF POTASH DOSE AND APPLICATION METHODS ON YIELD AND QUALITY OF POTATO TUBERS (*SOLANUM TUBEROSUM* L.)
Umesh Chandra Sati, Manoj Raghav, Lavlesh, Kailash Sati and Pooja Pandey 282
913. VIRULENCE AND REPRODUCTIVE POTENTIAL OF *STEINERMA ABBASI* AGAINST GREATER WAX MOTH (*GALLERIA MELLONELLA*) IN LABORATORY CONDITION
Shreyansh Srivastava and Ashok K. Chaubey 283
914. IN VIVO PRESERVATIVE POTENTIAL OF NEEM GILOY-TINOSPORA CORDIFOLIA(WILLD.) MIERS EX HOOK. F. AND THOMS LEAF ESSENTIAL OIL FOR *PIGEON PEA* [CAJANUS CAJAN (L.) MILLSP.] SEEDS
Narendra Kumar 283
915. A REVIEW: POST HARVEST PHYSIOLOGY AND TECHNOLOGY IN *LILIUM*
Sunita Kumar, Santosh Kumar and C.P. Singh 283
916. EFFECT OF DIFFERENT HERBICIDES ON WEED DYNAMICS OF SEMIDRY RICE
K. Hemalatha and N.R. Sandhya 284
917. EFFECT OF AMBIENT WEATHER ON POPULATION DYNAMICS OF MAJOR INSECT PESTS OF TAMARIND
Akhilesh Kumar, Manoj Kumar Painkra 284
918. EFFECT OF AM FUNGI ON THE GROWTH AND DEVELOPMENT OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER LEAD STRESS
Fariha Raghieb, Fareed A. Khan, Mohd Irfan Naikoo 284
919. INFLUENCE OF ORGANIC FERTILIZERS ON PRODUCTIVITY AND MEDICINAL PROPERTIES OF ALOE VERA
Dinesh Kumar Marapi, Hemant Kumar Jangde and Saurabh Kumar 284
920. COMPARATIVE EFFECT OF UN-IRRADIATED AND IRRADIATED CHITOSAN ON THE ESSENTIAL OIL AND CITRAL PRODUCTION IN *CYBBOPOGON FLEXUOSUS* (STEUD.) WATS.
Hassan Jaleel¹, Bilal Ahmad², M. Masroor A. Khan³, Asfia Shabir⁴, Yawar Sadiq⁵, Lalit Varshney 285
922. INFLUENCE OF DIFFERENT HARVESTING TIMES ON POST-HARVEST QUALITY OF GARLIC DURING STORAGE
Shiwani*, Makhan Lal¹, Pooja Rani² and M.K.Rana 285
923. EFFECT OF TYPES OF MULCH AND AMMONIUM MOLYBDATE SPRAY ON ABIOTIC STRESSES AND YIELD OF CAPSICUM CV. CALIFORNIA WONDER UNDER COLD ARID CONDITIONS OF KARGIL.
Tahir Saleem¹, Tariq Sultan¹ and N.A.Ganai 285
924. EFFECT OF TYPES OF MULCH AND AMMONIUM MOLYBDATE SPRAY ON ABIOTIC STRESSES AND YIELD OF CAPSICUM CV. CALIFORNIA WONDER UNDER COLD ARID CONDITIONS OF KARGIL.
Tahir Saleem¹, Tariq Sultan¹ and N. A. Ganai 286
925. STUDIES ON CHARACTERIZATION OF GUM GUAR GENOTYPES FOR SEED QUALITY PARAMETERS
Zuby Gohar Ansari, G.Ramara¹ and P.Sreelatha 286
926. EFFECT OF F Y M AND GYPSUM ON SEED PRODUCTION IN CARROT IRRIGATED WITH HIGH RSC WATER
Amit kumar, V. K. Batra and Ansul 286
927. THE EFFECT OF DIFFERENT SOIL AMENDMENTS ON GROWTH OF MUNG BEAN (*VIGNA RADIATA* L.) IN COAL MINE OVERBURDEN DUMPS
Shreya Sinha¹, Jyoti Singh 286
928. EFFECT OF TWO SPECIES OF CYANOBACTERIA AS BIOFERTILIZERS ON SOME METABOLIC ACTIVITIES, GROWTH, AND YIELD OF PEA PLANT
Shreya Sinha¹ and Jyoti Singh 287
929. EFFECT OF NITROGEN AND PHOSPHORUS ON GROWTH, FLOWERING AND YIELD OF ROSE IN POLYHOUSECONDITIONS IN WESTERN UP
G .R. Kishore¹ & Neetu Singh 287
930. EFFECT OF SPECIALITY FERTILIZERS ON GROWTH AND OF NUTRIENT FERTILITY OF COTTON
P.C. Kamat, S. L. Waikar, Madhavi Jangilwad, V.D. Patil, And H.K. Kausadikar 287
931. EFFECT OF SULPHUR NUTRITION ON QUALITY PARAMETERS OF GARDEN PEA(*PISUM SATIVUM* L.) VARIETIES
Bhavya M. N. and Hiremath, S. M 287
932. EFFECT OF SPACING AND NUTRIENTS MANAGEMENT ON GROWTH AND YIELD ATTRIBUTES IN *HIRSUTUM* COTTON IN CENTRAL PLAIN ZONE OF U.P.
Avinash Kumar Singh¹, Jagdish Kumar¹ and Rajeev Kumar 288
933. EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON PERFORMANCE OF DIRECT SEEDED RICE AND SOIL HEALTH IN RICE - WHEAT ROTATION
Robin kumar, Vivak kumar and Ashish Driwedi 288
934. POPULATION DYNAMICS OF MITE (*POLYPHAGOTARSONEMUS LATUS* BANK) AND CORRELATION WITH WEATHER PARAMETERS ON PROCESSING VARIETIES OF POTATO*
Vineet Sharma¹, BP Singh², Bandana¹ and Manoj kumar 288
935. BIOCHAR APPLICATION FOR SUSTAINABILITY OF SOIL HEALTH AND PRODUCTIVITY
Sarita Rani¹ and Rekha Ratanoo 289
936. ROLE OF PLANT HORMONES ON VEGETATIVE GROWTH OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)
Saurabh Tomar, Jayant Kumar Maurya, Jagendra Pratap Singh, and Rajeev Kumar 289
937. EFFECT OF LOW DOSES OF DIFFERENT FORMS OF SELENIUM ON BIOCHEMICAL AND ANTIOXIDANT SYSTEM OF TRACHYSPERMUM AMMI UNDER MELOIDOGYNE INCOGNITA STRESS AND PSEUDOMONAS FLUORESCENS
Mohammad Danish*, Mohammad Amir, Yasir Nishat, Atirah Tauseef, Chanchal chaudhary and Hisamuddin 289
938. SUSPENDED SEDIMENT LOAD MODELING USING SOFT COMPUTING BASED MODEL FOR PATHAGUEDEM AND POLAVARAM SITES OF GODAVARI BASIN
Ashish Kumar¹*, Vijay Kumar Singh², Bhagwat Saran³ and Sachin Kumar Singh 290
939. PANCHGAVYA AN ESSENTIAL TOOL OF ORGANIC FARMING
Rahul Sah*, Sharvan Kumar*, Dheeraj Yadav and Satish Yadav 290
940. BREEDING FOR BROWN PLANTHOPPER (*NILAPARVATA LUGENS* STål.) RESISTANCE: A SUSTAINABLE APPROACH FOR RICE IMPROVEMENT
Shoukat Ahmad Rather, Indra Deo and Neha Joshi 290
941. STUDIES ON GENETIC VARIABILITY FOR QUANTITATIVE CHARACTERS IN GARLIC (*ALLIUM SATIVUM* L.)
Sopal Singh, Manoj Kumar Singh, Dipankar Singh Badal, Jitendra Kumar and Atul Kumar 291
942. IMPROVED PRACTICES OF BROCCOLI UNDER SUSTAINABLY MANAGED SOIL OF PUNJAB
Sreeparna Chowdhury, Harshal Ashok Avinash², Shelly Sanasam 291
943. GENETIC VARIABILITY FOR YIELD AND YIELD ASSOCIATED TRAITS IN F₂ SEGREGATING POPULATIONS OF RICE
Srishti singh, Sadhna saha and Dr. D.K. Mishra 291
944. STAY GREEN : AN INDICATOR TRAIT FOR HEAT TOLERANCE IN WHEAT (*TRITICUM AESTIVUM* L.)
P. Thakur¹*, Namrata¹, Om Prakash¹, B. Loitongbam¹, R. Prasad¹ and L.C. Prasad 292
945. UNFAVORABLE EFFECT OF INTENSIVE CHEMICAL FERTILIZERS ON SOIL AND HUMAN HEALTH IN CURRENT CHANGING CLIMATIC CONDITIONS
¹Sunil Kumar, ²Surendra Singh Jatav, ²Radheshyam Jangir and ¹Tarun Verma 292
946. PRE-HARVEST POLYAMINE TREATMENTS MODULATE FLOWERING AND FRUIT DROP PATTERNS IN LITCHI (*LITCHI CHINENSIS* SONN.)
Swati Sharma*, S.K. Singh, S.D. Pandey, Alemwati Pongener, S.K. Purbey and Vishal Nath 292
947. DESCRIPTION OF THE BACTERIOVORUS NEMATODE *CURVIDITISMICROSPICULA* SP. N. (NEMATODA: RHABDITIDA)
Shikha Ahalavat & Qudsia Tahseen 293
948. EFFECT OF DIFFERENT MULCHING TREATMENTS ON SEED PRODUCTION OF RADISH (*RAPHANUS SATIVUS* L.)
Anurag Malik*, D.K.Mehta, Pradeep Singh and Smriti Guleria 293
949. BIO-EFFICACY OF *TRICHODERMA* SPP. AGAINST *ALTERNARIA BRASSICAE* (BERK.) SACC.ISOLATES COLLECTED FROM DIFFERENT BRASSICA HOST CROPS
Vaibhav Pratap Singh* and R. U. Khan 293
950. POPULATION GROWTH AND CHANGES IN LAND USE BY AGRICULTURE IN INDIA
Veena Kumari 293
951. EFFECT OF SPACING AND FERTILIZERS ON SEEDS VIABILITY OF HISAR UNNAT AND HBT-49-1 VARIETY OF OKRA IN HARYANA
Vikash Kumar¹*, S.K. Dhankhar² and Desh Raj Choudhary 294

952. INTERACTIVE EFFECT OF PHOSPHORUS AND SULPHUR APPLICATION ON YIELD AND YIELD ATTRIBUTING CHARACTERS BY BLACK GRAM [*VIGNA MUNGO* (L.) HEPPER]
Mamta Phogat¹ and A.P. Rai² 294
953. IMPACT OF ZINC NUTRIENTS ON CROP GROWTH
Pawan Kumar Goutam, S. P. Kushwaha, Dharmadew Chauhan¹, Subhash Kumar, Nitin maurya, Vinay Kumar Yadav 294
954. MAPPING OF BACTERIAL LEAF BLIGHT RESISTANCE GENE USING MICROSATELLITE MARKERS IN GUAR
Priti* and Neelam R Yadav 295
955. LONG TERM EFFECT OF INM ON SOIL PHYSICO-CHEMICAL PROPERTIES AND PRODUCTIVITY OF COTTON + GREENGRAM INTERCROPPING SYSTEM IN VERTISOLS OF MAHARASHTRA
Ashwini Chandel and V.V.Gabhane 295
956. COLOUR ANALYSIS OF MINIMALLY PROCESSED MANGO UNDER DIFFERENT TREATMENTS
Ankit Kumar, S.K. Gupta & M.S. Alam 295
957. DECLINE OF WHISKERED TERN NEST SUCCESS: RELATIONSHIP WITH PREDATORS AT HOKERSAR AND HAIGAM WETLANDS, KASHMIR
Ishrat Jan*, G. Mustafa Shah, and Ulfat Jan. 296
958. EFFECT OF SEED PRIMING ON YIELD ATTRIBUTES OF RICE
Mahesh Kumar^{1*}, Ravi P. Singh² and Bandana Bose 296
959. EFFECT OF SEED PRIMING ON GERMINATION AND SEEDLING GROWTH OF RICE UNDER HEAVY METAL STRESS
Navneet Kumar*, Mahesh Kumar, Rajesh Kumar Singhal, Satish Chand Shukla 296
960. GDOT- A NEW SOIL MOISTURE MONITORING TECHNICAL TOOL FOR FARMER GROUPS
¹Meenakshi Sangwan*, ²J. cummins and ³V. S. Hooda 296
- CHARACTERISATION OF CHROMIUM RESISTANT *MESORHIZOBium CICERI* STRAIN RZ2 RECOVERED FROM ROOT NODULES OF CHICKPEA GROWN IN METAL CONTAMINATED SOILS
Saima Saif*, Mohammad Saghir Khan 297
961. HARVESTING WEED (*LANTANA CAMARA*) FOR UTILIZATION IN SILVER NANOPARTICLES SYNTHESIS WITH ANTIBACTERIAL ACTIVITY AGAINST ANTIBIOTIC RESISTANT *ESCHERICHIA COLI* AND *STAPHYLOCOCCUS AUREUS* ISOLATED FROM HOSPITAL SEWAGE.
Abha Verma¹, Neellesh Kapoor¹ and Prakash Joshi 297
962. DESIGNING AND OPTIMIZATION OF CIRCULATORY HYDROPONICS SYSTEM FOR THE EVALUATION OF NUTRITIONAL STATUS AND PLANT'S GROWTH IN FINGER MILLET
Naved Akbar^{1,2}, Manoj Singh¹, Supriya Gupta¹, K P Singh² and Anil Kumar 297
963. OPTION FOR HIGH – TECH NURSERY RAISING FOR ENHANCED PRODUCTIVITY AND PROFITABILITY IN THE DISTRICT, BULANDSHAHR REGION OF U.P.
S.D. Singh, Reshu Singh & Manoj Kumar 298
964. EVALUATION OF AGRONOMIC PERFORMANCE OF *PRUNUS* CLONAL ROOTSTOCKS UNDER MID HILL CONDITION OF HIMACHAL PRADESH
Ritu Sharma and Amit Kumar 298
965. CLUSTER ANALYSIS AND PRINCIPLE COMPONENT ANALYSIS IN GRAPE, *VITIS VINIFERA* L. GERMPLASM OF LEH DISTRICT OF JAMMU AND KASHMIR
Tsering Dolkar, M. K. Sharma, Amit Kumar, M.S. Mir and Shabbir Hussain 298
966. IMPACT OF PESTICIDES USE IN KASHMIR HORTICULTURE: BENEFITS AND HAZARDS?
Tajamul Farooq Wani, Anil Sharma and Jagdeesh Prasad Rathore 299
967. FUNGICIDES INDUCE RESISTANCE TO *TOURMYCES APPENDICULATUS* IN FRENCH BEAN
Gurvinder Singh, S.K. Gupta, Vijay Kumar and Ankur Tyagi 299
968. EVALUATION AND COMMERCIALIZATION OF AFRICAN MARIGOLD (*TAGETUS ERECTA* L.) GENOTYPES UNDER UKP COMMAND AREA OF KARNATAKA
P Vasudev Naik, Mahantesh Y Jogi and Seetharamu G K 299
969. BIODIVERSITY AND CONSERVATION OF TROPICAL FRUITS
Sumaya Mumtaz, N.A. Ganai¹, Mehnigar Hamid, Shahida Ashraf and Shabnam Ahad 300
970. DRYING OF JACKFRUIT BULB AND ITS IMPORTANCE FOR LIVELIHOOD
Minam Tabing* And A.K.Chaurasiya 300
971. MINE SPOIL REHABILITATION AND REVEGETATION FOR SUSTAINABLE DEVELOPMENT
Preeti Singh and Maneesh Kumar 300
972. STUDY ON EVALUATION OF BLENDED MANGO BAR
Minerva Potsangbam¹, A. K. Chaurasiya² and Francis A. Sangma 300
973. EFFICACY OF DIFFERENT STRATEGIES OF ZINC APPLICATION FOR CORRECTION OF ZINC DEFICIENCY AND ITS BIOFORTIFICATION IN HYBRID RICE (*ORYZA SATIVA*)
S.S. Jatav, S. Kumar, H.S. Jatav, H. Jayant 301
974. ANTAGONISTIC EFFECT OF DIFFERENT *TRICHODERMA* SPECIES AGAINST DIFFERENT SOIL BORNE PATHOGEN IN VITRO CONDITIONS
Jagraj Singh, Mohit Kumar, Dilpreet Brar, Baby Wangkhem. 301
975. STUDIES ON EFFECT OF ABIOTIC FACTORS ON PRODUCTION OF MILKY MUSHROOM (*ALOCYBE INDICA*)
Mohit*, Gopal Singh, Sandeep Kumar, Amarpal Soam and Pradeep Kumar 301
976. MOLECULAR TOOLS IN PLANT DISEASE MANAGEMENT
Mamta¹, Kanika Rani^{2*} and Rajender Singh 302
977. EFFECT OF SEED PRIMING WITH PROLINE ON GERMINATION OF RICE (*ORYZA SATIVA* L.) UNDER SALT STRESS CONDITION
Monika Singh¹, A. K. Singh¹, Nikita Nehal^{1*}, Nitish Sharma¹ and Sneha Singh 302
978. MORPHOLOGICAL BEHAVIOUR OF BARLEY CULTIVARS UNDER DIFFERENT DATE OF SOWING
Ankur Chaudhary, Meena Sewhag, Bhagat Singh and V.S. Hooda 302
979. MUSHROOM PRODUCTION TECHNOLOGY: ISSUES AND CHALLENGES IN INDIA
Pushpendra Kumar Dhakad¹, Ram Chandra¹, M. K. Yadav², and Rahul Singh Rajput 302
980. MANAGEMENT OF MUNGBEAN YELLOW MOSAIC VIRUS USING NEWER GROUP OF INSECTICIDAL TREATMENTS
Sakshi Gandotra 303
981. INTEGRATED FERTILIZER PRESCRIPTION EQUATIONS FOR RECOMMENDATIONS OF FERTILIZERS IN HYBRID RICE ON ALLUVIAL SOILS OF ASSAM
Namrata Kashyap, Bipul Deka and K.N. Das 303
982. IMPACT OF CHITOSAN ON MULTIPLICATION AND ROOTING OF JACKFRUIT UNDER *IN VITRO* SYSTEM
Divyangana, Ratna Rai, Ranjan Srivastava, K K Misra & Pradyot Nalini 303
983. MYCORRHIZAE: IMPORTANTS AND ITS APPLICATIONS IN PLANT DISEASE MANAGEMENT
¹NAVEENKUMAR R*, ²MUTHUKUMAR A, ¹VINEETA SINGH 304
984. USE OF SLOW RELEASE CHEMICAL FERTILIZERS IN CROP PRODUCTION
Ch. Vidhyashree Venkatarao^{1*}, I. Jagga Rao², And G. Siva Nagaraju 304
985. SEED BIOPRIMING WITH MICROBIAL AGENTS MITIGATING STRESS IN PULSES FOR SUSTAINABLE AGRICULTURAL PRODUCTION
Mehjabeen 304
986. STUDIES ON POLLINATION AND FRUIT SET IN STRAWBERRY (*FRAGARIA* × *ANANASA*) AND RASPBERRY FRUIT (*RUBUS ELLIPTICUS*) UNDER HILLY CONDITIONS OF UTTARAKHAND
Neema Pawar, Mahuri Kandwal, Manju Negi and Nihika Thakur 305
987. NEMATODE MANAGEMENT BY USING THE BIOPESTICIDES
Shashi Bala 305
988. NEONICOTINOIDS IN HONEY
Arya P.S., Tanmaya Kumar Bhoi and Hemant Kumar 305
989. STUDIES ON POPULATION DYNAMICS OF *HELICOVERPA ARMIGERA* (HUBNER) ON CHICKPEA
M.P.Gautam, Dr. Umesh Chandra, Ramveer, S.K.Giri and S.K.Yadav 306
990. MANAGEMENT OF RICE ROOT KNOT THROUGH PLANT EXTRACTS
Mukesh, Sunil Kumar Arsia, Satish Chand, Sachin Kumar Jain 306
991. NEMATODES FROM SAPHROBIC HABITAT
Hiba Fatima*, Sabia Mumtaz and Irfan Ahmad 306
992. META-TOPOLIN INDUCED RAPID *IN VITRO* AXILLARY SHOOT BUD PROLIFERATION IN *WEDELIA CHINENSIS* L. : A POTENTIAL MEDICINAL PLANT
Mehrun Nisha Khanam* and Mohammad Anis 306
993. PRE-BREEDING INTERSPECIFIC HYBRIDIZATION WITH BIOTECHNOLOGICAL APPROACHES FOR CROP IMPROVEMENT.
Sachin kumar, Chandan yadav 307
994. ECR (EFFECTIVE CONSUMER RESPONSE): AN EFFECTIVE TOOL OF AGRICULTURAL MARKETING
L.Karan Raika*, Dr Kapil Khaturia and Puli Sridhar Reddy 307
995. RELEVANCE OF VA MYCORRHIZA IN ENVIRONMENT FRIENDLY AND SUSTAINABLE AGRICULTURAL PRACTICES
Fauzia-Naushin 307
996. DROUGHT IMPACTS IN AGRICULTURE: WATER CONSERVATION AND WATER SAVING PRACTICES
Sunita Kumari^{1*}, Tikendra Kumar Yadav², Vinod Kumar Yadav³, Rajesh Kumar Sheshma 307
997. RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON TURNIP (*BRASSICA RAPAL.*) CV. PURPLE TOP WHITE GLOBE.
Nikhil Jhariya, Vishwa Nath, Brijesh Kumar and Roshan kushwah 308
998. EFFECT OF SODICITY ON BIOCHEMICALS OF DIFFERENT RICE VARIETIES
Nikita Nehal¹, a. H. Khan¹, Nitish Sharma¹, Sanjay Kumar Tripathi² and Nayanker Singh 308
999. SEED GERMINATION OF COWPEA (*VIGNA UNGUICULATA* L.) VARIETY HIMACHAL LOBIA-1 AS AFFECTED BY *RHIZOBIUM* PELLETTING DURING ONE YEAR STORAGE
Nirmal Singh¹, Sourabh^{2*} and Ashok Kumar Thakur 308
1000. MINIMIZING YIELD LOSSES WITH THE FOLIAR SPRAY OF GLYCINE BETAINE AND KNO₃ UNDER DROUGHT STRESS IN RICE (*ORYZA SATIVA* L.)
Nitish Sharma¹, A.K. Singh¹, Nikita Nehal^{1*}, Mayanker Singh¹ and Sanjay Kumar Tripathi 309
1001. INTEGRATED FARMING SYSTEM: A BETTER TOOL FOR SOIL HEALTH AND SUSTAINABLE AGRICULTURE.
Surendra Ram¹, Abhay Deep Gautam² and V.P. Chaudhary 309
1002. MANAGEMENT OF TOMATO LEAF CURL VIRUS AND ITS VECTOR WHITE FLY (*BEMISSIA TABACI*) IN FIELD CONDITION
Amit Kumar Yadav, *Ramesh Singh Yadav, Hem Singh, Abhishek Kumar and Jaskaran Singh 309

1003. STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF TOMATO CV. PUNJAB CHHUHARA UNDER COLD ARID CONDITIONS OF KARGIL. Tahir Saleem ¹ and N.A.Ganai	310	1028. INTEGRATED WEED MANAGEMENT IN DIRECT SEEDED RICE B. Rama Devi ¹ and D. Rakshith Roshan	317
1004. STANDARDIZATION OF ORGANIC MEDIA FOR PRODUCTION OF TOMATO (<i>Lycopersicon esculentum</i>) CV. INDAM-13 Nosilchi Ch Marak, Dr. A. K. Chaurasiya and Susmita Chakraborty	310	1029. GENETIC VARIABILITY AND ITS IMPLICATION IN SELECTION OF ELITE LINES OF CHICKPEA (<i>CICER ARIETINUM</i> L.) Sadhna Saha ^{*1} , Srishti Singh ² And Anita Babbar	317
1005. NUTRIENTS MANAGEMENT IN DRY LAND AGRICULTURE IN INDIA Shiv Poojan Yadav*, Tikendra Kumar Yadav, Sudhanshu Verma, Nupur Sharma	310	1030. ASSESSMENT OF BIO- MANAGEMENT POTENTIAL OF SOME CARNIVOROUS FUNGI AGAINST ROOT- KNOT DISEASE OF BRINJAL (<i>SOLANUM MELONGENA</i> L.) Gaurav Kumar Yadav ^{*1} , Kajal Maurya ² , Akhiles Kumar	318
1006. NUTRITION EDUCATION AND IT'S IMPACT - A STUDY Dr. Sarita Joshi	310	1031. RESPONSE OF BIO-ENHANCERS ON THE PLANT GROWTH AND YIELD OF CAULIFLOWER (<i>BRASSICA OLERACEA</i> VAR. <i>BOTRYTIS</i>) Rahul Sah*, Sharvan Kumar*, Dheeraj Yadav and Satish Yadav	318
1007. NUTRITION GARDEN – AN INNOVATIVE APPROACH FOR SUSTAINABLE AGRICULTURE AND LIVELIHOOD SECURITY Nidhi Sinha ¹ Maya Kumari ² , Ashok Kumar ³ ,	311	1032. EVALUATION OF SELECTED CARROT CULTIVARS FOR THEIR RESISTANCE/SUSCEPTIBILITY AGAINST ROOT-KNOT NEMATODE <i>MELOIDOGYNE INCOGNITA</i> Faryad Khan*, Mohd. Asif, Amir Khan, Moh. Tariq, Taruba Ansari and Mansoor A. Siddiqui	319
1008. EFFECT OF DIFFERENT DOSES OF SULPHUR AND BORON ON YIELD, QUALITY AND NUTRIENT UPTAKE OF MOONG BEAN Sri Laxmi*, Biswabara Sahu	311	1033. ENHANCING GROWTH, YIELD AND QUALITY OF CHICK PEA (<i>CICER ARIETINUM</i> L.) THROUGH APPLICATION OF MICRONUTRIENT UNDER IRRIGATED CONDITION C.B.Verma, Shashank Srivastav and Mohd. Aslam	319
1009. STUDIES ON THE PERFORMANCE OF ONION (<i>ALLIUM CEPA</i> L) VARIETY IN WESTERN PLAIN ZONE CONDITION OF U.P. Dr. Satya Prakash Professor(Horti)cum Head , Dr. B.P.Shahi SMS(Horti)& Parmod Kumar	311	1034. EVALUATION OF POTATO PROCESSING QUALITY AND BEHAVIOUR OF INDIGENOUS AND EXOTIC CULTIVARS DURING STORAGE WITH CIPC Bandana ¹ , Vineet Sharma ¹ and Manoj Kumar	319
1010. STUDIES ON DIFFERENT VARIETAL GERBERA CULTIVATION IN POLY HOUSE FOR BETTER PRODUCTIVITY & INCOME IN SAHARANPUR CONDITION Dr. Satya Prakash Professor (Horti)cum Head, Dr. B.P.Shahi SMS(Horti)& Mahavir Singh	311	1035. STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN OAT Charupriya Chauhan and S.K. Singh	319
1011. STUDIES ON DIFFERENT VARIETAL GERBERA CULTIVATION IN POLY HOUSE FOR BETTER PRODUCTIVITY & INCOME IN SAHARANPUR CONDITION Satyaprakash, BP Sahi	312	1036. COMBINING ABILITY IN OAT (<i>AVENA SATIVA</i> L.) Charupriya Chauhan and S.K. Singh	320
1012. "INTEGRATED EFFECT OF DIFFERENT ORGANIC MANURES ON YIELD SUSTAINABILITY AND QUALITY OF WHEAT VARIETIES." Sanjay Kr. Kashyap*, Jitendra Kumar	312	1037. HETEROSIS FOR YIELD AND YIELD COMPONENTS IN OAT (<i>AVENA SATIVA</i> L.) Charupriya Chauhan and S.K. Singh	320
1013. ORGANIC FARMING AND ITS IMPACT ON CROP PRODUCTIVITY, FOOD QUALITY AND ENVIRONMENT Gangadhar Nanda ^{1*} , D. K. Singh ² and D. C. Kala	312	1038. REDUCTION IN POLLUTION LOAD DURING BLEACHING STUDIES OF <i>L. LEUCOCEPHALA</i> BY XYLANASE ENZYME PRODUCED BY <i>C. CINEREA</i> RM-1 NFCCI-3086 Poonam Maan* and Dharm Dutt	320
1014. ORGANIC FARMING: A WAY TOWARDS ENVIRONMENTALLY FRIENDLY FARMING MOna nagargade, Vishal Tyagi MK Singh	313	1039. EFFICACY OF ORGANIC AMENDMENTS AGAINST DRY ROOT ROT PATHOGEN <i>RHIZOCTONIA BATATICOLOA</i> OF CLUSTER BEAN [<i>CYAMOPSIS TETRAGONOLOBA</i> (L.) TAUB.] Aman Dhawan, Satish Kumar, Pankaj Kumar Sharma and Surjeet Singh	321
1015. STUDY OF BEHAVIOUR AND ORIENTATION MODIFYING CUES OF <i>COCCINELLA TRANSVERSALIS</i> FAB. ON COWPEA APHID <i>APHISCRACCVORA</i> KOCH Rakshith H.S. Sacgibn S. Suroshe, Suresh M. Nebapure, Subhash Chander and Sweetee Kumari	313	1040. RATE OF DECOMPOSITION OF PLANT LITTER Raj Singh ¹ , Anju Rani ¹ , Permod Kumar ¹ , Gyanika Shukla ² and Chhaya Singh	321
1016. STUDY OF BEHAVIOUR AND ORIENTATION MODIFYING CUES OF <i>COCCINELLA TRANSVERSALIS</i> FAB. ON COWPEA APHID <i>APHISCRACCVORA</i> KOCH Rakshith H. S., Sachin S. Suroshe., Suresh M. Nebapure., Subhash Chander and Sweetee Kumari	313	1041. EFFECT OF BIO-CONTROL AGENT TRICHODERMA ON WILT Archana Srivastava	321
1017. IMPROVING GROWTH, BIOCHEMICAL CHARACTERISTICS AND ESSENTIAL OIL PRODUCTION OF <i>VETIVERIA ZIZANIOIDES</i> L. NASH BY THE FOLIAR APPLICATION OF RADIATION PROCESSED CHITOSAN AND METHYL JASMONATE Asfia Shabbir*, M. Masroor A. Khan, Bilal Ahmad, Hassan Jaleel, Yawar Sadiq	314	1042. ANTIFUNGAL ACTIVITY OF ANGIOSPERMIC PLANTS AGAINST <i>PHYTOPHTHORA INFESTANS</i> (L) Anju Rani ¹ , Raj Singh ¹ , Permod Kumar ¹ , Gyanika Shukla ² and Chhaya Singh	322
1018. IMPORTANCE OF PREDATORY NEMATODES IN ORGANIC FARMING Harjot Singh Sidhu and R S Kanwar	314	1043. EVALUATION OF TOMATO GENOTYPES FOR GROWTH, YIELD AND QUALITY ATTRIBUTES Mahantesh Y. Jogi, H. B. Lingaiah, Vasudeva Naik. P and Jyothi Kattagoudar	322
1019. EVALUATION OF SOME INSECTICIDES AGAINST CITRUS PSYLLA, <i>DIAPHORINA CITRI</i> KUWAYAMA ON SWEET ORANGE Naveen Singh, G.S.Yadav and Meenakshi Devi	314	1044. STUDY ON DETECTION OF ADULTERANTS OF MILK S.P. Verma	322
1020. PLUS TREE SELECTION AND PROGENY TESTING OF MAHANEEM (<i>AILANTHUS EXCELSA</i> ROXB) Vijay Daneva ¹ , R.S. Dhillon and Vishal Johar	315	1045. MODULATION OF SENESCENCE AND POSTHARVEST PERICARP BROWNING IN LITCHI Kalyan Barman ^{1*} , Md. Wasim Siddiqui ² and Muneshwar Prasad	323
1021. EVALUATING DIFFERENT PRE AND POST HERBICIDES FOR CONTROLLING BARNYARD GRASS (<i>ECHINOCHLOA GLABRESCENS</i>) IN DIRECT SEEDED RICE Ajay Singh*, D P Nandal, S S Punia, Govind Prasad and Priti Malik	315	1046. PREDICTION OF WHEAT YIELD USING CROP SIMULATION MODEL (CERES-WHEAT) FOR DEHRADUN DISTRICT OF UTTARAKHAND Pawan Mall*, A.S. Nain, R.K. Singh and Neha Sharma	323
1022. SEASONAL INCIDENCE OF <i>HELICOVERPA ARMIGERA</i> (HUB.) IN RELATION TO ABIOTIC FACTORS IN CHICKPEA Spoorthi. G. S ¹ , Rajendra Singh and Sudhir Kumar	315	1047. ATTITUDE OF FARMERS TOWARDS MAIZE FARMING Nandita Kumari (Subject Matter Specialist, Home Science)	323
1023. EFFECT OF SOME INSECTICIDES AND BIO-PRODUCTS ON COCCINELLIDS AND SPIDER POPULATION IN MAIZE Sudhir Kumar ^{*1} , D. V. Singh ¹ , Rajendra Singh ¹ , Jogendra Singh ² and Awaneesh Kumar	315	1048. DEVELOPMENT OF TRICHODERMA BASED NOVEL BIO-FORMULATIONS WITH INCREASED SHELF LIFE FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS Shubha Trivedi ^{1*} , Mukesh Srivastava ² , Ved Ratan ³ , Abhishek Mishra ³ , Supriya Dixit, ³ and Yatindra Srivastava	324
1024. MECHANISM OF <i>TRICHODERMA HARZIANUM</i> AS A BIOCONTROL AGENT IN DISEASE MANAGEMENT Vinay Kumar Kardam ¹ , Deepak Kumar ² , Chandni Kumari ³ , Puli Sridhar Reddy	316	1049. KISAN CALL CENTRE IN INDIA Satendra Kumar*, Gaurav Kumar & Anurag Verma	324
1025. INTEGRATED WEED MANAGEMENT IN DIRECT SEEDED RICE B. Rama Devi ¹ and D. Rakshith Roshan	316	1050. EXTRACTION AND EVALUATION OF INSECTICIDAL ACTIVITY FROM RESISTANT AND WILD ACCESSIONS OF <i>CICER ARIETINUM</i> AGAINST <i>APHIS CRACCVORA</i> Heena Dhall and Sagar D.	324
1026. DIVERSITY ANALYSIS IN A CORE COLLECTION OF INDIAN BREAD WHEAT (<i>TRITICUM AESTIVUM</i> L.) Author: Vivek Sharma ^{1,2} , Ashwani Kumar	316	1051. EFFECT OF <i>TRICHODERMA</i> SPP. ON TURMERIC LEAF SPOT DISEASE (<i>COLLETOTRICHUM GLEOSPORIODES</i> PENZ AND SACC.) AND RHIZOME YIELD. Nasreen Musheer and Shabbir Ashraf	325
1027. NEMATODE AS BIOINDICATORS FROM ORGANIC-ENRICHED HABITATS Rehmat Jahan*, Mohammad Asif, Numreen Nazir & Qudsia Tahseen	317	1052. ROLE OF CHEMICAL FERTILIZER AND CROP RESIDUE ON NUTRITIONAL CONTENT AND ECONOMICS OF BASMATI RICE (<i>Oryza sativa</i> L.) SOLANKI HEMANT CH1 THOMAS TARENCE2	325
		1053. RESPONSE OF INORGANIC FERTILIZER AND WHEAT RESIDUE ON CARBOHYDRATE AND OIL CONTENT IN PADDY (<i>ORYZA SATIVA</i> L.) CH. Hemant Solanki1, Tarence Thomas2, Arun A. David	325

1054. EFFECT OF FERTILIZER AND ORGANIC RESIDUE ON YIELD PARAMETER AND YIELD OF BASMATI RICE (<i>ORYZA SATIVA</i> L.) CH Hemant Solanki, Tarence Thomas, Arun A David 326	Preeti Kumar, R.B. Verma, Md Wasim Siddiqui, Ashish K. Singha and Nisha Rani 333
1055. ENHANCING SOIL HEALTH AND PRODUCTIVITY OF BASMATI RICE THROUGH INORGANIC FERTILIZATION AND CROP RESIDUE INCORPORATION CH. Hemant Solanki ¹ , Arun A. David 326	1079. VARIATION IN MORPHOLOGICAL AND REPRODUCTIVE BEHAVIOUR OF JACKFRUIT GENOTYPES IN THE TARAI REGION OF UTTARAKHAND Avishek Roy, Pratibha, Ankit Dongariyal and Manoj Chaudhry 333
1056. ADOPTION OF DD KISAN AMONG FARMERS OF JABALPUR DISTRICT (M.P.) Sonam Upadhyay, N.K. Khare and M.K. Dubey 326	1080. EXTENT OF PARTICIPATION AND DECISION MAKING OF MAN ALONE AND JOINTLY WITH WOMEN IN DIFFERENT AGRICULTURAL ACTIVITIES. (Anuradha Ranjan Kumari ¹ , Maya Kumari ² Laxmikant ³ and Kamlesh Meena ⁴) 333
1057. MANGO PROCESSING; PRESENT STATUS AND FUTURE OUTLOOK IN INDIA Manoj Kumar ¹ , R.N.Yadav ¹ and Kiran Kumari 326	1081. EFFECT OF INTEGRATED USE OF INORGANIC WITH CHEMICAL FERTILIZERS ON GROWTH PARAMETERS OF RICE CROP Maneesh Kumar, A. K. Rai, S. Rai and Preeti Singh 334
1058. BEHAVIOURAL DEFENCE ADAPTATIONS IN INSECTS AGAINST NATURAL ENEMIES ChallaNalini*and Isha Sharma 327	1082. BASED ON M.S.C. (AGRIC.) THESIS OF THE FIRST AUTHOR Corresponding author 334
1059. ECO-FRIENDLY ROLE OF ORGANICS AND BIO-ORGANICS ON THE GROWTH PARAMETERS OF TOMATO IN RELATION TO THE MANAGEMENT OF PLANT PATHOGENS Safuddin, Rose Rizvi, Gufran Ahmad, Sartaj A. Tiyyagi and Irshad Mahmood 327	1083. SCREENING OF POTATO GENOTYPES FOR FOLIAR AND TUBER RESISTANCE AGAINST <i>PHYTOPHTHORA INFESTANS</i> CAUSING LATE BLIGHT OF POTATO UNDER SUBTROPICAL PLAINS OF INDIA Mehi Lal, S K Luthra, V K Gupta and Saurabh Yadav 334
1060. STUDIES ON BIOFILM DEVELOPMENT AND MULTIFARIOUS PLANT GROWTH PROMOTING ACTIVITIES OF SELECTED RHIZOBACTERIA AND WHEAT ROOT COLONIZATION BEHAVIOR OF <i>BACILLUS</i> SP. Firoz Ahmad Ansari and Iqbal Ahmad 327	1084. BIOLOGICAL CONTROL OF DAMPING OFF OF TOMATO CAUSED BY <i>PYTHIUM APHANIDERMATUM</i> Laxmi tiwari and Archana Srivastava 335
1061. EFFECT OF NANOCITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION Parul Chaudhary, Priyankakhati 328	1085. EFFECT OF DIFFERENT SPACING ON SNAPDRAGON (<i>ANTIRRHINUM MAJUS</i> L.) CV. AFRICAN MIX". Ram Lakhan Maurya, Ashok Kumar, Vivak Ujjwal, Manoj Kumar 335
1062. CYTOKININ REGIME FOR INVITRO PROPAGATION AND ASSESSMENT OF ANTIOXIDANT ACTIVITIES DURING EX VITRO ESTABLISHMENT OF ANTI DIABETIC PLANT (<i>TECOMASTANS</i> L.). Sheikh Altaf Hussain and Mohammad Anis 238	1086. SCREENING AND EVALUATION OF HIGH YIELDING NITROGEN EFFICIENT ADVANCED HYBRIDS OF POTATO (<i>SOLANUM TUBEROSUM</i> L.). Sarala Yadav ¹ , Manoj Kumar ² and Raj Kumar 335
1063. MICROBIAL PESTICIDES: AN ECOFRIENDLY APPROACH FOR PEST MANAGEMENT Babita Bhatt 328	1087. CULTURAL PRACTICES FOR WEED MANAGEMENT FOR SUSTAINABLE PRODUCTION OF TURMERIC (<i>CURCUMA LONGA</i> L.) Puli Sridhar Reddy*, Praveen Khatri, L. Karan Raika, Monika Kapil, 336
1064. PEST MANAGEMENT STRATEGIES IN KUMAON REGION ON AGRO- ECOSYSTEM: AN ECOFRIENDLY APPROACH Neelam Yadav, Neeraja Agrawal and *Renu Yadav 329	1088. COMMUNITY ANALYSIS OF PLANT PARASITIC NEMATODES ASSOCIATED WITH <i>VIGNA MUNGO</i> (BLACK GRAM) IN ALIGARH DISTRICT UTTAR PRADESH Aiman zafar* and Irshad Mahmood 336
1065. ECO-FRIENDLY ROLE OF MICROBIAL PROTEASES IN LEATHER & TEXTILE INDUSTRIES Deepak Kumar Koli ¹ * and Ganesh Kumar Koli 329	1089. EVALUATION OF MORPHOLOGICAL AND PHYSIOLOGICAL PARAMETERS DURING DROUGHT STRESS IMPOSED BY PEG 6000 IN- VITRO GROWING BARNYARD MILLET FROM KUMAON REGION OF HIMALAYAN. Dipti Singh. Ashutosh Dubey. A.K. Verma
1066. EFFECT OF SEED TREATMENTS AND PACKAGING MATERIALS ON SEED GERMINATION IN COWPEA (<i>VIGNA UNGUICULATA</i>) DURING STORAGE Pusarla Susmitha ^{1*} , Prashant Kumar Rai 329	1090. SPECIFICATION IN CROP IMPROVEMENT Gobu R., * Kailash Chandra, Naveenkumar R., Omprakash and Dhanapal R. 336
1067. SEED VIGOUR AND VIABILITY IN DIFFERENT VARIETIES OF INDIAN MUSTARD [<i>BRASSICA JUNCEA</i> (L.) CZERN.&COSS.] Himanshu Rai*, O.S.Dahiya* and S.S.Jakhar 329	1091. INTEGRATED PEST MANAGEMENT FOR OKRA FRUIT AND SHOOT BORER, <i>Earias vittella</i> (Fabricius) Kanchan G. Padwal* and Sameer Kumar Singh 337
1068. EFFECT OF DROUGHT STRESS ON PROLINE AND CHLOROPHYLL CONTENT IN DIFFERENT RICE GENOTYPES Ritika Yadav ¹ , Vinai Kumar ² , Gurdeep Bains 330	1092. INTEGRATED PEST MANAGEMENT FOR TOMATO FRUIT BORER, <i>Helicoverpa armigera</i> (Hübner) Sameer Kumar Singh* and Kanchan G. Padwal 337
1069. APPLICATION OF SOLAR ENERGY BASED DEVICES IN FOOD PROCESSING SECTOR Iftikhar Alam ¹ , Sachin Kumar 330	1093. INTEGRATED PEST MANAGEMENT FOR TOMATO FRUIT BORER, <i>Helicoverpa armigera</i> (Hübner) Sameer Kumar Singh* and Kanchan G. Padwal 337
1070. OPTIMIZING NITROGEN AND PHOSPHORUS LEVELS COMBINED WITH LOW MOLECULAR WEIGHT FRACTIONS OF γ -IRRADIATED SODIUM ALGINATE FOR ENHANCED PHOTOSYNTHETIC ATTRIBUTES, ESSENTIAL OIL AND MENTHOL PRODUCTION IN <i>MENTHA PIPERITA</i> L. Bilal Ahmad ^{1*} , Hassan Jaleel ¹ , Asfia Shabbir, Yawar Sadiq ¹ , Ajmat Jahan ¹ , M. Masroor A. Khan 330	1094. YIELD ENHANCEMENT OF PULSES THROUGH INTEGRATED WEED MANAGEMENT Gurdeep Singh ^{1*} , Angrej Singh ² , Virender Sardana ³ , Tarundeep Kaur ⁴ , Navish Kumar Kamboj 337
1071. EFFECT OF TERMINAL HEAT STRESS ON AGRO MORPHOLOGICAL TRAITS IN BREAD WHEAT Monu Kumar ^{*1,2} and R K Sharma 331	1095. IMPACT OF CLIMATE CHANGE ON THE POPULATION DYNAMICS OF INSECT-PESTS SPECIES AND THEIR NATURAL ENEMIES Kamal Ravi Sharma ^{1*} , Deepak Kumar Jaiswal ¹ , D. Rakshit Roshan ¹ and Rashmirekha Singh 338
1072. IN VITRO PROPAGATION AND CONSERVATION OF <i>HEMIDESMUS INDICUS</i> L. R. BR. THROUGH SOMATIC EMBRYOGENESIS AND SYNTHETIC SEED PRODUCTION Vikas Yadav and Anwar Shahzad 331	1096. HIGH TEMPERATURE A PROBLEM FOR WHEAT CROP Khyati Lehari, Vishakha Burman, Mukesh Kumar 338
1073. BIOLOGICAL CONTROL OF DAMPING OFF OF TOMATO CAUSED BY <i>PYTHIUM APHANIDERMATUM</i> Laxmi tiwari and Archana Srivastava 331	1097. POTASSIUM-SOLUBILIZING BACTERIA AND THEIR IMPORTANCE IN SOIL HEALTH ¹ Radheshyam Jangir, ² Dheeraj Kumar Bagri and ³ Sunil Kumar 338
1074. INFLUENCE OF CLIMATE PARAMETERS ON INCIDENCE OF LENTIL APHID (<i>APHIS CRACCIVORA</i> KOCH) IN EASTERN PLAIN OF UTTAR PRADESH Sachin Kumar ¹ , Harikesh Singh ² and Ashwani Kumar 331	1098. ANTIMYCOTIC ACTIVITY OF <i>TRICHODERMA</i> SP. AGAINST <i>FUSARIUM OXYSPOURUM</i> F. SP. <i>CAPSICI</i> CAUSING WILT DISEASE IN CHILLI Ankita Sinha ¹ , Harshita ² , Saurav Govind Rao ³ , Dr. Ramesh Singh ⁴ , Dr. Shubha Trivedi ⁵ . 339
1075. SUITABILITY OF <i>CRABE ABYSSINICA</i> IN SUPPORTING OF GROWTH AND DEVELOPMENT OF MUSTARD APHID <i>LIPAPHIS ERYSIMI</i> (KALT.) Wajid Hasan ¹ and C.P. Singh 332	1099. BIOTRANSFER OF CADMIUM, LEAD AND ZINC FROM FLY ASH AMENDED SOIL IN PLANT- ARTHROPOD FOOD CHAIN. Mohd Irfan Naikoo*, Mudasir Irfan Dar, Fariha Raghieb, Fareed Ahmad Khan 339
1076. ENHANCE THE ORGANIC MATTER IN SOIL THROUGH MODERN AGRICULTURAL PRACTICES Manikant Prabhakar 332	1100. AGROFORESTRY: AN OPPORTUNITY FOR CARBON SEQUESTRATION AND LIVELIHOOD SECURITY C.P. Rahangdale ^{1*} , Neelam Bisen ² , S.D. Upadhyaya ¹ and Vijay Bagare 339
1077. AVAILABILITY OF SOME MACRO AND MICRONUTRIENTS AND THEIR CORRELATION WITH SOME PHYSICO-CHEMICAL PARAMETERS IN MOLLISOLS SOIL OF UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND Vineet Kumar and Shiv Singh Meena 332	1101. ADAPTATION AND MANAGEMENT PRACTICES TO MITIGATE THE IMPACT OF HIGH TEMPERATURE ON WHEAT Vinaya Kumar Yadav ^A , R.K. Yadav ^B , A.K. Singh ^A , Meera Srivastav ^A and M.A. Khan 340
1078. ANTIOXIDANT POTENTIAL OF <i>MOMORDICA CHARANTIA</i> FRUIT IN FOUR DIFFERENT	1102. ROLE OF RHIZOBIUM ON THE GROWTH AND DEVELOPMENT OF PEA PLANT Aman Deep Ranga ¹ , Sourav Kumar ¹ , Bijendra Kumar 2 340
	1103. SODIUM FLUORIDE EFFECT ON LINSEED AT ON GERMINATION LEVEL Amit Nagar, Shashank Gupta, Ramu K 340
	1104. INTEGRATED NUTRIENT MANAGEMENT IN FRUITS Amit Kumar, Vivek Ujjwal, Ajay Yadav, and Vimal Nagar 340

1105. MICROPROPAGATION OF GERBERA JAMESONII -AN ORNAMENTAL PLANT. Amit, Sanat Sujat Singh* & Narendar Singh	341	Vivek Saurabh*, Kalyan Barman and Anil K. Singh	349
1106. ANTIMYCOTIC ACTIVITY OF <i>TRICHODERMA</i> SP. AGAINST <i>FUSARIUM OXYSPORUM</i> F. SP. <i>CAPSICI</i> CAUSING WILT DISEASE IN CHILLI Ankita Sinha, Harshita, Saurav Govind Rao, Dr. Ramesh Singh, Dr. Shubha Trivedi	341	1133. INVOLVEMENT OF NITRIC OXIDE AND GLUCOSE IN ALLEVIATION OF SALT STRESS INHIBITED PHOTOSYNTHESIS IN MUNG BEAN (<i>VIGNA RADIATA</i> L.)	349
1107. BREEDING FOR ENHANCING NUTRITIONAL QUALITY IN TOMATO (<i>LYCOPERSICON ESCULENTUM</i> L.) Ankita Bhakri ¹ , Mandeep Kumar ² Bijendra Kumar ³ , Harshal Ashok Avinash ⁴ ,	341	1134. GROWING MORE RICE WITH LESS WATER Deo Narayan Singh ^{1*} , Subodh Kumar ² and Deepak Kumar Jaiswal	349
1108. INTEGRATED NUTRIENT MANAGEMENT (INM): A WAY TO IMPROVE ECOLOGICAL BALANCE AND FARM INCOME Ankur Bhakar	342	1135. DECOMPOSITION OF KITCHEN ORGANIC WASTE Dr. Pankaj Chhabra, Associate Professor in Home science	350
1109. CONSERVATION FOR SUSTAINABLE DEVELOPMENT	342	1136. CHANGING CLIMATE AND ADAPTIVE CAPACITIES OF MOUNTAIN COMMUNITIES: A CASE STUDY FROM RUDRAPRAYAG DISTRICT, UTTARAKHAND Rekha Dhanai and R.S. negi	350
1110. CHANGE IN BIODIVERSITY: IMPORTANCE OF FOREST RESOURCE CONSERVATION Tripathi Anuj Kumar	342	1137. STRUCTURE AND COMPOSITION OF VEGETATION IN KOSI RIVER WILDLIFE CORRIDOR OF TERAI ARC LANDSCAPE, UTTARAKHAND, INDIA Meraj Anwar	350
1111. MANAGEMENT OF SOIL BORNE DISEASES THROUGH BIOAGENTS Anupam Kumar* Surendra Kumar, Kamal Khilari, Sushil Kumar	342	1138. PERSPECTIVES AND APPROACHES OF CONSERVATION TILLAGE IN	
1112. NATURAL RESOURCES CONSERVATION: AGROFORESTRY FOR IMPROVING CARBON SEQUESTRATION Sandya.N.R* and K. Hemalatha	343	1139. SUSTAINABLE AGRICULTURE: A REVIEW Bikrmatiya ¹ & Sanjeev Kumar Singh	351
1113. PERFORMANCE RELATIONSHIPS BETWEEN NIGHT SATELLITE AND OCO-2 SIGNATURE- IN THE CASE OF DELHI (INDIA) Ambreen Matloob, Jung-Sup Um	343	1140. ESTIMATION OF MICRONUTRIENT UPTAKE BY MAIZE(<i>ZEA MAYS</i> L.) PLANTS UNDER HARYANA ECOLOGICAL CONDITIONS Harender, Narender Singh, Manjeet, Naveen Rathi and Kavinder,	351
1114. INTELLECTUAL PROPERTY RIGHTS (IPR) ISSUES IN HORTICULTURE AN INDIAN SCENARIO WITH PARTICULAR REFERENCE TO VEGETABLE CROPS Sunil K. Maurya ¹ , Sandeep K. Mauriya ¹ , Ragini Maurya ¹ , Jyoti Singh	343	1141. RECENT DEVELOPMENT IN DETERMINATION OF MICRONUTRIENT CATIONS IN SOIL: A REVIEW Rahul Mishra ¹ , Ashish Rai ^{2*} , Gopal Kumar ³ , Chandan Kumar ⁴ and Bhudeo Rana Yashu351	
1115. SEASONAL INCIDENCE PATTERN OF MUSTARD APHID, <i>LIPAPHIS ERSYMI</i> (KALT.) IN TARAI REGION OF UTTAR PRADESH AND UTTARAKHAND C.P. Singh and Shweta Patel	344	1142. MITIGATIVE EFFECTS OF POTASSIUM ON DROUGHT STRESS IN SWEET CORN Suhana Rao and Narender Singh	352
1116. ROLE OF POTASSIUM SOLUBILIZING MICROBES IN PLANT NUTRITION Alka Arya	344	1143. IMPACT OF SALINITY ON DIFFERENT VALUABLE CROPS: PHYSIOLOGICAL, BIOCHEMICAL AND MOLECULAR CHARACTERIZATION Neelesh Kapoor ¹ and Veena Pande	352
1117. A NEWFANGLED TOOL OF NANO-TECHNOLOGY- AGNPS MEDIATED CONTROL OF <i>MELOIDOGYNE INCOGNITA</i> (ROOT-KNOT NEMATODE) ON <i>VIGNA UNGUICULATA</i> (COWPEA) Atirah Tauseef, Hisamuddin, Mohd Danish, Chanchal Chaudhary, Yasar Nishat	344	1144. MANAGEMENT AND HARVESTING OF GROUND WATER IN JAIPUR RAJASTHAN Poonam Chaudhary	352
1118. NANOTECHNOLOGY FOR SUSTAINABLE AGRICULTURE Sheeba Malik, Anupama Singh	344	1145. DRINKING WATER MONITORING IN AGRICULTURE INTENSIVE AREA OF RIVER KRISHNI CATCHMENT, BAGHPAT, UTTAR PRADESH, INDIA Bharti, ⁴ Amrisha Kumar ⁵ , J. S. Jangwan ² , Vivek Kumar	353
1119. SOIL HEALTH MANAGEMENT THROUGH CARBON SEQUESTRATION FOR SUSTAINABLE AGRICULTURE Maneesh Bhatt* and Shiv Singh Meena	345	1146. IMPACT ASSESSMENT OF NATIONAL FOOD SECURITY MISSION WITH RESPECT TO CHANGE IN AREA AND PRODUCTION OF DIFFERENT CATEGORIES OF CHICKPEA GROWERS Varsha Upadhyay, S.K. Agrawal and Sonam Upadhyay	353
1120. STUDIES ON <i>XANTHOMONAS AXONOPODIS</i> PV. <i>PUNICAE</i> , CAUSING BACTERIAL BLIGHT OF POMEGRANATE IN PUNJAB Adesh Kumar ¹ , Tanjeet Singh Chahal ¹ , Mandeep Singh Hunjan ² and Harminder Kaur	345	1147. SOIL AND WATER CONSERVATION EVAPORATION ESTIMATION BY MULTIPLE LINEAR REGRESSION AND ARTIFICIAL NEURAL NETWORK SYSTEM BASED MODELS SUSHMA TAMTA ¹ and P. S. KASHYAP	353
1121. RECENTLY EMERGED TECHNOLOGY: CONSTRUCTED WETLAND COUPLED WITH MICROBIAL FUEL CELLS FOR WASTEWATER TREATMENT AND ENERGY PRODUCTION Maitreyie Narayan ^{1*} , Hina Khatoon ² , Amit Kumar Rabha ³ , Pushpa Yadav ⁴ and R.K. Srivastava	345	1148. PESTICIDE RESIDUES IN FRUIT CROPS AND REMEDIES TO OVERCOME THEIR ILL EFFECT SudiptaPadhan, M. Raghuraman and Manish Chandra Mehta	353
1122. SOIL BIOLOGICAL PARAMETERS AND THEIR MANAGEMENT FOR SOIL HEALTH AND CROP PRODUCTION. A REVIEW Pushpa Yadav ^{1*} and Maitreyie Narayan	346	1149. WATER QUALITY STATUS OF KRITHUA WETLAND, DISTRICT, MAINPURI, U.P. Prashant Mishra And Arun Kumar Singh	354
1123. COW URINE BOON FOR SUSTAINABLE AGRICULTURE Ravindra Kumar and Ashutosh Kumar Arya	346	1150. HYBRID SEED PRODUCTION TECHNIQUE OF RICE IN CROP IMPROVEMENT BapsilaLoitongbam*, Kailash Chandra, PrashantBisen, Namarata, Padma Thakur and P.K.Singh	354
1124. CHALLENGES OF LAND DEGRADATION AND STRATEGIES OF THEIR MANAGEMENT Shiv Singh Meena and Vineet Kumar	347	1151. HISTOLOGICAL OBSERVATION OF TANNERY INDUSTRY WASTE WATER ON INDIAN MAJOR CARPS LABEO – ROHITA Arun Kumar Singh And Kavita Sharma	354
1125. CLIMATE CHANGE AND ITS IMPACT ON POLLINATORS Gouri Shankar Giri ^{*1} , Shikha Rohila ² , Sunil Verma ³ , Seenam Mishra	347	1152. WATER RETENTION CHARACTERISTICS OF SOILS OF NAGALVADI MICRO-WATERSHED OF WARDHA DISTRICT, MAHARASHTRA Nilima S. Sadanshiv ¹ and M.S.S. Nagaraju	355
1126. SALT STRESS: A SERIOUS ENVIRONMENTAL ISSUE IN AGRICULTURE PRODUCTION Gagan Kumar and Birinchi Kumar Sarma	347	1153. IMPACT OF CLIMATE CHANGE ON WEED FLORA SHIFT Manish Kushwaha* Pooja Gupta Soni, TaramaniYadav, Sourabh Kumar	355
1127. CLIMATE CHANGE IMPACT ON RIVERINE SYSTEMS OF INDIA Mahendra Pal ^{*1} , H. K. Kardani ¹ , V. Sarman ¹ , Krishna ¹ , & N. Harika	347	1154. THEME- BIO-NANOTECHNOLOGY AND GREEN TECHNOLOGY FOR SUSTAINABILITY NANOMATERIALS FOR SUSTAINABLE AGRICULTURE Priyal Pandey* and Nirmal De	355
1128. MITIGATION AND ADAPTATION STRATEGIES FOR CLIMATE CHANGE Navish Kumar Kamboj ¹ , Gaurendra Gupta	348	1155. RAW MANGO AND ITS VALUE ADDED PRODUCTS Merionydd Langtang ¹ and A. K. Chaurasiya	355
1129. SEASONAL ASSESSMENT OF DEHYDROGENASE AND UREASE ACTIVITIES IN MULBERRY SOILS UNDER TEMPERATE CLIMATIC CONDITIONS OF KASHMIR Saima khursheed and M.R.Mir.	348	1156. CARBON TRADING: A STEP TO MITIGATE GLOBAL WARMING ShivaniLalotra*, Sandeep kumar ,jyostnarani Pradhan	356
1130. DIVERSITY AND COMMUNITY STRUCTURE OF NEMATODES ASSOCIATED WITH AGRICULTURAL FIELDS NEAR YAMUNA IN DELHI REGION Shikha Ahalavat & A.K. Chaubey	348	1157. CARBON TRADING: A STEP TO MITIGATE GLOBAL WARMING ShivaniLalotra*, Sandeep kumar ,jyostnarani Pradhan	356
1131. EVALUATION OF BARLEY GERMPLASM FOR ROOT SYSTEM ARCHITECTURE UNDER POLYETHYLENE GLYCOL STIMULATED DROUGHT STRESS Manju ^{1*} , Vikender Kaur ² , Kamal Sharma ¹ and Sunder Singh Arya	349	1158. MICROORGANISMS: A KEY TO IMPROVE SOIL HEALTH Nitesh Kumar Singh ¹ and Yukti Verma	356
1132. FLOWERS: A NEW POTENTIAL SOURCE OF NUTRACEUTICALS FOR FOOD APPLICATIONS		1159. SOIL PROPERTIES IN RELATION TO RESOURCE CONSERVATION TECHNOLOGIES D. C. KALA	356
		1160. THE STATE OF ANAEROBIC DIGESTION PROCESS IN RENEWABLE ENERGY SECTOR OF INDIA ¹ Mudasir Youssouf Malik ² Zahid Nabi and ³ Aadil Gulzar	357
		1161. IMPACT OF TEXTILE INDUSTRIAL EFFLUENTS ON ENVIROMENT AND ITS MANAGEMENT Susmita Bajpai	357

1162. CONSERVATION AGRICULTURE: A FUTURE OF SUSTAINABLE CROP PRODUCTION
Dinesh Kumar^{1*}, B. S. Prajapat², Ashok Patidar³ and R. K. Goswami 358
1163. SOIL CARBON SEQUESTRATION TO MITIGATE CLIMATE CHANGE AND ADVANCE FOOD SECURITY
Shreya Sinha¹, Jyoti Singh 358
1164. SUPER ABSORBENT POLYMERS - AN INNOVATIVE WATER SAVING TECHNIQUE FOR OPTIMIZING CROP YIELD
Avinash Patel^{1*}, Abhishek Shori¹, Sudhanshu Verma¹, Shani Kumar Singh 358
1165. EFFECT OF ASCORBIC ACID IN COMBINATION WITH NaCl FOR MITIGATING THE SALINITY STRESS IN SUGARCANE (SACCHARUM OFFICINARUM L.) VARIETY CO 0118 AND CO 0238 UNDER IN VITRO CONDITION
Ranjana Singh* and R.S. Sengar 359
1166. CALIBRATION AND VALIDATION APSIM-WHEAT MODEL FOR SUB HUMID REGION OF WESTERN HIMALAYAS FOR CLIMATE CHANGE STUDY
SMITA GUPTA¹, R.K.SINGH¹, AJIT SINGH², SUMANA ROY¹ U.P.SHAHI 359
1167. CLIMATE CHANGE AND GLOBAL WARMING: MODERN GLOBAL CLIMATE CHANGE
¹KALYANI SINGH, ²VIMAL SINGH, ³SRAVANTHI.M 359
1168. NATURAL RESOURCE CONSERVATION
Sandeep K. Mauriya, Deeptimayee Sahoo and A.K.Pal, Sunil K. Maurya 360
1169. NATURAL RESOURCES AND ENVIRONMENTAL ISSUES
Arun Solanki, Abhishek Kumar and Pankaj Kumar 360
1170. MANAGEMENT OF EMERGING WEED SPECIES IN CONSERVATION AGRICULTURE (CA) AN OVERVIEW
Akhilesh Chandra Singh 360
1171. IN VITRO REGENERATION AND CONSERVATION OF DECALEPIS SALICIFOLIA- A CRITICALLY ENDANGERED PLANT OF WESTERN GHATS, INDIA
Zishan Ahmad* and Anwar Shahzad 361
1172. DEGRADED SOILS, THEIR PROBLEMS AND MANAGEMENT FOR ENHANCING CROP PRODUCTION
Sukanya Ghosh^{*1}, Navneet Pareek, and K.P. Raverkar 361
1173. UTILIZATION OF AGRICULTURAL WASTES FOR ENVIRONMENTAL SUSTAINABILITY
HINA KHATOON AND MAITREYIE NARAYAN 361
1174. ROLE OF CROP WASTE IN SUSTAINABLE AGRICULTURE
Komal and Joginder Kumar 362
1175. GROWTH, YIELD AND CANOPY ENVIRONMENT IN ARBOREAL, HIRSUTUM ND BT COTTON UNDER HIGH DENSITY PLANTING SYSTEM
Arvind Kumar and A.P. Karunakar 362
1176. ROLE OF GREEN MANURING IN SUSTAINABLE CROP PRODUCTION
Rakesh Kumar Jogendra Kumar and Surgyan Rundla 362
1177. STABILITY ANALYSIS FOR TERMINAL HEAT TOLERANCE BREAD WHEAT (*TRITICUM AESTIVUM* L. EM. *THELL.*)
Santosh 363
1178. INFLUENCE OF INM ON REDUCING SOIL N₂O EMISSIONS, NUTRIENT USE EFFICIENCY, SOIL FERTILITY AND PRODUCTIVITY OF RICE CROP
Vijay Kant Singh 363
1179. SUSTAINABILITY REALIZATION THROUGH CONSERVATION AGRICULTURE
Sweta Shikta Mahapatra*, Joginder Kumar** and Rakesh Kumar 363
1180. SOIL AND WATER CONSERVATION BORON CONTENT AND ITS UPTAKE BY COTTON (*GOSSYPIMUM HIRSUTUM* L.) AS AFFECTED BY APPLICATION OF BORON IN CALCAREOUS SOILS OF SOUTH-WEST PUNJAB
¹Sunil Kumar*, ²Dinesh Kumar 364
1182. CLIMATE CHANGE AND INCIDENCE OF INSECT PESTS
Saxena R.P.N, P.S.Singh, Deepak Kr Jaiswal, D.Rakshit Roshan & Prateek Singh 364
1183. IMPACT OF CLIMATE CHANGE ON HORTICULTURAL CROPS
Ajay Yadav* Rohit Maurya** Vimal Nagar***Vivek Ujjawal 364
1184. WATER QUALITY ASSESSMENT BETWEEN OF RIVER HINDON BETWEEN GHAZIABAD AND GREATER NOIDA, U.P
Mukesh Ruhela 365
1185. EMERGENCE OF SPACE TECHNOLOGICAL SOLUTION FOR NATURAL RESOURCE CONSERVATION AND CLEAN ENVIRONMENT
Yadav, Droupti¹ and Lal, Banwari 365
1186. SOIL PROPERTIES IN RELATION TO RESOURCE CONSERVATION TECHNOLOGIES
D. C. KALA^{1*}, H. S. KUSHWAHA² and GANGADHAR NANDA 365
1187. IMPACT OF HORTICULTURAL WASTE ON ENVIRONMENT
Dr. S.L. Pal 366
1188. BENEDICTIONS OF GLOBAL WARMING – A CONTRADICTIONARY REVIEW
Vinod Kumar 366
1189. AN OVERVIEW ON OUR ANCIENT WATER CONSERVATION SYSTEM
Manika Barar¹, Anuj Kumar² and Kaviraj 366
1190. RESPONSE OF SUMMER GROUNDNUT TO NUTRIENT SOURCES AND NUTRIENT SOLUBILIZERS IN BLACK CALACEROUS SOIL IN SOURASHTRA REGION
Aniket Diwedi^{1*} and Ram A. Jat 367
1191. EFFECT OF NITROGEN LEVELS ON LATE SOWN VARIETIES OF WHEAT (*TRITICUM AESTIVUM* L.)
Anil Kumar^{1*}, R. N. Maurya²
1192. BIO-COMPATIBLE LIGAND COATED GD₂O₃ NANOMATERIALS AS MRI CONTRAST AGENTS
Md. Wasi Ahmad^{*1}, Gang Ho Lee* 367
1193. RESPONSE OF SELECTED LENTIL CULTIVARS AGAINST THE ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA*
Taruba Ansari, Mohd Asif, Amir Khan, Moh Tariq, Faryad Khan and Mansoor Ahmad Siddiqui 368
1194. HAPLOID: PRODUCTION AND USE IN CROP IMPROVEMENT
Deepankar Pandey, Vinay Chaurasiya, Rakesh Chaudhary, Tabassum and Sneha Adhikari 368
1195. RESISTANCE OF DIFFERENT MAIZE PROMISING GERMPLASM AGAINST MAIZE STEM BORER *CHILO PARTELLUS* (SWIMHOE) IN KHARIF SEASON
Kaushal Kishor, Neelam Yadav, Ram Kewal, S.K. Dotsara 368
1196. STUDIES ON *Xanthomonas axonopodis* pv. *punicae*, CAUSING BACTERIAL BLIGHT OF POMEGRANATE IN PUNJAB
Adesh Kumar¹, Tanjeet Singh Chahal¹, Mandeep Singh Hunjan² and Harminder Kaur 368
1197. MUTAGENS EFFECT ON PLANT SURVIVAL IN M₁ GENERATION
Partap Singh¹, V.K Dweivedi² and Vinay Panwar 369
1198. ACUTE TOXICITY STUDY OF BEES (APIS DORSATA) REARING: PESTICIDES & WEEDICIDES TREATMENT IN VIVO CONDITION.
Vinay Panwar¹, Swati Rathi² and Partap Singh 369
1199. APPLICATION OF RADIOTRACER OR ISOTOPIC TECHNIQUES IN AGRICULTURE
Atul Dhansil¹ Shivani Thakur² Mukul Kumar Gandhi 369
1200. PHYTOCHEMICAL SCREENING, TOTAL PHENOLICS, FLAVONOID CONTENT AND ANTIOXIDANT POTENTIAL OF DIFFERENT PARTS OF *BETULA UTILIS* D. DON FROM KASHMIR HIMALAYA
Mohammad Saleem Wani^{*1}, Raghuir Chand Gupta¹, A.H. Munshi 370
1201. INFLUENCE OF INDOLE-3-BUTYRIC ACID ON ROOTING EFFICACY IN DIFFERENT CARNATION (*DIANTHUS CARYOPHYLLUS* L.) GENOTYPES UNDER PROTECTED CONDITION
Prince^{1*}, Arvind Mailk² and Vivek Beniwal 370
1202. PHOTOSYNTHETIC ACTIVITIES AFFECTED BY INTERACTIVE EFFECT OF ZINC UNDER DIFFERENT SALINE CONDITION IN WHEAT PLANT
Sonia Rani*, Manoj Kumar Sharma, Pooja Rani and Nidhi Kamboj 370
1203. ROLE OF EXTRACELLULAR LIGNOCELLULOLYTIC FUNGAL ENZYMES IN BIOCONVERSION OF BAMBOO BIOMASS INTO FERMENTABLE SUGARS FOR BIOETHANOL PRODUCTION
Raj Kumar Pandey¹, Salil K. Tewari², Khan Chand³, Lakshmi Tewari 371
1204. 24-Epibrassinolide Mediated Changes in Growth and Some Biochemical Aspects of *Vigna mungo* (L.) Hepper under salt stress
Sombir Singh and Somveer Jakhar 371
1205. MICROALGAE BIOMASS UTILIZATION FOR BIODIESEL DEVELOPMENT
*Parveen Kumar¹, Devendra Kumar², P. K. Sharma 371
1206. QUANTIFICATION OF THERMAL INDICES IN INDIAN MUSTARD (*BRASSICA JUNCEA*) VARIETIES AT VARIOUS PHENOPHASES UNDER DIFFERENT GROWING ENVIRONMENT IN HISAR
YOGESH KUMAR*, RAJ SINGH, C S DAGAR, ANIL KUMAR and KARAN CHHABRA 371
1207. EFFECT OF MICRONUTRIENTS ON YIELD, QUALITY AND STORAGE OF ONION (*ALLIUM CEPA* L.) IN NORTH BIHAR
Yadav, L. M., Prasad, S. S., Kumar, Jitendra and Singh, Yamuna Prasad 372
1208. COST EFFECTIVE INDUSTRIAL AND MEDICINE MOLECULAR FARMING
Namrata^{1*}, Prashant Bisen¹, Bhumika Singh², Padma Thakur¹, Bapsila Loitongbam¹ and Risha Varan 372
1209. CHARACTERIZATION AND CLASSIFICATION OF ELITE GENOTYPES OF CHICKPEA (*CICERARIETINUM* L.) FOR MORPHOLOGICAL CHARACTERS USING DUS DESCRIPTORS
D.K. Janghel*, Krishan Kumar, Mukesh Kumar and A.K. Chhabra 372
1210. EFFECT OF MARKET WASTE AND ITS PROPER MANAGEMENT TOWARDS A SUSTAINABLE ENVIRONMENT
Diptanu banik*, Hina upadhyay, Arun kumar and Vipul kumar 373
1211. GENETIC TRANSFORMATION OF RICE: PROGRESS AND PROSPECTS
Parul Devi, Pushpendra kumar, Shilpy singh 373
1212. INTEGRATED NUTRIENT MANAGEMENT (INM) FOR SUSTAINING PULSE CROP PRODUCTIVITY AND REDUCING ENVIRONMENTAL IMPACT: A REVIEW
Chetan kumar jangir^{*1}, Dheeraj panghaal^{*2}, Sandeep siha^{*3} and Shish ram jakhar 373
1213. EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON PLANT GROWTH AND YIELD OF TOMATO (*SOLANUM LYCOPERSICON* L.) C.V. PKM-1
Rajya Laxmi P and Sanjana R.Y. Dr. P.D.K.V. Akola. 374
1214. UTILIZATION OF GENETICALLY DIVERSE GENOTYPES OF INDIAN MUSTARD IN ISOLATION OF HETEROTIC CROSSES FOR YIELD AND YIELD RELATED TRAITS
Sneha Adhikari*, Usha pant and Ram Bhajan 374
1215. IMPACT OF FRONT LINE DEMONSTRATION ON YIELD AND ECONOMICS OF WHEAT
Ashok Kumar¹, Govind Kumar², Maya Kumari³, Nidhi Sinha⁴ and Anil Kumar 375
1216. TILLING: A TRADITIONAL MUTAGENESIS FOR FUNCTIONAL GENOMICS AND CROP IMPROVEMENT
Ashok Singamsetti* and Mounika Korada 375

1217. EFFECT OF CHEMICAL FERTILIZERS AND VARIOUS BIOFERTILIZERS ON PHENOLOGY IN BARLEY Priti Malik, Meena Sewhag, Karmal Malik and Shweta	375	Aarti Sharma and Ayushi Srivastava, Omprakash, Girish Tanturway	383
1218. REGENERATION OF PLANTLETS THROUGH TISSUE CULTURE IN SUGARCANE CULTIVAR COSE 93232 Kumar ^{*1} , V.K. Srivastava ¹ , S.P. Yadav ¹ , Sonia Yadav ¹ and B.L. Sharma	375	1244. EFFECT OF SEED TREATMENTS AND PACKAGING MATERIALS ON SEED QUALITY PARAMETERS IN COWPEA (<i>VIGNA UNGUICULATA</i>) DURING STORAGE Pusarla Susmitha ^{1*} , Prashant Kumar Rai	383
1219. HARMFUL EFFECTS OF MICROCYSTIN ON FISHES OAshvani Kumar Srivastav	375	1245. WATER CONSERVATION BY TRADITIONAL PRACTICES Varun Shukla	383
1220. CYTOGENETIC CHANGES ON <i>VICIA FABA</i> BY SODIUM AZIDE Naina Srivastava	376	1246. KRISHI VIGYAN KENDRA PLAY KEY ROLE IN EVERGREEN REVALUATION Vikas Kumar ¹ , Satya Prakash ¹ , Vimal Singh ² , Arjun Singh ² , Y.P.Singh ² and Manoj Kumar	384
1221. EFFECT OF PLANE OF NUTRITION ON GROWTH OF FEMALE BUFFALO CALVES. Narendra Kumar, Ram Jee Gupta, Adesh Kumar, Deepak Singh And Govind Kumar	376	1247. ROLE OF TECHNOLOGY ADOPTION ON PADDY PRODUCTIVITY THROUGH FRONT LINE DEMONSTRATION Vikas Kumar ¹ , Satya Parkash ¹ , Ashok Singh ¹ , B.P. Shashi ¹ , D.P. Singh ² and Hitash Kumar	384
1222. RESPONSE OF DIFFERENT PAPAYA VARIETIES UNDER PROTECTED CONDITIONS Manu Tyagi ¹ , Harminder Singh ² and C.P. Singh	376	1248. POPULARIZATION OF SUGARCANE VARIETY Co.0238 IN WESTERN U.P. Vikas Kumar ¹ , Mukash Kumar ² and Anil Sirohi	384
1223. ELUCIDATING GENETIC DIVERSITY IN 180 GERMPLASM LINES OF BREAD WHEAT FOR DIFFERENT YIELD AND COMPONENT CHARACTERS Neha Joshi and Anil Kumar	377	1249. HIGH FREQUENCY AXILLARY SHOOT PROLIFERATION THROUGH <i>VIVO</i> DERIVED EXPLANTS IN <i>GYMNETA SYLVESTRICOUPLUM</i> WITH HISTOLOGICAL, BIOCHEMICAL AND PHYSIOLOGICAL STUDIES Taiba Saeed and Anwar Shahzad	385
1224. SUSPENDED SEDIMENT LOAD SIMULATION BASED ON GAMMA TEST, HEURISTIC AND SEDIMENT RATING CURVE TECHNIQUES Vijay Kumar Singh ^{1*} , Daniel Prakash Kushwaha ¹ , Ashish Kumar ¹ and Bhagwat Saran	377	1250. CONCEPT OF INTEGRATED PEST MANAGEMENT TO SUPPRESS PEST POPULATION Ankit Kumar and Lakhi Ram	385
1225. PHENOTYPIC AND MICROSATELLITE MARKER ANALYSIS OF SELECTED LINES OF AEROBIC RICE UNDER WATER LIMITED CONDITIONS Kanika Rani ^{1*} and Rajinder Kumar Jain	377	1251. INVASIVE ALIEN SPECIES: A THREAT TO NATIVE BIODIVERSITY Ipsita Samal, Tanmaya Kumar Bhoi and Hemant Kumar	385
1226. AGRICULTURAL BIODIVERSITY CONSERVATION, DEVELOPMENT IN SUSTAINABLE AGRICULTURE Jyoti Chauhan ^{1*} , Sneha Kumari ² and Rajesh Singhal	377	1252. INTEGRATED PEST MANAGEMENT: PREREQUISITE FOR SUSTAINABLE NATURE Surbhi Garg	386
1227. NANOTECHNOLOGY : A NEW FRONTIER IN AGRICULTURE Nikhil Katayyan, Virta Tomar	378	1253. ROLE OF SYSTEMIC ACQUIRED RESISTANCE IN PLANT DEFENCE Ishan Raheja, Adesh Kumar, Vipul Kumar, Kabrabam Suraj Jackson, Mohit Kumar, Baby Wangkhem, Dilpreet Singh and Jagraj Singh	386
1228. MAIZE RESPONSE TO SOWING TIME AND VALIDATION WITH CERES MAIZE MODEL M. Swetha Sree, R. Rajarajeswari, T. Prathima, P. Latha and P. Sudhakar	378	1254. INDIGENOUS TECHNOLOGY KNOWLEDGE: A NEED OF PRESENT ERA Nitika Kumari, Vijayshree Gahlot, Komal Kathuria and Rajaram Bunker	386
1229. THE ANALYSIS OF CLIMATIC VARIABILITY/WEATHER TRENDS (PAST AND FUTURE) IN EASTERN U.P. Ajit Singh ¹ , S.R. Mishra ² , Smita Gupta ³ and U.P. Shahi	378	1255. INTEGRATED WEED MANAGEMENT IN VEGETABLE CROPS Nisha Jangre ¹ , Anjit Jangre ² , Pappu Lal Bairwa ¹ , Bhanupratap Jangde ¹ .	386
A. VARIETAL CANE IMPROVEMENT PROGRAMME FOR HIGH ECONOMICAL YIELD IN BIHAR K. Mall, Varucha Misra and A.D. Pathak	379	1256. OPTIMIZATION OF CULTURE CONDITIONS FOR ENHANCED PHYTASE PRODUCTION BY <i>ASPERGILLUS TERREUS</i> Sarita Singh and P.K. Sharma	387
1230. PERFORMANCE RELATIONSHIPS BETWEEN NIGHT SATELLITE AND OCO-2 SIGNATURE- IN THE CASE OF DELHI (INDIA) Ambreen Matloob ¹ , Jung-Sup Um	379	1257. EVALUATION OF POINTED GOURD FOR FRUIT YIELD UNDER TARA CONDITION OF UTTARAKHAND Jagamohan Debata, S. K. Maurya and Lalit Bhatt	387
1231. SODIUM FLUORIDE EFFECT ON LINSEED AT ON GERMINATION LEVEL AMIT NAGAR, SHASHANK GUPTA, RAMU K	379	1258. GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (<i>ORYZA SATIVA L.</i>) Devidas Thomabare, Archana Prasad and Satish Verulker	387
1232. DEPARTMENT OF PLANT PHYSIOLOGY, IAS, BANARAS HINDU UNIVERSITY, VARANASI 221005, INDIA. INTEGRATED NUTRIENT MANAGEMENT IN FRUITS Amit Kumar, Vivek Ujjwal, Ajay Yadav, and Vimal Nagar	380	1259. SEED GERMINATION OF GUAVA (<i>PSIDUM GUAJABA L.</i>) AS AFFECTED BY DIFFERENT SCRIFICATION TREATMENTS SOURABH*, JEET RAM SHARMA AND SATPAL BALODA	388
1233. MICROPROPAGATION OF GERBERA JAMESONII - AN ORNAMENTAL PLANT. Amit, Sanat Sujat Singh* & Narendra Singh	380	1260. LET STUBBLE NOT TO BE A TROUBLE Jilani Syed, Y. Satish, P. Renuka and Adesh Kumar	388
1234. CHARACTERIZATION OF <i>BACILLUS THURINGIENSIS</i> STRAINS FOR THEIR TOXICITY AGAINST GRAM POD BORER (<i>HELIOPHAPS ARMIGERA</i> , LEPIDOPTERA: NOCTUIDAE) Mohammad Anas and Abdul Malik	380	1261. ROLE OF BIO AGENTS IN PLANT DISEASES MANAGEMENT Jitendra Sharma*, S. K. Goyal, G.S. Rathore, S. Godika and Sonali Meena	388
1235. GASTROPROTECTIVE EFFECT OF FORMONONETIN, A METHOXYLATED ISOFLAVONE AGAINST ETHANOL-INDUCED GASTRIC ULCERATION IN RATS VIA AUGMENTATION OF CYTOPROTECTIVE MARKERS AND CURTAILING APOPTOTIC GENE EXPRESSION.	381	1262. BODY TEMPERATURE, CLOACAL PROTUBERANCE, GONADAL SIZE AND NUPITAL COLOURATION IN MATING SUCCESSION IN BLACKHEADED MUNIA (<i>LONGCHURA MALACCA</i>) Kumar P, Pandey RK, Chhabra R and Bhardwaj SK	389
1236. INTERNATIONAL CONFERENCE ON ADVANCES IN AGRICULTURAL AND BIODIVERSITY		1263. STUDY OF TOTAL SEED STORAGE PROTEIN PATTERN OF RICE (<i>Oryza Sativa L.</i>) GENOTYPES USING SDS-PAGE Shende Rajendra ¹ , Sheilendra Pandey ² , Kanchan S. Bhan ³ .	389
1237. APILARNIL (A PRODUCT OF MALE HONEY BEE): IMPORTANCE IN HUMAN WELFARE Supratik Banik* and Lokesh Bag	381	1264. IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD AND PRODUCTIVITY OF MUSTERED CROP Rhit Kumar ^a , Akhila Nand Dubey ^{b*} and Manish Singh	389
1238. COMPETITIVE ABILITY OF RICE VARIETIES AGAINST WEED UNDER AEROBIC CONDITION Sagar dhage S	381	1265. INFLUENCE OF PANCHAGAVYA WITH DIFFERENT LEAF EXTRACTS FOLIAR SPRAY ON GROWTH AND YIELD OF GROUNDNUT (<i>ARACHIS HYPOGAEA L.</i>) KM Choudhary, K G Vyas, SK Kakraliya and M K Man	390
1239. INFLUENCE OF INDOLE-3-BUTYRIC ACID ON ROOTING EFFICACY IN DIFFERENT CARNATION (<i>DIANTHUS CARYOPHYLLUS L.</i>) GENOTYPES UNDER PROTECTED CONDITION Prince ^{1*} , Arvind Maik ² and Vivek Beniwal	382	1266. DISTRIBUTION AND DIVERSITY OF PHYTOPLANKTON IN SELECTED PONDS OF ALIGARH DISTRICT, U.P., NORTH INDIA	390
1240. EFFECT OF DROUGHT STRESS IN WHEAT AND ASSOCIATED REGULATORY TRANSCRIPTION FACTOR Vandana Sharma, Ashwini Kumar, Arun Kumar, Shilpy Singh and Vaishali	382	1267. UTILIZATION PATTERN OF MOBILE PHONE TECHNOLOGY (SMARTPHONE) AMONG THE FARMERS OF NAGOUR DISTRICT IN RAJASTHAN Kailash, Om Prakash Mishra, Shani Kumar Singh and H.K. Verma	390
1241. EPIGENOMICS PROJECTS ON CROP PLANTS Gyanika Shukla ¹ , S. S. Gaurav ² , Anju Rani ³ , Raj Singh ⁴ , Rekha Dixit ⁵ and Amit Kumar	382	1268. POPULATION IMPROVEMENT STRATEGIES FOR IMPROVING THE ALLOGAMOUS CROP PLANTS Kailash Chandra*, Ravindra Prasad and Lal Chand Prasad	390
1242. HUMAN-TIGER CONFLICT: IN PERSPECTIVE OF PILIBHIT TIGER RESERVE Dr. Brijesh Kumar Rathi	383	1269. MOLECULAR CHARACTERIZATION OF <i>HETERORHABDITIS INDICA</i> DH ₃ ISOLATE AND ITS REPRODUCTIVE POTENTIAL AGAINST <i>GALLERIA MELLONELLA</i> Kajol*, Aashaq Hussain Bhat, Aasha and AK Chaubey	391
1243. INTELLECTUAL PROPERTY RIGHTS IN INDIA		1270. RESPONSE OF INM ON YIELD AND NUTRIENT UPTAKE OF SESAME (<i>SESAMUM INDICUM L.</i>) *Kamlesh Choudhary ¹ , Vijay Kumar Didal ² and Shish Ram Jakhar	391
		1271. APIS SPP. (HYMENOPTERA: APIDAE) AS POTENTIAL VISITOR OF INDIAN MUSTARD, <i>BRASSICA JUNCEA (L.) CZERNJ. & COSSON</i> Kanika Nagpal ¹ , Sunita Yadav ^{*2} and Robin Singh	391

1272. DIVERSITY OF INSECT VISITORS/POLLINATORS ON INDIAN MUSTARD(BRASSICA JUNCEA L.)FLOWERS Kanika Nagpal ¹ , Sunita Yadav ^{*2} and Robin Singh	392	Sumit Jangra ¹ , Asha Rani ¹ , R. C. Yadav ¹ , N. R. Yadav ¹ and Dev Vart	400
1273. NUTRITION GARDEN AN INTERVENTION AGAINST MALNUTRITION: A CASE STUDY OF NICRA VILLAGE. Sarita Joshi	392	1302. COMPUTATIONAL MODELING AND ANALYSIS OF VARIETAL EFFECTS ON GROWTH AND YIELD OF RICE USING IFSS VER. 1.1 MODEL IN WESTERN PLAIN ZONE OF UTTAR PRADESH Sunil Kumar ¹ , M. Shamim ¹ , Mamta Bansal ² and A.S. Panwar	401
1274. EFFECT OF MICRONUTRIENT AND ORGANIC MANURE IN GRAIN YIELD OF RICE (NDR-359) Sanjeev Kumar Singh ¹ and Bikramaditya	392	1303. MUTATION BREEDING, USE OF IRRADIATED POLLEN FOR IMPROVEMENT OF HORTICULTURAL CROPS Prashant Bisen ¹ , Namrata ¹ , Omprakash ¹ , Bapsila Loitngbam ¹ , Vikas Kumar Jain ² , Risha Varan ³ , Anupam Tiwari	401
1275. IMPORTANCE OF ZINC BIOFORTIFICATION AND ITS APPLICATION AT DIFFERENT STAGES OF WHEAT ON THE BASIS OF ZADOK'S SCALE. Pramod Lawate and S.K. Prasad	392	1304. CONSTRAINTS PERCEIVED BY GOAT KEEPERS IN ADOPTION OF GOAT HUSBANDRY IN WESTERN U.P. Manoj Kumar ¹ S.D. Singh ¹ Reshu Singh ¹ Kirti Mani Tripathi ¹ & Pravendra kumar	401
1276. EVALUATION OF BIO-AGENT POTENTIAL OF TRICHODERMA SP.AGAINST VASCULAR WILT OF LENTIL IN BUNDELKHAND REGION KAMLESH RAM	393	1305. EFFICACY OF CHEMICALS AND BOTANICALS ON VARROA DESTRUCTOR, AN ECTOPARASITE ON APIS MELLIFERA Kawsar Rasool, Ishtiyahq Ahad, Parveena Bano, Amit Kumar ¹ and Ritesh Kumar	402
1277. LAND USE PLANNING: A KEY TO SUSTAINABLE AGRICULTURE Arun Solanki ^{1*} , Pukhraj Singh ^{2*} , Lalit Kr. Verma ^{3*} and Nitin Kr. Nag	393	1306. CONSERVATION EFFORTS IN WHEAT GENETIC RESOURCES AT THE NATIONAL GENE BANK, ICAR- NBPGR Sherry Rachel Jacob ¹ , Sandeep Sharma ² , Arun Kumar MB ² , J Radhamani ¹ and Kalyani Srinivasan	402
1278. LAND USE PLANNING: - OBJECTIVES AND STEPS Pramila Kumari ^{1*} , Sunita Kumari	393	1307. GENETIC ANALYSIS OF SEGREGATING POPULATION IN RICE (ORYZA SATIVA L.) DERIVED FROM CROSS BETWEEN BASMATI AND INDICA (SALT TOLERANT) Mahavir ¹ , Bhoir P.I. ¹ , Shikha Yashveer ¹ , Khushiram Battan ² , Sunita Jain ¹ and R.K. Jain	403
1279. LAND-USE PLANNING FOR SUSTAINABLE DEVELOPMENT USING GEOINFORMATICS: POLICY IMPLICATIONS FOR DRYLANDS Arun Solanki ^{1*} , Pankaj Kumar ^{2*} , and Abhishek Kumar	394	1308. ROLE OF NANOTECHNOLOGY IN INSECT-PEST MANAGEMENT Purti Rohilla [*] , Anuradha and R.S. Jaglan	403
1280. CROP GROWTH AND YIELD OF POTATO (Solanum tuberosum L.) AS AFFECTED BY DIFFERENT WEED MANAGEMENT PRACTICES Lavlesh*, Manoj Raghav, Umesh Chandra Sati, Kailash Sati, Amita Yadav ² and Prakash Kanwar	394	1309. EFFECT OF NANOCHITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION Parul Chaudhary, Priyanka khati, Saurabh Gangola	403
1281. EFFECT OF CLIMATE CHANGE, GLOBAL WARMING AND ITS IMPACT ON HORTICULTURE CULTEIVATION Leela Bhatt ¹ , Mahesh Kumar ² Shivani Dhyani ¹ , Pooja ¹ and Prakash Kanwar	394	1310. CROP IMPROVEMENT THROUGH RNA MEDIATED GENE SILENCING APPROACHES Omprakash, Ayushi Srivastava, Prashant Bisen, Padma thakur and Gobu R.	403
1282. STUDIES ON HERITABILITY FOR YIELD AND ITS COMPONENTS IN BITTERGOURD (Mormordica charantia L.) Leela Bhatt and S.P. Singh	394	1311. GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (ORYZA SATIVA L.) Devidas Thomabare, Archana Prasadand, Satish Verulke	403
1283. MECHANISM OF TRICHODERMA HARZIANUM AS A BIOCONTROL AGENT IN DISEASE MANAGEMENT Vinay Kumar Kardam ¹ , Deepak Kumar ² , Chandni Kumari	395	1312. ELUCIDATING GENETIC DIVERSITY IN 180 GERMPLASM LINES OF BREAD WHEAT FOR DIFFERENT YIELD AND COMPONENT CHARACTERS Neha Joshi and Anil Kumar	404
1284. BIOLOGICAL CONTROL SYSTEMS OF WILT DISEASES Dr. Archana Srivastava & Shenu Sankhwar	395	1313. EFFECT OF PLASMA SEED TREATMENTSON QUALITY OF OKRA [ABELMOSCHUS ESCULENTUS (L.) SEED CROP Ravinder Kumar ¹ , Ashok K. Thakur ¹ , Amit Vikram ² , A. Vaid ³ and R. Rane	404
1285. PATHOGENECITY OF HETERORHABDITIS SPP. ISOLATE CH18 AGAINST GALLERIA MELLONELLA Lovely Bharti [*] and A.K. Chaubey	395	1314. DOUBLE HAPLOIDS FOR ACCELERATED BREEDING IN RICE Pratik Pusadkar and Zenu Jha	404
1286. ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM SUGARCANE BY KOLLURI RAMU ¹ , AMIT KUMAR ² AND SHASHANK GUPTA	396	1315. STUDY ON DNA QUANTIFICATION OF WILD AND CULTURED LABEO ROHITA (HAMILTON, 1822) Nisha Rana and Seema Jain ASHISH KUMAR [*] and NAVNITA SHARMA	405
1287. EFFECT OF POST HARVEST APPLICATION ON VASE LIFE OF FLOWER Lyang B. Sangama ^{**} and A. K. Chaurasiya	396	1316. Green synthesis of hematite (α -Fe ₂ O ₃) nanoparticles using aqueous Aloe vera leaf extract and their antibacterial and antibiofilm activities Khursheed Ali ¹ , Sourabh Dwivedi ¹ , Bilal Ahmed ¹ , Quaiser Saquib ² , Abdulaziz A. Alkhedhairi ² , Md. Saghir Khan ¹ , Javed Musarrat	405
1288. MANAGE OF SEED QUALITY FOR BETTER PRODUCTION OF SUGARCANE CROP IN BIHAR AND UTTAR PRADESH Mukesh Kumar, Varucha Misra, A. K. Mall [*] , B. D. Singh and A. D. Pathak	396	1317. BIOTECHNOLOGY IN PLANT GENETIC RESOURCE (PGR) CHARACTERIZATION AND ITS MANAGEMENT Ravi Ranjan Saxena ^{1*} , Prabhat Kumar ¹ , L.B Gaur ¹ , Prashant Singh ² ,	405
1289. MANAGEMENT OF INSECT PESTS USING NANOTECHNOLOGY D. Vamsi Chandrasekhar Reddy, Abhishek Yadav and Tara Yadav	396	1318. CONSORTIUM EFFECTS OF AM FUNGI AND BACTERIA ON BIOCHEMISTRY OF CATHARANTHUS ROSEUS L. ASHISH KUMAR [*] AND NAVNITA SHARMA	406
1290. MANAGEMENT OF STORED INSECTS IN RELATION TO CLIMATE CHANGE Tanmaya Kumar Bhoi [*] , Hemant Kumar and Ipsita Samal	397	1319. MARKER ASSISTED TRANSFER OF SPIKELET NUMBER QTL QSPP2.2 FROM O. LONGISTAMINATA DERIVED INTROGRATION LINE INTO PUNJAB BASMATI 3 Sadhan Debnath, Kuldeep Singh, Dharminder Bhatia, Kumari Neelam Singh, Kishore Sinha, Amanpreet Kaur, Neha	406
1291. MANAGEMENT STRATEGIES FOR CONSERVATION OF NATURAL RESOURCES IN AGRICULTURE Pukhraj Singh ^{1*} , Lalit Kr. Verma ^{2*} and Nitin Kr. Nag	397	1320. CYTOKININ REGIME FOR IN VITRO PROPAGATION AND ASSESSMENT OF ANTIOXIDANT ACTIVITIES DURING EX VITRO ESTABLISHMENT OF ANTI DIABETIC PLANT (TECOMA STANS L.). Sheikh Altaf Hussain and Mohammad Anis	406
1292. ASSESSMENT OF GENETIC VARIABILITY IN NIGELLA SATIVA L. INDUCED BY CHEMICAL MUTAGEN (EMS) RUHUL AMIN AND SAMIULLAH KHAN	397	1321. PLANT BIOTECHNOLOGY LABORATORY, DEPARTMENT OF BOTANY, ALIGARH MUSLIM UNIVERSITY, ALIGARH - 202002, U.P. BIOTECHNOLOGICAL INVENTIONS IN PLANT GENETIC RESOURCE MANAGEMENT Sonali Habde, Amrutlal Khaire	407
1293. A COMPARATIVE STUDY OF GENETIC DIVERSITY USING MORPHOLOGICAL AND MOLECULAR DESCRIPTORS AMONG TROPICAL AND SUBTROPICAL MAIZE INBRED LINES (ZEA MAYS L.) Vijay Kumar ^{1*} , S. K. Singh ¹ , V.K. Malik ¹ and Vinay Mahajan	398	1322. Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, BHU, Varanasi, Uttar pradesh-221005.	
1294. TILLING: A TRADITIONAL MUTAGENESIS FOR FUNCTIONAL GENOMICS AND CROP IMPROVEMENT Ashok Singamsetti [*] and Mounika Korada Indu, Dr. Amit Dadheech and Ashok Kumar Malav	398	1323. ROLE OF GENETICALLY MODIFIED CROPS IN PRESENT SCENARIO FOR THE WELFARE OF HUMAN BEING Mandeep Kumar ¹ , Bijendra Kumar ² , Harshal Ashok Avinash ³ ,	407
1295. EFFECT OF GLUCOSE CONCENTRATION ON GROWTH OF BACTERIAL ISOLATES UNDER ALUMINIUM STRESS Priyanka Arora ^{1*} , Geeta Singh ² and Archana Tiwari	399	1324. MARKER ASSISTED SELECTION IN FRUIT CROPS: A NEW HORIZON TO EXPLORE Anjana Kholia ^{1*} , Vishal Nirgude ² , Pradyot Nalini ³ and Nishant Kadge	407
1296. CHEMICAL MUTAGEN INDUCED HIGH YIELDING AND HIGH PROTEIN MUTANTS OF COWPEA (VIGNA UNGUICULATA L.) Aamir Raina, Samiullah Khan	399	1325. ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN OKRA GENOTYPES FOR YIELD AND YIELD RELATED CHARACTERS Meenakshi Kumari ^{1*} , S.S. Solankey ² , A.K. Dubey ³ and Pallavi Neha	408
1297. EFFECT OF BASIC FUCHSIN DYES ON SOIL MYCOBIOTA Permod Kumar ¹ Raj Singh ¹ , Anju Rani ¹ and Pradip Kumar	399		
1298. BIOCHEMICAL BASIS OF STARCH BIOSYNTHESIS TO IMPROVE QUALITY ASSOCIATED WITH NUTRITION Vivek Chandra Verma and Sanjeev Agrawal	399		
1299. MOLECULAR CHARACTERIZATION OF SIKKIM GOATS Pushp Raj Shivahre ¹ , N. K. Verma ² , Rekha Sharma ² and Sonika Ahlawat	400		
1300. CHANGES IN HEMOCYTE POPULATION OF G. MELLONELLA AGAINST HETERORHABDITIS ISOLATE CH2 Suman [*] , Aasha, Aashaq Hussain Bhat and A. K. Chaubey	400		
1301. IMPROVING DROUGHT TOLERANCE IN PEARL MILLET THROUGH MARKER ASSISTED BREEDING			

1326. EVALUATION OF GROWTH PROMOTING AND IMMUNOSTIMULATORY EFFECTS OF FEED PROBIOTIC BIOSYN IN <i>LABEOROHITA</i> .” IqraNazir* and R. S. Chauhan	408	1354. FECT OF DIFFERENT INOCULUM LEVELS OF <i>H.AVENAE</i> ON PHYSIOLOGY OF WHEAT *Ajay Singh Sindhu and R.S. Kanwar	417
1327. ASSESSMENT OF GENETIC VARIABILITY IN TARO (<i>COLOCASIAESCULENTA</i> (L.) SCHOTTVAR. <i>ANTIQUORUM</i>) GERMPLASM” KhushbooKathayat*, M.L.Kushwaha ¹ &Monisha Rawat	408	1355. BIOCHEMICAL RESPONSES OF RICE (<i>ORYZA SATIVA</i> L.) VARIETIES UNDER SODIC SOIL Sanjay Kumar Tripathi ¹ , A. H. Khan ² , Nikita Nehal ^{*2} and Nitish Sharma	417
1328. <i>PHALARIS MINOR</i> RESISTANCE MECHANISM TO ISOPROTURON IN UTTARAKHAND Nitin Kumar, PrinsaRamola, PriyankaGanghariya and S.K. Guru	409	1356. EFFECT OF MICRONUTRIENT AND ORGANIC MANURE IN GRAIN YIELD OFRICE (NDR-359) Sanjeev Kumar Singh ¹ and Bikramaditya	417
1329. CHEMICAL ECOLOGY AND ITS USE IN HOST PLANT RESISTANCE Maneesha ^{1*} , S. R. Koteswara Rao ¹ , T. Murali Krishna ² and P. Sudhakar	409	1357. EFFECT OF IRRIGATION SCHEDULING ON TOMATO YIELD (<i>LYCOPERSICON ESCULENTUM</i>) AND WATER USE EFFICIENCY UNDER DRIP IRRIGATION Ram Kumar [*] and Gurcharan Singh	417
1330. Genetic improvement of quantitative trait loci (QTL) for yield related component in rice (<i>Oryzasativa</i> L.) DevidasThomabare, ArchanaPrasadand*SatishVerulker	409	1358. CONTROL OF SOIL POLLUTION PROSPECTIVE: PHYTOSTABILIZATION AND PHTYOEXTRACTION POTENTIAL OF <i>PARTHENIUM HYTEROPHORUS</i> L. AGAINST NICKEL AND CHROMIUM Sayma Samreen,* and Athar Ali Khan	418
1331. CONSERVATION OF NATURAL ENEMIES OF PESTS IN THE MOLECULAR ERA: NEW OPPORTUNITIES TO ADDRESS OLD CONSTRAINTS SUNIL VERMA ^{1*} , KALPANA BISHT ¹ , GOURI SHANKAR GIRI ¹ , RITESH KUMAR PARIHAR ² , and ANOOP KUMAR DIVEDEE	410	1359. ASSESSMENT OF CYTO-GENOTOXICITY CAUSED BY HEAVY METAL (CD) IN <i>LYCOPERSICON ESCULENTUM</i> MILL. Nusrat Jahan*, M Y K Ansari	418
1332. SEED GERMINATION OF GUAVA (<i>PSIDIUMGUAJAVA</i> L.) AS AFFECTED BY DIFFERENT SCARIFICATION TREATMENTS Sourabh*, Jeet Ram Sharma and SatpalBaloda	410	1360. DISTRIBUTION AND DIVERSITY OF PHYTOPLANKTON IN SELECTED PONDS OF ALIGARH DISTRICT, U.P., NORTH INDIA Taskkeena Hassan* Saltanat Parveen, Bilal Nabi Bhat and Uzma Ahmad	418
1333. ROLE OF NANOTECHNOLOGY IN PEST MANAGEMENT: A REVIEW Isha Sharma ^{1*} , Divender Gupta ² and Nalini Challa	410	1361. USE OF PEANUT MEAL S AN ALTERNATIVE PROTEIN SOURCE TO FISH MEAL IN PRACTICAL FEEDS FOR FINGERLING HETEROPNEUSTES FOSSILIS (BLOCH) Noorin Zafar ¹ and Mukhtar A. Khan	419
1334. PERSPECTIVES AND APPROACHES OF CONSERVATION TILLAGE IN SUSTAINABLE AGRICULTURE: A REVIEW Bikrmaditya ¹ and Sanjeeve Kumar Singh	411	1362. ¹ FISH NUTRITION RESEARCH LABORATORY, 1363. SURVEY ON NATURAL OCCURRENCE OF ENDOPHYTES IN MAIZE ECOSYSTEM (<i>Zea mays</i> L.) Bhagyasree, S. N ¹ ., S. K. Ghosh ² and Sachin S. Suroshe	419
1335. ASSESSMENT OF GENETIC VARIABILITY IN LINSEED USING INDUCED MUTAGENESIS Roshan Jahan, and Samiullah Khan	411	1364. EFFECT OF DIFFERENT INOCULUM LEVELS OF <i>H.AVENAE</i> ON PHYSIOLOGY OF WHEAT *Ajay Singh Sindhu and R.S. Kanwar	419
1336. <u>MUTAGENIC SENSITIVITY OF PHYSICAL AND CHEMICAL MUTAGENIZED POPULATION OF A VALUABLE MEDICINAL PLANT <i>TRIGONELLA FOENUM-GRACUM</i> L.</u> Shazia Bi Ansari and Samiullah Khan	411	1365. EFFECT OF MICRONUTRIENT AND ORGANIC MANURE IN GRAIN YIELD OFRICE (NDR-359) Sanjeev Kumar Singh ¹ and Bikramaditya	420
1337. ORGANIC FARMING: AN ECO-FRIENDLY WAY TO SUSTAINABLE AGRICULTURE Vishal Tyagi* Mona Nagargade and R. K. Singh	412	1366. MANAGEMENT OF TOMATO LEAF CURL VIRUS AND ITS VECTOR WHITE FLY (<i>BEMISSIA TABACI</i>) IN FIELD CONDITION Amit Kumar Yadav, *Ramesh Singh Yadav, Hem Singh, Abhishek Kumar and Jaskaran Singh	420
1338. ENHANCED SACCHARIFICATION OF IONIC LIQUID PRETREATED AGRICULTURAL WASTE WITH IMMOBILIZED ENZYMES FOR BIOETHANOL PRODUCTION Archana singh, Ashutosh Dubey and A.K. Verma	412	1367. BIO- EFFICACY OF VARIOUS HERBICIDES AGAINST MIXED WEED FLORA OF WHEAT CROP. B.K Mishra, ¹ A.K Singh ² and S.P Vishwakarma	420
1339. GENETIC CHARACTER VARIABILITY STUDIES IN DESI CHICKPEA (<i>CICER ARIETINUM</i> L.) GENOTYPES Alka Dev ¹ , Preeti Verma	412	1368. FIG - A MICROHABITAT SHOWING FASCINATING TRI-TROPHIC INTERACTION Numreen Nazir*, Mohammad Asif, Mohammad Mahboob, Rehmat Jahan, Malka Mustaqim and Qudsia Tahseen	420
1340. PROCESSING AND UTILIZATION OF BY-PRODUCTS OF SUGAR INDUSTRIES Kapil Kumar, Suresh Chandra, Samsher, Prince and Tarun Kumar	413	1369. EVALUATION OF DIFFERENT NUTRIENT MEDIA ON RADIAL GROWTH AND SCLEROTIAL FORMATION OF <i>SCLEROTINIA SCLEROTIUM</i> (LIB.) DE BARYCAUSING WHITE STEM ROT OF MUSTARD Devesh Pathak and R. U. Khan	421
1341. ADVANCE IN AGRONOMIC MANAGEMENT OF INDIAN MUSTARD (<i>BRASSICA JUNCEA</i>) Shreya Sinha ¹ , Jyoti Singh	413	1370. CORRELATION AND PATH COEFFICIENT ANALYAIS IN BRINJAL (<i>SOLANUM MELONGENA</i> L.) Omkar Singh ¹ , B. Singh ² , Sanjay Kumar ² and Sheespal Singh	421
1342. MICROALGAE: THE FUTURE OF CLEAN SUSTAINABLE ENERGY Deepak Kumar	413	1371. EXPRESSION OF HETEROSIS FOR YIELD IN BARLEY ¹ AbhayDeep Gautam and ² Surendra Ram Impact of different levels and sources of sulphur on growth, yield and quality of mustard (Brassica juncea L.) K. K. Verma ¹ , Surendra Ram ² , Prashant Deo Singh ³ and A. K. Singh	421
1343. PERIPHYTON ANALYSIS IN TARA POND OF PANTNAGAR, UTTARAKHAND Jettiboina Mahija and Hema Tewari	413	1372. KRISHI VIGYAN KENDRAS (KVKS) - A POWERFUL TOOL TO TRANSFER OF TECHNOLOGY Surendra Ram ¹ and Dinesh Kumar	422
1344. PLANTS WITH THERAPEUTIC POTENTIAL IN PARTS OF WESTERNUTTAR PRADESH Sumit Kumar, R. C. Arya	414	1373. INTEGRATED FARMING SYSTEM: A BETTER TOOL FOR SOIL HEALTH AND SUSTAINABLE AGRICULTURE. Surendra Ram ¹ , Abhay Deep Gautam ² and V.P. Chaudhary	422
1345. MAJOR PEST OF PEA AND THEIR INTEGRATED PESTMANAGEMENT Vikrant and D. R. Singh.	414	1374. EFFECT OF HIGHER DOSES OF FERTILIZERS ON CROP ESTABLISHMENT AND PRODUCTIVITY OF LATE SOWN VARIETIES OF WHEAT (<i>TRITICUMAESTIVUML</i> . EMEND. FIORI AND POAL) Ashok Kumar Singh ¹ , Arun Kumar ² and R.K Singh	423
1346. EFFECT OF DIFFERENT SUBSTRATES ON MYCELIAL RUN OF <i>HYPHYZYGUS ULMARIUS</i> (BULL.EX.FR.) REDHEAD. (BLUE OYSTER MUSHROOM) Pankaj Kumar Sharma, Fateh Singh, Aman Dhawan and Surjeet Singh	414	1375. EFFECT OF WINTER MAIZE-BASED INTERCROPPING SYSTEMS ON MAIZE YIELD, ASSOCIATED WEEDS AND ECONOMIC EFFICIENCY Somendra nath , Suresh kumar kannaujia, S. Ram, Sandeep kumar and S.P. Sonkar	423
1347. EFFECT OF DIFFERENT LEVELS AND SOURCES OF SULPHUR ON SOIL PROPERTIES, YIELD AND NUTRIENT UPTAKE BY MUSTARD Prashant Deo Singh ¹ ,Sanjeev Singh	415	1376. CLIMATE STRESS MITIGATION AND ETHNO-BOTANICAL POTENTIAL OF ORPHAN LEGUMES T. P. Mall	423
1348. RAPID GREENER BIOSYNTHESIS OF ZINC OXIDE NANOPARTICLESUSING MEDICINALLY IMPORTANT PLANT <i>ANACYLUS PHYTHRUM</i> Sapna Tyagi ¹ and Tanveer Alam	415	1377. EFFECT OF FUNGICIDES SPRAYS ON SHELF LIFE OF KINNOW FRUITS STORED UNDER AMBIENT CONDITIONS Vivek Beniwal*, A.K. Godara and Prince	424
1349. ADVANCES IN FOOD AUTHENCITY TEST Satish chand*, Navneet kumar, kailash pati tripathi	415	1378. NEEDS AND ADVANTAGES OF PRECISION FARMING IN INDIA Pushpanjali ¹ , Pratishtha Diwaker ² , Ravindra Kumar Dhaka ³ and Jitendra Singh Ranawat	424
1350. PROCESSING AND UTILIZATION OF BY-PRODUCTS OF SUGAR INDUSTRIES Kapil Kumar*, Suresh Chandra, Samsher, Prince and Tarun Kumar	415	1379. ECO- TOURISM AND SUSTAINABLE DEVELOPMENT Sandeep Shandilya	424
1351. EPIGENOMICS PROJECTS ON CROP PLANTS Gyanika Shukla ¹ , S. S. Gaurav ² , Anju Rani ³ , Raj Singh ⁴ , Rekha Dixit ⁵ and Amit Kumar	416		
1352. PLANTS WITH THERAPEUTIC POTENTIAL IN PARTS OF WESTERNUTTAR PRADESH Sumit Kumar, R.C.Arya (Associate Professor)	416		
1353. MAPPING OF QTLS IN MAIZE (<i>ZEA MAIZE</i> L.) FOR HIGH FE AND ZN CONTENT Pargat Singh,Sanchari Chakravorty, Shankar M	416		

1380. TOXICITY AND FORMATION OF ACRYLAMIDE DURING FOOD PROCESSING: A REVIEW Anita Laghulkar ¹ , Hanuman Bobade ¹ and Savita Sharma	425	1406. PLANTS WITH THERAPEUTIC POTENTIAL IN PARTS OF WESTERN UTTAR PRADESH Sumit Kumar, R.C.Arya (Associate Professor)	434
1381. EFFECT OF CLIMATE CHANGE ON VEGETABLE CROPS Rohit Maurya*, Ajay Yadav**, Uday Pratap Singh***, Samiksha Verma	425	1407. DEFICIT IRRIGATION FOR CROP PRODUCTION UNDER DROUGHT STRESS Sudhanshu Verma*, Swati Swayamprabha Pradhan, Avinash Patel, Sneha Kumari, Tikendra Kumar Yadav, Shiv Poojan Yadav	434
1382. COMBINING ABILITY AND GENE ACTION STUDIES FOR GRAIN YIELD AND COMPONENT CHARACTERS IN PEARL MILLET [<i>Pennisetum glaucum</i> (L.) R. BR.] UNDER ARID CONDITION OF RAJASTHAN Kanti Lal Solanki*, Mahendar Singh Bhinda, P.C. Gupta and Shravan Kumar Sharma	426	1408. TITLE OF : -BIOTECHNOLOGICAL INVENTIONS IN PLANT GENETIC RESOURCE MANAGEMENT	435
1383. EFFECT OF CLIMATE CHANGE ON INSECT POPULATION Megha G and Sreedhar M	426	1409. MAJOR THEME AREA OF CONFERENCE- INNOVATION IN BIOTECHNOLOGY AND PLANT GENETIC RESOURCES Sonali Habde, Amrutlal Khaire	435
1384. EFFECT OF WEDGE GRAFTING IN GUAVA ON DIFFERENT AGE ROOTSTOCK UNDER SHADE NET AND OPEN CONDITION NEHA SHARMA and Dr. A. K. GODARA	426	1410. EVALUATION OF BIOCONTROL AGENTS AGAINST PHYTOPHTHORA BLIGHT IN PIGEONPEA SUJATA SINGH YADAV, SOMESHWAR BHAGAT, VISHAL SINGH, SHAHNASHI HASHMI AND MEGHRAJ BHAGEL	435
1385. MORPHOMETRIC ANALYSIS OF DOMAGOR-PAHUJ WATERSHED OF BUNDELKHAND REGION OF UTTAR PRADESH USING GIS AND REMOTE SENSING P.K. Mistry and H.C. Sharma	427	1411. NATIONAL CENTRE FOR INTEGRATED PEST MANAGEMENT, ICAR	
1386. NATURAL RESOURCES CONSERVATION Manish Kumar*, Govind Ram Choudhary* and Radhe Shyam Kherwa	427	1412. TILLING/EcoTILLING: PRESENT STATUS AND FUTURE PROSPECTS *Ayushi Srivastava, Omprakash and Aarti Sharma	435
1387. PROBLEM OF WEEDS IN RICE AND THEIR MANAGEMENT Kunwar Satyendra Singh, Ashish Kumar Pandey, Nihal Chandra Mahajan.	427	1413. RESPONSE OF SELECTED LENTIL CULTIVARS AGAINST THE ROOT-KNOT NEMATODE <i>MELOIDOGYNE INCOGNITA</i> Taruba Ansari, Mohd Asif, Amir Khan, Moh Tariq, Faryad Khan and Mansoor Ahmad Siddiqui	436
1388. EFFECT OF SEEDLING AGE AND PLANT HORMONES ON GROWTH, QUALITY AND BOLTING IN ONION (<i>Allium cepa</i> L.) Desh Raj Choudhary ¹ and Satesh Kumar	427	1414. USE AND IMPORTANCE OF REMOTE SENSING IN INTEGRATED PEST MANAGEMENT Awaneesh Kumar ¹ , Sudhir Kumar ² and Promish Kumar	436
1389. PRECISION FARMING: AN OPTION FOR SUSTAINABLE AGRICULTURE Biswabara Sahu*, Sri Laxmi	428	1415. EFFECT OF FOLIAR APPLICATION OF NAA, GA ₃ AND NPK ON FRUIT DROP, GROWTH, YIELD AND QUALITY OF BER (<i>Zizyphus mauritiana</i> LAMK.) C.V. BANARASI KARAKA Poornima Devi ¹ , Dr. R.K.S. Gautam ¹ , Jyoti Singh ² , Sunil Kumar Maurya ³ , Deepika Kannaujia	436
1390. EFFECT OF DIFFERENT PRUNING INTENSITIES ON WOOD PRODUCTION AND YIELD OF LATE SOWN WHEAT VARIETIES UNDER DALBARGIA SISOO BASED AGRISILVICULTURE SYSTEM Rahul Dongre and M. L. Sahu	428	1416. GENOMICS RESEARCH AND ITS ROLE IN PLANT BREEDING MAURYA, BRIJESH KUMAR, KUMAR, RAJENDRA, SINGH, SAHADEV ² Department of Genetics & Plant Breeding	437
1391. EVALUATION OF POPULATION DENSITY OF <i>MELOIDOGYNE INCOGNITA</i> ON GROWTH AND ROOT KNOT DEVELOPMENT ON CHILLI CV. G-4. Rahul Kumar Sharma	429	1417. EFFECT OF CHEMICAL FERTILIZERS AND VARIOUS BIOFERTILIZERS ON PHENOLOGY IN BARLEY Priti Malik, Meena Sewhag, Karmal Malik and Shweta	437
1392. RECENT ADVANCES IN GENETICS AND BREEDING OF RAPESEED MUSTARD KUMAR, RAJENDRA, MAURYA, BRIJESH KUMAR, SINGH, SAHADEV	429	1418. COMPARISON OF ORGANIC AND CONVENTIONAL FARMING UNDER RICE CULTIVATION Babita Joshi*, Hem Chandra Joshi, Prinsa Ramola, S.K. Guru	437
1393. EFFECT OF SEED TREATMENT OF BIO-CONTROL AGENTS AND FUNGICIDES ON GROWTH, BIOMASS AND YIELD OF LENTIL (<i>Lens culinaris</i> Medik) Vaibhav Pratap Singh ¹ , Rajesh Kumari ^{1*} , Govind Kumar Bagri ² , Dheeraj Kumar Bagri	429	1419. EFFECT OF GA ₃ AND STAGE OF APPLICATION ON THE SEED CROP OF CARROT (<i>Daucus carota</i> L.) CV. PUSA KESAR. Murari Lal, Vishwa Nath, Rajat Kumar Sharma and Mahesh Kumar Singh	437
1394. ROLE OF INSECTICIDE SYNERGISTS AND THEIR FUTURE TRENDS IN INTEGRATED PEST MANAGEMENT S. Ramesh Babu*, D. Rakshith Roshan, Deepak Kr. Jaiswal and Kamal Ravi Sharma	430	1420. BIOREMEDIATION AND SUSTAINABLE ENVIRONMENT Tej Ram Banjara*, Omprakash and Anil Kumar Kanthle	438
1395. "RESOURCE CONSERVATION TECHNOLOGIES IN RICE- WHEAT CROPPING SYSTEM IN INDO GANGETIC PLAINS" Sanyogita Chaudhary*, Vasundhara Kaushik and Shiv Vendra Singh	430	1421. EFFICIENCY OF DIFFERENT LIGHT SOURCES IN LIGHT TRAPS IN MONITORING INSECT DIVERSITY Beerendra Singh ¹ and Vijay Kumar	438
1396. EFFECT OF COMBINED USE OF CHEMICAL AND BIOLOGICAL FERTILIZERS ON SOIL HEALTH AND NUTRIENT AVAILABILITY TO PLANTS Rekha Ratanoo ¹ , Sarita Rani	430	1422. MICROBIOLOGICAL AND PHYSICO- CHEMICAL ASSESSMENT OF THE WATER QUALITY OF THE SACRED RIVER BHAGIRATHI, INDIA Nidhi Sharma ¹ , R. C. Sharma ² , Mahesh Kumar ³ , Varun Tomer ³ and Reena Tomer	438
1397. MITIGATION STRATEGIES OF PLANT ABIOTIC STRESS BY SUSTAINABLE AGRICULTURE By RELANGI SAIRAM ¹ , KOLLURI RAMU	431	1423. GENETIC VARIABILITY AND CHARACTER ASSOCIATION AMONG YIELD AND YIELD CONTRIBUTING TRAITS IN GARLIC GERMPLASM Bhawana Bhatt, A.K. Soni, Deepika Sharma	439
1398. PHYTOREMEDIATION: A TOOL FOR ENVIRONMENTAL CONSERVATION Vikas Kumar Jain ^{1*} , Anil K. Singh ¹ , Anupam Tiwari ¹ , Risha Varan ² , Prashant Bisen ² , Namrata ² and Sumit Pal	431	1424. EFFICACY OF SOME SELECTED BIOPESTICIDES AGAINST <i>HELICOVERPA ARMIGERA</i> (HUB.) USING DETACHED LEAF BIOASSAY IN CHICKPEA AGALE, S.V.* ^{1,2} , RAJEEV GUPTA ¹ , RANGARAO, G.V. ² , GOPALAKRISHNAN, S ² , JAGDISH JABA ² , AND WANI, S.P. ² .	439
1399. IMPACT OF AGRICULTURE ON BIODIVERSITY Arshi Jamil And Shabbir Ashraf	431	1425. BIODIVERSITY CONSERVATION: ex-situ and in-situ Conservation DILSHAD ALI AND DINESH KUMAR SHARMA	439
1400. EFFECTS OF FOLIAR SPRAY OF GA ₃ , Zn ²⁺ AND MH(MALEIC HYDRAZIDE) GROWTH COMPONENTS OF CAJANUS CAJAN CV MANIK (PIGEON PEA) AND VIGNA UNGUICULATA CV PUSA KOMAL Sarita Rani	432	1426. IMPORTANCE OF BIODIVERSITY CONSERVATION Tarun Kumar*, Samsheer, Suresh Chandra and Ankur M. Arya	439
1401. EFFECT OF HERBICIDE COMBINATION OF DIFFERENT DOSE ON GRAIN YIELD AND ECONOMICS OF TRANSPLANTED RICE (<i>ORYZA SATIVA</i> L.) IN TYPIC USTOCHREPT SOIL Arun Kumar ¹ , Kapil kumar ² , Shrawan Singh Thori ³ and S.L.Khaswan	432	1427. BIODIVERSITY OF HORTICULTURAL CROPS IN HIMALAYAN REGION OF UTTARAKHAND Ankit Panchbhैया, Dinesh Kumar Singh, Priyanka Verma, Neeraj Singh and Ashish Kr. Singh	440
1402. IMPROVING THE RESOURCE CONSERVATION AND USE EFFICIENCY THROUGH THE INTEGRATED FARMING SYSTEM APPROACH Arun Kumar ¹ , Kapil kumar ² , S S Thori ³ , S L khaswan ⁴ and M K Jat	432	1428. BIO ETHANOL PRODUCTION FROM POTATO PEEL WASTE Sachin A. Surwade ¹ and Khan Chand	440
1403. IMPROVING THE RESOURCE CONSERVATION AND USE EFFICIENCY THROUGH THE INTEGRATED FARMING SYSTEM APPROACH Arun Kumar ¹ , Kapil kumar ² , S S Thori ³ , S L khaswan ⁴ and M K Jat	433	1429. BIOLOGY AND FUNCTIONAL RESPONSE OF <i>COCCINELLA TRANSVERSALIS</i> FAB. ON COWPEA APHID, <i>APHIS CRACCIVORA</i> KOCH Rakshith H. S., Sachin S. Suresh., Suresh M. Nebapure., Subhash Chander and Sweetee Kumari	440
1404. IN-VITRO REGENERATION AND ASSESSMENT OF GENETIC FIDELITY USING RAPD MARKERS IN GLADIOLUS (<i>GLADIOLUS HYBRIDA</i> L.) Arun Kumar ¹ , Pushpendra Kumar ¹ , Ashwini Kumar ¹ , Vandana Sharma ¹ and Rakesh S. Vinukonda	433	1430. ROLE OF HORMONE AND BIO-REGULATOR IN SUSTAINABLE AGRICULTURE Pushpendra Singh ^{1*} , T. R. Banjara ² , Alka Sai ³ , Durga Prasad Moharana ¹ and Ashutosh Kumar	441
1405. CONSERVATION PRACTICES OF SOIL AND WATER RESOURCES TO MAINTAIN LONG TERM FERTILITY Arvin Bhai Patel ¹ , Rahul Singh ² , Asheesh Chaurasiya ¹ , Tej Pratap Singh	434	1431. ROLE OF BIOTECHNOLOGY IN VEGETABLE CROPS Bhanupratap Jangde, Pappu Lal Bairwa, Nisha Jangre, Preetesh Kumar Pandey	441
		1432. GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (<i>ORYZA SATIVA</i> L.) Devidas Thomabare, Archana Prasadand *Satish Verulkar	441
		1433. ROLE OF BOTANICAL INSECTICIDES IN IPM M. Sreedhar and Megha G	442

1434. BOVINECUTANEOUS PAPILLOMATOSIS: AN EFFICACY OF TREATMENT STRATEGIES USING AUTOGENOUS VACCINES, AUTOHEMOTHERAPY, HOMEOPATHIC AND ALLOPATHIC MEDICINES R.K.Singh ¹ , Pankaj Chaudhary ² , Yogesh Sony ³ , Gulab Chandra ¹ and Siddhartha Saha 442	1460. INFLUENCE OF FOLIAR APPLICATION OF UREA AND MICRONUTRIENTS ON GARLIC Pooja Rani*, V.P.S. Panghal, Shiwani and D.S. Duhan 450
1435. DRY AND RAINFED AGRICULTURE- CHARACTERISTICS AND ISSUES TO ENHANCE THE PROSPERITY OF INDIAN FARMING COMMUNITY Mohinder Singh, N. K Tiwari, Naveen Kumar and K. R. Dabur 442	1461. POST HARVEST LOSSES FOR POTATO DURING TRANSPORTATION AND STORAGE Anuj Yadav ¹ and Upendra Singh 450
1436. DEVELOPMENT OF THE WATER EFFICIENT LINES OF RICE WITH AEROBIC ADAPTATION THROUGH MARKER ASSISTED SELECTION Bhoyar P.I. ¹ , Mahavir ¹ , Shikha Yashveer ¹ , Khushiram Battan ² , Sunita Jain ¹ and R.K. Jain 443	1462. EFFECT OF NITROGEN APPLICATION METHOD ON POTATO Pooja Pandey, Manoj Raghav, Neeraj Singh and Umesh Sati 451
1437. SECTION: NATURAL RESOURCES CONSERVATION <i>IN VITRO</i> CALLUS PROPAGATION AND BIOACTIVE METABOLITES ESTIMATION UNDER SALT STRESS IN <i>CALOTROPIS PROCERA</i> Juhi Dhillon, Vimala Y. and Ishwar Singh 443	1463. IMPORTANCE OF ZINC BIOFORTIFICATION AND ITS APPLICATION AT DIFFERENT STAGES OF WHEAT ON THE BASIS OF ZADOK'S SCALE. Pramod Lawate and S.K. Prasad 451
1438. EFFECTS OF SOME MEDICINAL PLANT EXTRACTS AGAINST MULTIDRUG RESISTANCE HUMAN PATHOGENIC BACTERIA Neha pal ¹ , Narendra pratap singh ² , Mayadatt joshi ³ , Ram saxena ⁴ and Dev anand 443	1464. FLY ASH AMENDMENT TOGETHER WITH POTASSIUM FERTILIZER IN THE REGULATION OF GROWTH BIOMARKERS AND YIELD ATTRIBUTES OF MUSTARD (<i>BRASSICA JUNCEA</i> L.). Farha Ashfaq*, Akhtar Inam 451
1439. CONCEPT OF INTEGRATED PEST MANAGEMENT TO SUPPRESS PEST POPULATION Ankit Kumar and Lakhi Ram 443	1465. EFFECT OF GREEN LEAF CUTTINGS AND GROWTH REGULATORS ON SEED YIELD AND QUALITY OF CORIANDER (<i>CORIANDRUM SATIVUM</i> L.) Pradeep Singh*, V.S. Mor, R.C. Punia and Sunil Kumar 452
1440. EFFECT OF DROUGHT STRESS ON GROWTH AND DEVELOPMENT OF HIGHER PLANTS Morajdhwaj Singh*, Shraddha Singh ¹ and Ajay Singh 444	1466. IN VITRO EFFICACY OF LEAF EXTRACT OF DIFFERENT PLANTS AGAINST <i>ALTERNARIA</i> LEAF SPOT OF SESAME Naren Kumar ¹ , Prahlad Masurkar ^{2*} , Prahlad 452
1441. PHENOLOGICAL BEHAVIOUR AND REPRODUCTIVE BIOLOGY OF KHEJRI (<i>PROSOPIS CINERARIA</i> (L.) DRUCE) Preeti Singh, K.S. Bangarwa, R.S. Dhillon 444	1467. INTELLECTUAL PROPERTY RIGHTS ISSUES FOR AGRICULTURE GOODS AND SERVICES Pratishtha Diwaker ¹ , Pushpanjali ² , Jitendra Singh Ranawat ³ , Ayush Kumar Diwaker 452
1442. HYDROSTATIC PRESSURE TREATMENT: A NON THERMAL TECHNIQUE OF FOOD PRESERVATION Varsha Kanojia ¹ , Syed Zameer Hussain ² , A. Rouf ³ and Amit Khokhar 444	1468. "EFFECT OF BORON AND MOLYBDENUM APPLICATION ON YIELD COMPONENTS AND QUALITY PARAMETERS IN MUNGBEAN (<i>VIGNA RADIATA</i> L. WILCZEK)." ¹ Praveen Kumar* Dheeraj Yadav*, Satish Yadav* and Sharvan Kumar 453
1443. INTELLECTUAL PROPERTY RIGHTS ISSUES: DETERMINANTS OF PATENT RIGHTS- A CROSS-NATIONAL STUDY ¹ M .Sravanthi, ² Kalyani Singh, ³ Vimal Singh. 445	1469. PRECISION FARMING: A PERSPECTIVE OF AGRICULTURAL DEVELOPMENT Sreenivasa Reddy .K ¹ , Venkata Reddy. ² , Pulla rao.CH 453
1444. AN INNOVATIVE APPROACH OF GREEN TECHNOLOGY IN ORGANIC FOODS FOR SUSTAINABLE DEVELOPMENT Owais Yousuf ¹ , Anupama Singh 445	1470. ASPECTS OF PRECISION AGRICULTURE IN BANANA Poornima Devi ¹ , Dr. R.K.S. Gautam ¹ , Jyoti Singh ² , Sunil Kumar Maurya ³ , Deepika Kannaujia 453
1445. GREEN SYNTHESIS OF HEMATITE (A-Fe ₂ O ₃) NANOPARTICLES USING AQUEOUS <i>ALOE VERA</i> LEAF EXTRACT AND THEIR ANTIBACTERIAL AND ANTIBIOFILM ACTIVITIES Khurshed Ali ¹ , Sourabh Dwivedi ¹ , Bilal Ahmed ¹ , Quaiser Saquib ² , Abdulaziz A. Alkhedhairy ² , Md. Saghir Khan ¹ , Javed Musarrat 445	1471. A REVIEW: STUDIES ON VALUE ADDED FENUGREEK PRODUCTS Prerana R. Deshpande 454
1446. EFFICACY OF PLANT EXTRACTS AGAINST <i>ALTERNARIA ALTERNATA</i> CAUSING LEAF SPOT OF BRINJAL Pramod kumar, Shailesh godika, Jitendra Sharma* and Sonali Meena 446	1472. PREVALENCE OF URINARY TRACT INFECTION AMONG PREGNANT WOMEN SHALAGHA SHARMA ¹ , NARENDRA PRATAP SINGH ² , JAYANAND ³ and RAMSAXENA 454
1447. EFFECT OF NANOCHITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION Parul Chaudhary, Priyanka khati 446	1473. CHLOROPHYLL STATUS OF ISOPROTURON RESISTANT <i>PHALARIS MINOR</i> Prinsa Ramola* Nitin Kumar, Babita Joshi and S.K. Guru 454
1448. PATHOGENICITY OF ROOT- KNOT NEMATODE, MELOIDOGYNE INCOGNITA ON TRIGONELLA FOENUM GRAECUM Chanchal Chaudhary*, Mohd Danish, Yasar Nishat, Atirah Tauseef, 446	1474. BIOTIC AND ABIOTIC STRESS IN CROP PRODUCTION AND THEIR MANAGEMENT Priyanka and R.S. Sheoran 454
1449. HISAMUDDIN STUDIES ON EFFECT OF COCONUT WATER AND LISTERINE ON VASE LIFE OF CUT <i>ANTHURIUM DREANUM</i> LINDEN. Patiasa D. Shira ¹ and A.K. Chaurasiya 447	1475. EFFECT OF NUTRACEUTICAL ON FINGERLINGS OF INDIAN MAJOR CARP <i>LABEO ROHITA</i> Priyanka ariya and R. S. Chauhan 455
1450. DIFFERENTIAL EXPRESSION ANALYSIS OF NAC TRANSCRIPTION FACTOR FAMILY GENE IN MINOR MILLET UNDER WATER STRESS Patil Arun H ¹ , Mahima Dubey ¹ , Girish Chandel 447	1476. PRECISION FARMING: AN APPROACH FOR SUSTAINABLE AGRICULTURE AND PRODUCTION Puja Singh 455
1451. IMPACT OF ZINC NUTRIENTS ON CROP GROWTH Pawan Kumar Goutam, S. P. Kushwaha, Dharmadew Chauhan ¹ , Subhash Kumar, Nitin maurya, Vinay Kumar Yadav 447	1477. ADVANCES IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT SCREEN VARIETAL SUSCEPTIBILITY OF CHICKPEA CULTIVARS AGAINST <i>C. CHINENSIS</i> (LINN) ¹ Rahul Singh, ² Visvash Vaibhav, ³ Rajat Deshwal, ⁴ Anuj Kumar, ⁵ Nitin Kumar 456
1452. PGPR BIOFORMULATION FOR SUSTAINABLE AGRICULTURE Kusum Sharma ¹ , Kuldeep kumar ² , Shilpa singh 448	1478. EFFECT MOISTURE USE AND MOISTURE EFFICIENCY OF MUSTARD 'BASANTI' UNDER DIFFERENT DATE OF SOWING AND MOISTURE CONSERVATION PRACTICES UNDER RAINFED ECO-SYSTEM OF CENTRAL UTTAR PRADESH Raj Kumar and Munish Kumar 456
1453. PHYTOREMEDIATION ARZOO and ABDUL SAMAD 448	1479. APPLICATION OF REMOTE SENSING & GIS IN WATERSHED LAND USE DEVELOPMENT Raj Kumar*, Gautam veer Chauhan**, Sandeep Kumar** and Girish Goyal 456
1454. PHYTOREMEDIATION: A GREEN TECHNOLOGY TO CLEAN UP POLLUTANTS Yukti Verma ¹ and Nitesh Kumar Singh 448	1480. CONSERVATION OF NATURAL RESOURCES LAND DEGRADATION AND SOIL EROSION FOR SUSTAINABILITY CONDITION OF INDIA Raj Kumar and Durgesh Kumar 457
1455. FLY ASH AMENDMENT TOGETHER WITH POTASSIUM FERTILIZER IN THE REGULATION OF GROWTH BIOMARKERS AND YIELD ATTRIBUTES OF MUSTARD (<i>BRASSICA JUNCEA</i> L.). Farha Ashfaq*, Akhtar Inam 449	1481. STUDIES ON THE RESPONSE OF POTASSIUM LEVELS ON DIFFERENT VARIETIES OF CHICKPEA Birendra Singh Yadav*, D.D. Yadav and Raj Kumar 457
1456. ROLE OF GROUNDWATER RECHARGE IN AGRICULTURE Ved Prakash, Mainak Ghosh, Praveen Kumar, Mishra and Santosh Kumar Dubey 449	1482. STUDIES ON THE EFFECT OF FYM ON POTASSIUM REQUIREMENT OF CHICKPEA (<i>CICER ARIETINUM</i> L.) Mukesh Kumar* D.D. Yadav* and Raj Kumar 457
1457. PEST INCIDENCE AND PREVALENT CONTROL STRATEGIES IN SOME APPLE ORCHARDS OF CENTRAL KASHMIR IN VOGUE DURING BLOOM AND POST BLOOM. Ishana Qadir* and Ayesha Qamar 449	1483. "STUDY ON THE BIOLOGY OF PULSE BEETLE (<i>callosobruchus chinensis</i> L.) ON GRAM (<i>cicer arietinum</i> L.) AND ITS SAFER AND EFFECTIVE MANAGEMENT WITH SOME BOTANICALS" Jaswant Kumar*, R.K. Dwivedi* and Raj Kumar 458
1458. PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY) Jagatpal ¹ , Ankit Singh Yadav ² , Dheerendra Kumar 449	1484. EFFECT OF PHOSPHORUS, SULPHUR AND FYM ON GROWTH AND YIELD OF CHICKPEA IN CENTRAL PLAIN ZONE OF UTTAR PRADESH Upendra Verma* Ram Pyare and Raj Kumar 458
1459. EFFECT OF ARTIFICIAL LIGHT AND CHEMICAL TREATMENT ON FLOWER INDUCTION IN POTATO (<i>SOLANUM TUBEROSUM</i> L.) GENOTYPES UNDER PLAINS AND HILLY CONDITIONS DHARMENDRA SHARMA ¹ , SAT PAL SHARMA 450	1485. CURRENT STATUS OF RED ROT DISEASE OF SUGARCANE IN UTTAR PRADESH Rajani Bala ¹ , Y.P. Bharti ² , S.K. Singh 458

1486. INTEGRATED PEST MANAGEMENT FOR STORAGE INSECT-PESTS Rajat Deshwal ¹ , Visvash Vaibhav ² , Rahul Singh ³ , Nitin Kumar ⁴ and ⁵ Ankit Kumar	459	1504. ORGANIC WEED MANAGEMENT IN FIELD CROPS Bolta Ram Meena	464
1487. EFFECT OF CROP ESTABLISHMENT METHODS AND MOISTURE CONSERVATION TECHNIQUES ON PERFORMANCE OF RICE ¹ Rajendra Kumar, ² Adesh Singh, ³ Vivak Ujjwal and ⁴ Rahul Rajan	459	1505. ORGANIC AGRICULTURE: WAY TO SUSTAIN LIFE Ardeep	465
1488. EFFECT OF DEFORESTATION ON AGRICULTURAL PRODUCTION K. Rajaneesh, A. H. Madakemohekar, MylaruSravaniandM. Swetha	459	1506. SMART FERTILIZER FOR SUSTAINABLE CROP PRODUCTION Joginder Pabnawa	465
1489. CONSERVATION AGRICULTURE (CA) IN MAIZE BASED CROPPING SYSTEMS R. N. Maurya ^{1*} , Jay Kumar Yadav ¹ , Rajmani ³ , U. P. Singh ¹ , and Girish Goyal	460	1507. PRECISION FARMING IN HORTICULTURE Anuradha ^{1*} , Puri ² and Arvind Malik	465
1490. ROLE OF INTEGRATED NUTRIENT MANAGEMENT IN OPTIMIZING THE FARM INCOME Ram Raj Karwasara ^{1*} and Dinesh Kumar	460	1508. AGRICULTURAL SUSTAINABILITY THROUGH INTEGRATION OF INDIGENOUS TRADITIONAL KNOWLEDGE OF FARMERS AND SCIENTIFIC KNOWLEDGE OF RESEARCHERS Neelam Basera and Neelam Bhardwaj	465
1491. BEES DIVERSITY IN AGRO-ECOSYSTEM OF AROUND PUNE, MAHARASHTRA Ramnath Andhale [*] , Vishal Pathare [*] , Kalpana Pai [*] , Aswini Pai [#] and R. S. Pandit ⁴⁶⁰	460	1509. IMPACT OF KVK IN THE TECHNOLOGICAL EMPOWERMENT OF WOMEN WITH RESPECT TO INCOME GENERATING ACTIVITIES Anuradha Ranjan Kumari ¹ , Maya Kumari ² and Laxmikant	466
1492. DETAILED TAXONOMIC ILLUSTRATION OF <i>MAIESTAS DORSALIS</i> (MOTSCHULSKY) (HEMIPTERA: CICADELLIDAE) WITH MOLECULAR CHARACTERIZATION Ramya. N and Naresh M. Meshram	461	1510. ECO FRIENDLY ELECTROPLATING FOR SUSTAINABLE FUTURE Renu Rastogi	466
1493. SORGHUM (<i>SORGHUM BICOLOR L.</i>) BASED INTERCROPPING SYSTEM UNDER RAINFED CONDITION Ranjeet Kumar, U.D. Awasthi, S.K. Uttam and Raj Kumar	461	1511. INTELLECTUAL PROPERTY RIGHTS (IPR), BENEFIT OF IPR AND ITS APPLICATION IN HORTICULTURAL CROPS. Sunil K. Maurya, Sandeep K. Mauriya, Ragini maurya, Kulveer singh yadav	467
1494. ADVANTAGES OF TRADITIONAL AND MODERN TECHNOLOGY IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT Ranjeet Rawat	461	1512. MOBILE PHONE APPLICATION FOR TRANSFER OF TECHNOLOGY IN INDIA *Ramjee Lal Meena ¹ , Dr. B. Jirli	467
1495. ADVANTAGES OF TRADITIONAL AND MODERN TECHNOLOGY IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT Ranjeet Rawat	462	1513. BAKERY INDUSTRY: CURRENT STATUS AND FUTURE PROSPECT Prince, B.R Singh, Kapil Kumar	467
1496. AGRO-WASTE DERIVED PRODUCTS FOR COMMERCIAL APPLICATIONS: A REVIEW Ranjna Sirohi ^{1*} , Anupama Singh	462	1514. BAKERY INDUSTRY: CURRENT STATUS AND FUTURE PROSPECT Prince, B.R Singh, Kapil Kumar	467
1497. USAGE OF NANOTECHNOLOGY IN AGRICULTURE AND ITS ROLE ININSECT-PEST MANAGEMENT Rashmirekha Singh ^{1*} , Kamal Ravi Sharma ² and V.K.Mishra	462	1515. ADVANCES IN FOOD AUTHENCITY TEST Satish chand [*] , Navneet kumar, kailash pati tripathi	468
1498. PRESERVATION OF CAULIFLOWER BY DEHYDRATION TECHNIQUE FOR ENSURING EXTENDED SHELF LIFE AND HIGHER RETURN TO RURAL WOMEN FOLK OF KHAGARIA DISTRICT Anita Kumari ¹ and Maya Kumari	462	1516. PRIVATIZATION OF EXTENSION IN AGRICULTURAL DEVELOPMENT Suraji Yugender Reddy ¹ Pankaj Kumar Meghwal ² Rathwa Y. H	468
1499. EFFECT OF NPK AND SILICA GROWTH AND POD YIELD OF OKRA(<i>ABELMOSCHUS ESCULENTUSL.</i>) Ravindra Kumar Bind, Amit kumar verma, Rahul Kumar and Balmukund	463	1517. VOCATIONAL TRAINING NEEDS OF BUKSA YOUTH FOR LIVELIHOOD GENERATION IN AGRICULTURE AND ALLIED AREAS IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND Debashis Dash ¹ , B. Kumar ² and G.S. Mahra	468
1500. EFFECT OF NPK AND SILICA GROWTH AND POD YIELD OF OKRA(<i>ABELMOSCHUS ESCULENTUSL.</i>) Ravindra Kumar Bind, A. K. Verma, Rahul Kumar, Vishal Kumar and K. S Seervi	463	1518. HUMAN – THE ONLY THREAT TO HUMANITY Chandrika Sharma	469
1501. RECONCILING BIODIVERSITY CONSERVATION AND FOOD SECURITY: SCIENTIFIC CHALLENGES FOR A NEW AGRICULTURE ¹ Savrabh Tripathi, ² Vimal Sigh, ³ Kalyani Singh	463	1519. ROLE OF MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT IN RURAL DEVELOPMENT Roop Kumar, Amit Kumar Mishra and Akshay Kumar	469
1502. GROWTH, YIELD AND NITROGEN USE EFFICIENCY IN WHEAT AS INFLUENCED BY USING LEAF COLOUR CHART AND CHLOROPHYLL METER BASED NITROGEN MANAGEMENT REENA ¹ , V. C. DHYANI ² , SUMIT CHATURVEDI ³ AND SHIKHA	464	1520. HOW INTELLECTUAL PROPERTY RIGHTS IGNITES THE ZEAL OF A MAN TO RECOGNIZE HIS POTENTIAL FOR CREATIVITY AND SAVE IT Akashdeep Kamboj ¹ , Gaurav Thakur ² , Sumant Bindal ³ , Bijendra Kumar ⁴ , Swapnil Dnyashwar Kalubarme	469
1503. INTELLECTUAL PROPERETY RIGHTS AND ITS ISSUE AND WHY PROTECTION FOR PLANTS IS REQUIRED IN INDIA Sunil K. Maurya ¹ , Sandeep K. Mauriya ¹ , Ragini maurya ¹ , Jyoti Singh	464	1521. A STUDY ON AWARENESS OF RURAL DEVELOPMENT PROGRAMME AMONG THE RURAL PEOPLE OF MEERUT DISTRICT. Amit kumar, Dr. D. K. Singh	470
		1522. ASSESSMENT OF ANTIOXIDANT FACTORS IN ELEPHANT FOOT YAM (<i>AMORPHOPHALLUS PAEONIIFOLIUS</i> DENNST- NICOLSON) CULTIVARS DURING STORAGE Amit Kumar Singh ^{*1} , Arvind Kumar Chaurasiya ² and Surajit Mitra	470
		1523. RESHAPING AGRICULTURAL INNOVATION SYSTEMS FOR ENSURING FOOD SECURITY Amita Yadav ¹ , Renu Gangwar ² and Lavlesh	470

EFFECT OF FREEZING RATE ON THE MECHANICAL PROPERTIES OF EGYPTIAN MEDJOOL DATES.**A.M. Elansari, S.G. Mahmoud, Yehia S. Ahmed*, E. M. Abo Tour****

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The purpose of this work was to determine the optimum freezing rates of Medjool dates grown in Egypt based on their effect on the Texture Profile Analysis (TPA) after thawing. Physical characteristics (weight, dimensions, and color) and biochemical analyses of moisture content, protein, fat, crude fiber, ash, and carbohydrates were determined. Three air blast freezer setting temperatures were used; -20, -25, and -30 °C to reach a core temperature of -18 °C for the fruit, then fruit were thawed at room temperature until 5°C. The TPA test was conducted on both, treated and fresh samples. The results indicated that the freezing curves did not exhibit the latent heat plateau due to the lower moisture content as well as the higher sugar content which lead to the depression of the initial freezing point. The freezing times of Medjool (from 20°C initial temperature to -18°C final temperature) at the three levels of setting temperature were 15.0, 11.0, and 9.0 min with a freezing rates of -2.61, -3.51, and -4.35 °C.min⁻¹, respectively. The thawing time were not affected by freezing rate significantly (14.80, 14.13, and 14.82 min at freezing rate of -2.61, -3.51, and -4.35 °C.min⁻¹). The TPA test illustrated that, the Hardness, Gumminess, and Chewiness were significantly affected by freezing process. The Gumminess values were 1567.5, 2115.75, and 2434.25 g, the Chewiness values were 69.55, 105.95, and 144.35 mJ, hardness where it was 5321.5, 6079.25, and 7494.25 g at a freezing rate of -2.61, -3.51, and -4.35 °C.min⁻¹ respectively. However, Adhesiveness, Cohesiveness, and Springiness index were neither affected by freezing nor the thawing rates. The comparison between measured and calculated (per Plank, Nagaoka et al., Levy, Cleland & Earle, and Pham methods) freezing time indicated that the freezing times of Medjool calculated per Plank's equation were the closest to the measured time. The L* color coordinate was not affected by freezing, the C* coordinate was affected only by the smallest freezing rate, while the hue angle was not influenced by freezing rate. Both TSS and EL (Electrolyte leakage) was significantly influenced by freezing rates. The obtained results can be used to enhance stability of stored dates, maintain quality, and extend shelf life.

Keywords: Medjool, Dates, Freezing, TPA, Mechanical properties.**EFFECTS OF SOWING DATE AND PHOSPHORUS LEVEL ON GROWTH AND YIELD OF BLACK GRAM (VIGNA MUNGO (L) HEPPER) UNDER RAINFED CONDITIONS OF ERITREA****F. I. A. Brima , Awet Tesfay, Filmon Melake, Ibrahim O. Mussa and Idris M. Assire ***

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A field experiment was carried out at the demonstration farm of Hamelmalo Agricultural College, Keren, Eritrea, during the summer season of 2015 under the rainfed conditions to evaluate the effect of sowing date and level of phosphorus fertilizer on the growth and yield of Black gram. The experiment was laid out in a split-plot design with three replications. The main plot were devoted to three sowing dates (S₁, S₂ and S₃) namely 7th July, 14th July and 21st July, respectively and sub-plot to three levels of phosphorus fertilizer (P₀, P₁ and P₂) namely 0 kg P₂O₅/ha (Control), 50 kg P₂O₅/ha and 75 kg P₂O₅/ha, respectively. Introduced black gram variety (T-9) from India was used in this trail. The results showed that there was a significant effect of sowing date on some of the growth parameters viz. plant population, number of branches per plant, number of leaves per plant at (30 DAS) and plant fresh weight at (15 DAS). There was no significant effect of phosphorus application level in all growth parameters, except plant fresh weight, which recorded a significant effect at (60 DAS). Also there was a significant effect of the interaction between the sowing date and phosphorus level on all growth parameters. Regarding the yield attributes the results indicated that there was no significant effects of sowing dates, phosphorus application levels and their interactions on the yield parameters, except number of pods per plant which scored significant effects of sowing dates and their interactions. The highest number of pods per plant (24.07) was recorded in S₂ and the lowest (18.96) was obtained from S₃. The best seed yield per hectare (1841.1 kg/ha) was obtained from combined treatment S₁P₀ followed by (1817.78 kg/ha) scored from the treatment S₁P₂ and the lowest seed yield (1497.78 kg/ha) was recorded in the treatment S₂P₂.

Keywords: Black gram, Sowing dates, Phosphorus levels, Eritrea.**EVALUATION OF NEW INSECTICIDE MOLECULES FOR THEIR EFFECTIVENESS IN THE MANAGEMENT OF INSECT PESTS OF RICE****Umashankar H.G., Rajanna, M.P., Chethana B.S., Deepak, C.A.,**

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Management of insect pests through use of chemicals has been an integral component of rice pest management. Therefore an experiment was conducted to know the field efficacy of new insecticide molecules. A set of insecticides including Spinetoram 6% w/v (5.66% w/w) + Moethoxy fenozide 30% w/v (28.3% w/w) SC 36 SC, DPX-RAB 55 106 SC, Flubendiamide 480 SC (g/L), Rynaxypyr 20 SC, Acephate 95% SG and Dinotetefuran 20 G were used to control more than single pests in rice fields at Zonal Agricultural Research Station, V.C farm, Mandya during Kharif 2016. The target pest comprised mainly of stem borer, leaf folder and planthoppers. Following observations and analysis, significant differences were noticed among the treatments. While insecticide treatments of Rynaxypyr (5.21% and 2.56%) and Flubendiamide (5.30% and 3.62%) were found to be superior in their performance, the new combination product of Spinetoram plus Moethoxy fenozide (6.58% and 3.25%) was at par in reducing stem borer incidence at both vegetative and reproductive stage. Similarly, Flubendiamide and Rynaxypyr significantly reduced leaf folder damage during 50 to 90 days after transplanting. Incidence of brown planthopper ranged from 6.00 to 37.37 hoppers/ 10 hills, and there was significant reduction in BPH population after use of DPX-RAB (6.00 hoppers/ 10 hills) followed by Dinotetefuran (8.00 hoppers /10 hills) which was at par. Other insecticide treatments showed a population ranging from 10.33 to 31.33 per 10 hills compared to 37.37 hoppers recorded in control plots. It was evident that Spinetoram plus Moethoxy fenozide was on par with recommended Rynaxypyr and Flubendiamide



treatments against stem borer and leaf folder. All the insecticide treatments yielded at par and were significantly higher than control.

EFFECT OF DATE OF PLANTING ON INSECT PEST INCIDENCE IN RICE, *ORYZA SATIVA* L

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Climate change had impact on the onset and progress of monsoons in the Mandya districts of Karnataka. During 2016, there was a delay in the onset of monsoon for about a month that has affected farmers's planting of rice crop. So, effect of planting dates on insect pest incidence experiment was conducted to know the effect of date of planting on insect pest incidence at Zonal Agricultural Research Station, V.C farm, Mandya during Kharif 2016. Most popular varieties of the region were planted at three dates viz., normal planting, early planting and late planting. Observations on insect pest incidence were recorded at 10 day interval starting from the first appearance of the insect. Incidence of stem borer, leaf folder, case worm and brown planthopper was recorded in all the planting but the incidence of White backed planthopper (WBPH) was absent in early planting. Low incidence of stem borer was recorded in all three planting. Damage was high in late planting (6.92%) compared to normal (4.84) and early planting (2.88%). Incidence of leaf folder and case worm was recorded in all the planting dates. Leaf folder damage was highest in late planting (7.75%). Similarly, case worm damage was highest in late planting (15.37%). Higher incidence of BPH was observed in late planting at 80 days after transplanting (27.00 hoppers /10 hills) followed by normal (20.00 hoppers /10 hills) and low incidence at early planting (9.00 hoppers /10 hills). Incidence of WBPH was absent in early planting but incidence was recorded in late planting (25 hoppers /10hills) followed by normal planting (10.00 hoppers /10hills).

COLLECTION AND CHARACTERIZATION OF FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.) GENOTYPES TO STRENGTHEN NUTRITIONAL SECURITY

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Fenugreek is becoming popular around the world with its medicinal and nutraceutical properties. It is inexpensive but high quality nutritional sources, for the poor segment of the population especially where malnutrition is wide spread as in India. Nutrient content varied among germplasm but not with fertility practices, suggesting that germplasm selection could lead to production of nutrient-rich varieties. The nutritional value (P, K, Fe, Zn, Cu, Mn), protein and Steroidal Saponin content of twenty-eight genotypes of fenugreek were determined. The quantitative estimation of macronutrient i.e. P and K was done by using spectrophotometer and flame photometer and micronutrients was done using atomic absorption spectrophotometer. Protein content was estimated by instrument Rapid N Cube Analyzer. Results showed that highest potassium content was observed in PFG-35 (1207 mg/100g). PFG-37 and PFG-20 was richest in phosphorus, iron and manganese content among all genotypes. The lowest zinc content was found in PFG-26 (1.19 mg/100g), while the maximum zinc content was found in PFG-28 (4.43 mg/100g). Highest content of copper was found in PFG-26 (1.97 mg/100g). PFG-39 has the highest protein content (29.60 %). Saponin content ranged from 0.38 g/100g to 1.31 g/100g. Significant differences among all the genotypes were obtained for all the characters namely P, K, Fe, Mn, Zn and Cu, protein and Saponin content which indicate that variation was due to genetic effects. There are clear implications from the variations among the most favourable genotypes in this study that will provide a basis for a genetically diverse breeding program. These nutrient rich genotypes can be used for the development of nutrient rich high yielding varieties.

EVALUATION OF TREATED TANNERY WASTEWATER OF THE PHYTOTOXIC AND GENOTOXIC EFFECTS OF USING *VIGNA RADIATA* AND *ALLIUM CEPA*

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The aim of study was tannery wastewater induced phytotoxicity and genotoxicity in mung bean (*Vigna radiata* L.) and root tip cells of onion (*Allium cepa* L.) were investigated. Physicochemical characteristics such as electrical conductivity (EC), biological oxygen demand (BOD), chemical oxygen demand (COD), and total phenols of the tannery wastewater were beyond the permissible limit specified for the discharge of wastewater in inland water bodies. Compared to control plants, seedling exposed to 100% wastewater concentration showed a reduction in root and shoot length and biomass by 68%, 70%, and 82%, respectively, after 5 days of treatment. *A. cepa* root tip cells exposed to wastewater concentrations ranging from 25 to 100% v/v showed a significant decrease in mitotic index (MI) from 32 to 13% with respect to control root tip cells (71%) indicating wastewater induced cytotoxicity. Further, the wastewater induced DNA damage as evidenced by the presence of various chromosomal aberrations like stickiness, chromosome loss, anaphase bridge, c-mitosis, tripolar anaphase, vagrant chromosome, and telophase bridge and micronucleated and binucleated cell in *A. cepa*. Findings of the present study indicate that tannery wastewater may act as genotoxic and phytotoxic agents in plant model system.

Keywords: Tannery wastewater, Toxicity, Chromosomal aberrations, *Vigna radiata*, *Allium cepa*



PSEUDOMONADS FOR GROWTH ENHANCEMENT AND BIOCONTROL AGAINST PHYTOPATHOGENS OF *BRASSICA JUNCEA* (L.)**Rishabh Chitranshi and Naveen Kumar Arora**Department of Environmental Microbiology, School for Environmental Sciences
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Indian mustard is one of the most important edible oilseed crop in India and contributes 23.2% of total oil seed production. There is some major restriction in cultivation of mustard in India because a number of biotic and abiotic stresses. Among the biotic stresses susceptibility towards several fungal diseases have adversely affected its yield. *Alternaria* blight, White rust, powdery mildew, damping-off, are some of the fungal diseases of mustard. Among these *Alternaria* blight is a common fungal disease which cause considerable damage in crop production in India and all over the world. *Alternaria* also affect the seed germination which is also responsible for less cultivation. In this prospect plant-associated microorganisms are viewed as superior alternative which not only enhance crop yield and protect plants from phytopathogens but also significantly increase seed germination percentage and phytochemical content. *Pseudomonads* are considered to be important rhizosphere organisms, wherein considerable research is underway globally to exploit the potential. Fluorescent pseudomonads are used as biocontrol agents for phytopathogens they also help in maintenance of soil health, protect crop from pathogens and are metabolically and functionally more diverse.

Keywords: Pseudomonads, biocontrol, brassica juncea, crop enhancement**ADVANCE SURFACE IRRIGATION METHOD FOR EFFICIENT WATER USE****Jitendra Kumar**

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Conventional surface irrigation methods are widely adopted in the command of irrigation projects in India. Water application efficiency of these methods is very poor. More than 30% water is lost during the application. Pressurized irrigation can be very good alternatives to above conventional method. But it requires electric energy, which is not available in the required amount as India is facing electric energy crises. Advance surface irrigation techniques can set boon to overcome the water application losses. Water application efficiency to the tune of 90% can be achieved with the proper application of advanced irrigation techniques; The efficiency of advance irrigation surface irrigation methods is nearly as good as drip and sprinkler irrigation. This paper illustrates the planning, design and layout of the advance surface irrigation methods to suit the needs in different type of soils.

ROLE OF BIOTIC STRESS THROUGH ANTIOXIDANT SYSTEM IN MUNG BEAN (*VIGNA RADIATA* L. WILCZEK)**Mukul kumar and Uma kant singh**M.B.A.C. ,Agwanpur, Saharsa , (B.A.U.Sabour Bihar),
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Nitrogen is the most limiting nutrient for crop production in many of the world's agricultural areas and its efficient use is important for the economic sustainability of cropping systems. Brassinosteroids (BRs) elicit diverse physiological responses and ameliorate various biotic and abiotic stresses. With an aim to further explore and elaborate their role in plants subjected to abiotic stress, more specifically the heavy metal stress, the seedlings of mung bean were grown in a plant growth chamber under controlled conditions, on a sandy substratum. The seedlings were subjected to aluminium (0.0, 1.0 or 10.0 mM) stress, at 1-week-old stage and were sprayed with 0 or 10^{-8} M of 24-epibrassinolide (EBL) or 28-homobrassinolide (HBL) at 14-day stage. The analysis of the plants at the completion of 3 weeks of growth revealed that the presence of aluminium in the nutrient medium caused a sharp reduction in growth (length, fresh and dry mass of root and shoot), the activity of carbonic anhydrase (E.C. 4.2.1.1), relative water content, water use efficiency, chlorophyll content and the rate of photosynthesis. However, the activity of antioxidative enzymes [catalase (E.C. 1.11.1.6), peroxidase (E.C. 1.11.1.7) and superoxide dismutase (E.C. 1.15.1.1)] in leaves and the content of proline, both in leaves and roots increased in the aluminium-stressed plants. The spray of EBL or HBL, in absence of aluminium strongly favoured the above parameters and also improved them, in the plants grown under aluminium stress. Moreover, it is also noteworthy that EBL and HBL caused a further stimulation of antioxidative enzymes and proline content, which were already enhanced by aluminium stress. This led us to the conclusion that the elevated level of proline in association with antioxidant system, at least in part, was responsible for the amelioration of Al stress in mung bean seedlings.

Keywords: Aluminium, Antioxidants, Brassinosteroids, Carbonic anhydrase, Mung bean, Photosynthesis, Proline**LAND USE PASSION ENTER POLLINATION CRISIS DEBATE****Mukul Kumar**

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Land use and land cover are important determinants of the state of the natural environment. As a result, measures of land use and land cover change have been widely used as indicators of environmental condition and quality. The relationship between resource availability and biodiversity of consumers has gained particular attention with the increasing loss of biodiversity. Biodiversity losses have accelerated worldwide due to the overexploitation of natural resources, habitat destruction and climate change. The loss of natural habitat is a primary cause of the loss of terrestrial biodiversity. The maintenance of ecosystem services such as pollination will require a better understanding of each species' role and how species losses may affect them. Several studies have shown that pollinator visitation and diversity may be negatively influenced by habitat degradation and fragmentation as well as by agrochemicals. Losses in pollinator diversity or abundance may lead to a reduced seed set in plants. Parallel diversity declines in insect-pollinated plants and pollinators were reported from Britain and the Netherlands. Reduced flower diversity causes reduced pollinator abundance and diversity in small scale experimental plots. Thus, it is conceivable that declines in plant



diversity, like those caused by land use intensification, may cause declines of flower visitor diversity due to mutual specialization and vice versa. Diversity and abundance of relatively more specialized flower visitors (bees and butterflies) decrease with increasing land use intensity and that this diversity decline is likely to represent an indirect effect of a lower diversity and altered composition of flowers. Preferred flowers differ among visitor species resulting in highly complementary interactions - a potential reason for the parallel biodiversity decline of consumers and resources. In turn, high complementarity of plant species in regard to their effective pollinators may cause a negative response of plant diversity to pollinator diversity declines.

Keywords: Biodiversity, Climate, Diversity, Environmental, Forest, Grass

EFFECT OF PHOSPHORUS AND SULPHUR ON THE YIELD OF GREEN GRAM (*Vigna radiate* L.)

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A Pot experiment was conducted to study Effect of Phosphorus and Sulphur on Yield and Nutrient Uptake by Moong Bean (*Vigna radiate* L.) at Agriculture experimental field, Nehru PG collage Lalitpur (U.P.) during 2014-15. The food legumes, particularly the grain or pulses are important food stuff in all tropical and subtropical countries. Pulses deal with those species of the plant which belong to the family and subfamily faboide. India is the world largest homeland of vegetarian and world leader in pulses production and import to provide protein supplement. The experiment was laid out in Randomized Block Design. There were in all 16 treatment combinations (4X4) and three replications, on clay-loamy soil (black-brown in colored) with consisting four levels of each sulphur (0 kg, 10kg, 20 kg and 40 kg sulphur ha⁻¹) and four levels of Phosphorus (0, 30, 60, 90 kg/ha). The 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 PXS 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 and 40kg S/ha) 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 over control respectively. Interaction effect was also significant. There was a significant increase in the utilization of nitrogen with increasing levels of phosphorus and sulphur and their interaction effect was found also significant.

Keywords: Sulphur, Seed and Straw Yield, Net Returns.

A STUDY ON ORGANIC MANURE ON GREEN GRAM [*PHASEOLUS RADIATA* L.] UNDER RAINFED CONDITION OF CHITRAKOOT AREA

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The field experiment was carried out during Kharif season 2014 at rajaula instructional farm to evaluate the appropriate dose of suitable organic matters used on green gram under rain fed condition. Green gram is third important pulse crop in India. It is used as vegetable, pulse, fodder and green manure crop. It is used as vegetable, pulse, fodder and green manure crop. The agriculture remains key sector for the economic development for most developing countries. It is critically important for ensuring food security, alleviating poverty and conserving the vital natural resources that the world's present and future generations will be entirely dependent upon for their survival and well-being. Green gram is agriculturally important warm season and tropical legumes, sub genus sigmoido tropis links with this crop which enabled so far to study the genome for better improvement. It is an excellent source of protein and minerals for most of the people Green gram has been considered as a "poor men's protein". It contains 60% Carbohydrate, 23.9% Protein, 4% minerals, 3% vitamins and 10% moisture. Nine different organic matter treatments along with one control were tested in Randomized Block Design with three replications. After analysis of data shifted in various table results revealed that poultry manure 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 gram.

Keywords: Organic manure, Green gram Rainfed.

INFLUENCE OF SULPHUR DOSE AND SPACING ON QUALITY ATTRIBUTES AND ECONOMICS OF KNOL-KHOL

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The field experiment was conducted to study the effect of sulphur and spacing on quality attributes and economics of knol-khol at Horticulture Farm, S.K.N. College of Agriculture, Jobner during Rabi season 2014-15 on loamy sand soil with consisting four levels of each sulphur (0 kg, 20 kg, 40 kg and 60 kg sulphur ha⁻¹) and spacing (30x20 cm, 30x30 cm, 45x30 cm and 45x45 cm). The Results revealed that application of 60 kg sulphur ha⁻¹ to the knol-khol crop significantly increased the sulphur content in knob, protein content (%), ascorbic acid content in knob (mg/100g), net returns and B: C ratio as compared to control and 20 kg sulphur ha⁻¹ but statistically at par with 40 kg sulphur ha⁻¹. The level of spacing 45x45 cm significantly increased the sulphur content in knob, protein content (%) and ascorbic acid content in knob (mg/100g) as compared to 30x20 cm spacing and 30x30 cm spacing, but statistically at par with 45x30 cm spacing. The net returns and B:C ratio were found significantly maximum at 30x30 cm spacing as compared to 45x45 cm and 30x20 cm spacing which was found statistically at par with 45x30 cm spacing. The combined application of 40 kg sulphur ha⁻¹ with 45x30 cm spacing proved to be most superior treatment combination in terms of sulphur content in knob and 40 kg sulphur ha⁻¹ with 30x30 cm spacing in terms of net returns and B:C ratio. In case of T.S.S. content in knob, maximum value of sulphur and spacing were found to be non significant over preceding levels of the treatments.



Keywords: Knol-khol, Sulphur, spacing, interaction effect, quality and economics.

GROWTH ATTRIBUTES OF PIGEON PEA BASED INTER CROPPING SYSTEM AS INFLUENCED BY CONSERVATION TILLAGE UNDER RAINFED CONDITION

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An experiment was conducted at Agronomy farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during *kharif* season of 2012-13 on medium deep black soil to find out effect of conservation tillage on growth attributes and yield of pigeonpea based intercropping system under *rainfed*. The experiment was laid out in factorial randomized block design with four replication consisting two tillage practices conventional tillage and minimum tillage and four levels of cropping system viz., Sole pigeonpea(C₁), Pigeonpea +soybean (1:2)(C₂), Pigeonpea +Sun hemp(1:2)(C₃), Pigeon pea+ soy bean (1:5)(C₄). Pigeon pea variety PKV-Tara, Soybean variety JS-335 and sunnhemp local variety was used. Sunnhemp was cut at 40 DAS and used as mulch in minimum tillage and *in situ* green manuring in conventional tillage plots. After hand weeding weeds were used as mulch in all plots. Canopy lateral spread, root lateral spread, root volume, root diameter and shoot diameter of pigeonpea were significantly influenced by different cropping systems. Tillage did not affect these parameters but at harvest root lateral spread and volume were affected. Canopy lateral spread was maximum at harvest (151.2cm) and observed in pigeonpea + soybean (1:5) over the treatment C₁ (143.8cm), C₂ (102.8cm) and C₃ (144.7cm). Root lateral spread in respect of pigeonpea and root lateral was highest at harvest (68.6cm) and found in pigeonpea + sunhemp system over the other treatment C₁ (63.6cm), C₂ (60.3) and C₄ (67.3). At harvest higher value of root volume (68.0 ml) were found in pigeonpea + sunhemp over other treatment viz C₁ (62.1 ml), C₂ (64.4 ml) and C₄ (66.5 ml). The Highest seed yield per ha (18.5q/ha) were significantly recorded in sole pigeonpea followed by pigeonpea + sunhemp (1:2) i.e. 18 q/ha and lowest with pigeonpea + soybean (1:5). Where as in soybean it was maximum (21.3q/ha) with pigeonpea+ soybean (1:5), followed by pigeonpea + soybean (1:2).

Keywords: minimum tillage, lateral spread and volume

AGRO-TECHNIQUES FOR QUALITATIVE SEED CANE PRODUCTION WITH NEW SUGARCANE VARIETIES UNDER SUBTROPICAL REGION

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Sugarcane being a vegetatively propagated crop, tends to accumulate disease and pests during the course of cultivation. Therefore, production and supply of quality planting materials assumes greater importance. The use of healthy and vigorous seed plays a vital role in the cane development programme. Seed borne disease are responsible for considerable crop losses, this problem is a serious concern with vegetatively propagated crops like sugarcane, in which there may be either a progressive decline in production along with sugar recovery with increasing trends of diseases. Heat therapy among various agro – techniques has provided an effective method for the management of seed bone diseases like smut, grassy shoot, ratoon stunting, mosaic etc. The goal of heat therapy is killing of the pathogen at a specific temperature that is lethal. Integration of the seed production chain (nucleus, breeder, foundation and certified seeds) is of utmost importance in the case of sugarcane crop. Proper planning and monitoring. There is urgent need to revise the seed programme both quantitatively and qualitatively. Duplication should be avoided. There should be a drive to popularize new varieties and crash programmes for their production, and distribution should be developed on priority so that fast replacement of old varieties by newer one may possible. India's population is expected to go up to 1.279 million in 1920. At the present rate of sugar consumption (20 kg per human annually) to meet out the sugar demand there is need to produce more number of qualitative seed cane for increased productivity per unit area and sugar recovery per cane within the time. To produce high seed yields and productivity, sugarcane need better land and inputs. Technological interventions such as seed treatment to prevent the spread of disease and tillers mortality, better germination and rapid growth, trench planting, effective weed control, binding etc will help in increasing productivity and stability with sound and significant manner.

Keywords: Qualitative seed cane production, Sugarcane, Agro –Techniques, Subtropical, Vegetatively propagated significant.

EFFICACY OF ORGANIC MATTER AND BIOCONTROL AGENTS AGAINST ROOT –KNOT NEMATODE (MELOIDOGYNE INCOGNITA) IN TOMATO (LYCOPERSICON ESCULENTUM)

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One organic matter viz. neem cake and two biocontrol agents viz. *Trichoderma viride* and *Beauveria bassiana* were used for experimental purpose. The result showed that *Trichoderma viride* was very effective for management of root –knot nematode followed by neem cake and *Beauveria bassiana* respectively. Maximum growth parameters { shoot length (58.25c.m.), root length (19.75c.m.), fresh root weight (15.37g), fresh shoot weight (2.37g) and number of fruits (2.25) } were observed in *Trichoderma viride* followed by neem cake {shoot length (53.00c.m.), root length (13.00c.m.), fresh root weight (11.75g), fresh shoot weight (2.12g), and number of fruits (1.75) } and *Beauveria bassiana* {shoot length (49.75c.m.), root length (8.75c.m.), fresh root weight (9.25g), fresh shoot weight (1.25g), and number of fruits (1.50) } respectively. Minimum number of root –knot was noted in *T. viride* (17.25), *B. bassiana* (18.50) and neem cake (24.50) respectively.



WEEDS AS INDICATORS OF SOIL CONDITIONS

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Large Populations of weed growth can signal poor soil conditions as well as soil type. Since these lawn weeds indicate soil conditions, it can make it easier to detect and fix problem areas before they get out of control, poor soil can include anything from moist, poorly drained soil to dry, sandy soil. It may also include heavy clay soil and hard compacted soil. Even fertile soils have their share of weeds. Some weeds will take up residence just about anywhere, such as dandelions, making it more difficult to determine soil conditions without close examination. Plants, including weeds, differ enormously in their degree of tolerance to changes in soil P^H , moisture content, etc. and some have a narrow tolerance for one variable but a wide tolerance for others. The best indicators are those with narrow tolerances because they would only be found associated with specific conditions. Perennial weeds often make better indicators than annuals. Perennial weeds, having been able to tolerate the conditions in a particular locality for more than one year, are often more reliable indicators than annuals, which may survive only one season. Weed communities are better indicators than single species. The presence of a group of weeds that are associated with one another because of similar requirements for certain soil conditions provides a more reliable indicator in contrast to a single weed species. A vigorous growth of leguminous weeds usually indicates a soil lacking in nitrogen as does the presence of stunted nonleguminous weeds with pale green leaves. Cornflowers make particularly useful indicators as their flowers are blue when found on soils with a high lime content but are pink when they are growing on acid soils. However, if it is found that the daisy, wild carrot, mugwort, common mullein, wild parsnip, wild radish, and biennial wormwood become dominant, these weeds thrive on soils of low fertility while weed can be a menace and an eyesore as they creep throughout our lawns and gardens they can also provide important clues to the quality of your soil. Many lawn weeds indicate soil conditions, making it easier for homeowners to manage their soil quality and future problems. This not only allows you the opportunity to improve your soil but can also add health and vigor to lawn and garden plants. The battle with weeds will most likely never be won. Garden soil conditions and weeds go hand in hand. So why not take advantage of the clues given for soil types and use the weeds to identify Potential Problems. The appearance of a given weed species such as height or color, can vary, depending upon the environment at that site. In compacted areas such as footpaths, prostrate knotweed (*Polygonum aviculare*) is a small, prostrate, dark-green colored plant. When growing in undisturbed sites, it can have a lighter green color, larger leaves, and a more upright growth habit. Wild carrot (*Daucus Carota*), teasel (*Dipsacus fullonum*), burdock (*Arctium minus*) and yellow sweet clover (*Melilotus officinalis*) all biennial broad leaves will also grow in areas that are not mowed on a regular basis. Weeds have also been used as indicators of the presence and quality of ground water. Weeds that accumulate different elements have also been used by prospectors. By analyzing different parts of the plants for high concentration of certain minerals, they have been able to determine the location of mineral deposits such as copper and selenium.

POLLEN FORAGING BEHAVIOUR OF *APIS DORSATA* AT THE ONSET OF SPRING IN LUCKNOW, UTTAR PRADESH, INDIA

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Honey is the natural sweet produced by honeybees from nectar and other secretions of plants. Honeybees not only collect nectar but also pollen that forms an integral part of their diet. House bees collect the nectar from the stomach of the worker bees followed by enzymatic action that ripens the nectar into honey. In the foregoing study gut analysis of *Apis dorsata* collected from Lucknow, Uttar Pradesh is done to study pollen load present therein. Reverse mellisopalynological analysis during early spring reflects the floral resource that makes up the dietary habit of the bee. *Syzygium cumini* forms the dominant grain in the pollen load recovered from the mid gut. This qualitative approach throws light to the bee flora of the region and can be utilized for the regional potential for apiary industries.

Keywords: *Apis dorsata*, Honey, Pollen, Reverse mellisopalynology.

STUDIES ON DIFFERENT LEVELS OF MAJOR NUTRIENTS ON GROWTH, YIELD AND QUALITY OF KALMEGH (*ANDROGRAPHIS PENICULATA* BURN. F.)

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A Field experiment entitled "studies on different levels of major nutrients i.e. nitrogen and phosphorus on growth, yield and quality of Kalmegh (*Andrographis peniculata* Burn. F.)" was conducted during season 2016-2017 at Deptt. of Horticulture field in R.R.S. & M.B.A.C. Agwanpur, Saharsa to evaluate the growth, yield and quality of kalmegh using different levels of nitrogen and phosphorus. The Experiment was laid out in 4 x 4 factorial in randomized block design with sixteen treatments each replicated thrice. Plant height (37.29cm), number of leaf (412.06), plant spread (23.29cm), leaf area (9.00cm²), number of primary branches per plant (21.18), number of secondary branches (24.68), fresh herb yield per plant (76.51gms), fresh herb yield per ha (121.25q/ha), dry herb yield per plant (21.74gm), dry herb yield /ha (35.35q/ha) and maximum andrographolide content (2.09 %) were recorded with treatment T₁₃-100kg N/ha + 40 kg P/ha while minimum value regarding plant growth, yield and quality were associated with T₀-0 kg N/ha + 0 kg P/ha (control).

keywords: kalmegh, growth, yield, quality, Nitrogen, phosphorus and potassium.



PHARMACOLOGICAL EXPLOITATIONS OF *BARLERIA LUPULINA* LINDL. : A FOLK MEDICINE**Ajeet Singh and Navneet**

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Barleria lupulina Lindl. is a small shrub, commonly known as “Sornomukhi” and distributed in South East Asia. It is also used for its medicinal importance as the leaf juice is given to stop bleeding when cut and the leaf-paste is used as poultice to relief pain. It is also used as an anti-inflammatory against insect bites, snake bites, herpes simplex virus. Compounds found in the leaves of *B. lupulina* include barlerin, acetylbarlerin, shanzhiside methyl ester, acetylshanzhiside methyl ester, ipolamiidoside and iridoidglucosides. *B. lupulina* is a cultivated medicinal plant, an introduced species from Mauritius, now somewhat naturalized besides its cultivation in the garden as ornamental shrub. The promising pharmacological activities include antimicrobial, antiulcer, antioxidant, antidiabetic, anti-inflammatory, anti-HIV, anti-arthritic, and cytopathic effects of this plant were discussed in this review reported. It is now considered as a valuable source of inimitable natural products for development of medicines against various diseases and also for the development of industrial products. In the present article we focused mainly on the biological activities of some bioactive compounds of *B. lupulina*, pharmacological actions of the crude extracts and medicinal applications

Keywords: *Barleria lupulina* Lindl., folk medicine, Pharmacology, Antimicrobial potential Phytochemistry

BIOLOGICAL ATTRIBUTES OF *TETRASTICHUS HOWARDI* (OLLIFF) (HYMENOPTERA: EULOPHIDAR) ON PUPAE OF SUGARCANE BORERS**Pradeep Kumar Bareliya, Harpal Singh, and Ajay Kumar**

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T.howardi parasitizes the pupae of *S.excerptalis*, *C.auriclius* and *S. inferens* and therefore seem to be a suitable for the biological of sugarcane borers in India. The maximum number of adult and female was emerges in 1:1 ratio which was significantly higher than those in other ratio on pupae of top, stalk and pink borer. As female ratio increases of adult decreased. Female progeny, the number of which is of great importance to the survival of a species, was several influenced by the female ratio. Female progeny sharply fell from 89.04 in 1:1 to 5.06 in 8:1 ratio on pink borer pupa. The number of adult emerged (81:29) from female pupa of *Scirpophaga excerptalis* was more than male pupa (65:30). The number and sex ratio of adult progeny emerging out of a host pupa depends on the size. The number of adult emerged from different ages of female varied from 77.80 to 123.40 and maximum was in 1 day old female in top borer pupae. As age of female increase, no. of adult decreased except in 3 rd day old female. The maximum female progeny (96.20%) was obtained in 1 day female which is at par with fresh female. The lowest female progeny (81.60) was obtained in 4 day old. Female retain their eggs and also produced lesser number of adults in later stage of their life. The number of adult emerged was maximum (88.20) in 24 hr of exposure and minimum (27.16) in 120h (5 days exposure) in top borer pupae. The longer exposure period to the parasitoid may stimulate decrease no. of adults. When the host pupa was subjected to prolonged exposure (>24 h) number of adult per pupa significantly decreased. There was lowest emergence (27.16%) when pupae were exposed for 5 days (120h), indicating pupal mortality due to heavy super parasitism. Percentage female production was maximum (99.52) in 24h exposure period and it declined significantly with increase in exposure period. Maximum number of adult (39.80) emerged in 24h of exposure which was significantly higher than those in other exposure hour in stalk borer pupae. As age of female increase, number of adult decreased from 2 h to 96h. Development period of the parasitoid varied from 16.60 to 18.4 days and it was at par with each other (Table 7 & Fig.7). Percentage female production was maximum (98.61) in 24 h exposure period followed by 4h (91.14). The per cent female progeny recorded was 98.61, 91.14, 90.61, 88.20, 86.22, 85.60, 84.08, 82.60 and 75.20 per pupa, when pupa were exposed for 1 h to 5days, respectively.

PROSPECTS AND ROLE OF PLANT DERIVED ANTIFEEDANT PRODUCTS IN INSECT PEST MANAGEMENT.**Bashir A Rather, G. N. Parrey, F. A. Misgar, Z. A. Badri, M. Zubair and R. A. Dar**

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The negative impact of chemical insecticides have forced scientists to search for alternative techniques of insect pest management that are sustainable, economical and environment friendly. Among the alternative strategies plant products have been found to be effective, socially acceptable and bio-degradable and target specific. There is an increasing scientific interest in the role of secondary plant metabolites in insect-plant-interaction, particularly in host acceptance and rejection. Plant derived compounds have a wide range of mode of actions such as, feeding deterrents, insecticidal, ovicidal, oviposition deterrents and growth inhibitors. While plant chemicals may produce toxic effects when ingested by insects, antifeeding activity may determine the extent of insect herbivory. An antifeedant approach for insect pest control has been extensively studied, at least at laboratory level, though only a handful of plant based compounds are currently used in agriculture. Insect feeding deterrents may be perceived either by stimulation of specialized deterrent receptors or by distortion of the normal function of neurons which perceive phagostimulating compounds. GABA and related amino butyric acids are known to stimulate feeding and evoke taste cell responses among herbivorous insects of various taxa like Orthoptera, Homoptera, Coleoptera, and Lepidoptera. Antifeedants constitute a useful element for integrated pest management strategies because they can protect plants from insect herbivory by making the host less palatable. Furthermore, antifeedants are usually safer alternative crop protectants than conventional synthetic pesticides owing to their low toxicity, specificity, effectiveness at small concentrations, quick degradation, slow down the development of resistance and lack of impacts on non-target organisms. Antifeedants minimize the use of insecticides in controlling insect pests. However, antifeedants suffer from greater interspecific differences in bioactivity and rapid desensitization. The lack of technology to produce them in sufficient quantity and the time consuming and labor-intensive procedures to prepare them together with the three basic factors like, limitations in natural resources, quality control and standardization and regulatory constraints, such chemicals have not really made headway towards large-scale use.

Keywords: Antifeedants, insect-plant interactions, plant derived products, IPM.



EVOLUTION OF SOME IMPROVED AND LOCAL VARIETIES OF RADISH (*RAPHAANUS SATIVUS* L) UNDER VALLEY CONDITION OF GARHWAL HILLS**Arjun Lal Ola, D.K. Rana, M. R.Jhahra and L.N. Bairwa**

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The Field experiment was conducted at Horticultural Research Centre, H.N.B. Garhwal University, Srinagar- Garhwal, Uttarakhand (India) during rabi season 2014-15 to evolution of 22 varieties (namely, Arka Nishant, Baramasi, Bharsar Local 2, Dehli White, Dunagiri, Evergreen, Hill Queen, J.U, Japanese White, Local 1, Local 2, Local 3, Local 4, Local 5, Local 6, Local 7, Local 8, M.E.L.W, Pusa Mridula, Snow White, Sonali White and Pusa Chetki) of radish for yield potential and suitability under valley condition of Garhwal hills. The experiment was laid out in Randomized Block Design with three replications. The results are indicated that highly significant differences among varieties for almost all the traits. The growth parameters showed maximum plant height at 45 DAS the variety Snow White was recorded maximum plant height (46.60 cm), followed by Arka Nishant (42.44 cm), whereas the minimum plant height (17.93cm) was recorded under the variety Pusa Mridula. The maximum number of leaves at 45 DAS, was recorded Snow White variety (19.01), followed by Ever Green (17.89), whereas the minimum under the variety Pusa Mridula. The yield parameters showed significantly minimum days taken to harvest (50.00) was recorded in variety Delhi White, followed by Arka Nishant (50.67), whereas the maximum days taken to harvest (62.33) was recorded under the variety Pusa Chetki. The maximum root length (36.70 cm) was recorded in variety Snow White followed by Ever Green (30.72 cm), whereas the minimum length of root (14.10 cm) was recorded under the variety Pusa Mridula. The maximum root length (36.70 cm) was recorded in variety Snow White followed by Ever Green (30.72 cm), whereas the minimum length of root (14.10 cm) was recorded under the variety Pusa Mridula. The highest root yield per hectare (509.28 q/ha) was obtained in variety Ever Green, followed by Snow White (474.17 q/ ha), whereas the minimum root yield per hectare (250.05 q) was recorded under the variety Pusa Mridula. The maximum TSS (6.13 °Brix) was recorded in variety Local 3, followed by Bharsar Local - 2, (6.03 °Brix), while the minimum TSS (4.80 °Brix) was recorded under the variety Delhi White (T₄).

Keywords: Variety, Radish, Variance, Growth and Yield.**ASSOCIATION AMONG GENETIC PARAMETERS IN INDIAN MUSTARD (*BRASSICA JUNCEA* L. CZERN&COSS.)****Vipin Kumar Malik, Shiv Kumar Singh*, Vijay Kumar, Norang Pal Singh, Ankit Malik** and Vipin Kumar Dwivedi*****

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The considerable amount of genetic variability on the basis of GCV and PCV estimates for the traits; days to 50% flowering, numbers of primary and secondary branches per plant, length of silique, 1000-seed weight, seed yield per plant, biological yield per plant and harvest index were found in thirty five genotypes of Indian mustard (*Brassica juncea* L. Czern&Coss). Heritability and genetic advance were higher for days to 50% flowering, plant height and biological yield per plant. Although, number of secondary branches per plant, seed yield per plant and harvest index had moderately high heritability with moderate genetic advance indicating additive gene effects and selection pressure could be applied on them for yield improvement leads to fast genetic improvement of the materials. Days to 75% maturity, length of silique, 1000-seed weight and oil content had low heritability indicating that these traits were under the influence of environmental factors and selection on the basis of these traits could not be effective.

Keywords: Genetic variability, Heritability, GCV, PCV, Genetic advance, Indian mustard**COMPARATIVE EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON VEGETATIVE GROWTH, YIELD AND QUALITY OF BER (*ZIZYPHUS MAURITIANA* LAMK.) CV. GOLA UNDER SEMI-ARID CONDITIONS****Rajbala Choudhary, O.P. Garhwal, H.D. Choudhary and Indu Choudhary**

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An experiment was carried out at S.K.N.A.U. Jobner (Jaipur) Rajasthan to find out the comparative effect of organic manures and inorganic fertilizers on growth parameters of three years old ber orchard cv. Gola. Four levels of organic manures (control, FYM @ 20 kg/plant, vermicompost @ 6 kg/plant and poultry manure @ 8 kg/plant) and five levels of RDF (control, 50% RDF, 75% RDF, 100% RDF and 125% RDF) in Randomized Block Design with three replications to balance fertilizer requirement of ber under semi-arid region of northern India during 2015-16. The experimental results revealed that application of vermicompost @ 6 kg/plant and 125% recommended dose of fertilizers significantly influence the growth parameters (Plant height, plant spread (E-W and N-S), number of primary branches, average length of primary branch, number of secondary branches per primary branches and leaf area), fruit yield (kg/plant and q/ha) and fruit quality (TSS and acidity content) of experimental plants.

Keywords: Organic manures, inorganic fertilizers, growth, yield and quality

INFLUENCE OF DIFFERENT CONTAINERS ON SEED ROT OF RICE IN STORAGE**Rajbir Singh**

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This investigation was undertaken to know the effect of cotton and 700 gauge polythene bags on seed rot in rice genotypes viz. CMS 58025 A, CMS 58025 B, IR- 66, KMR-3 and variety Pant Dhan-11 at different storage period from January to May. It has been observed that with the increase in storage period there has been an increase in per cent seed rot in both containers. In cotton bags, the seed rot incidence was comparatively more than in cotton bags at all the storage periods although there has not been any significant difference in per cent seed rot incidence in both types of bags.

COMPARATIVE PERFORMANCE OF BER (*ZIZYPHUS MAURITIANA* LAMK.) GENOTYPES UNDER SEMI-ARID CONDITIONS OF RAJASTHAN**H.D. Choudhary and O.P. Garhwal**

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The present studies were conducted on twenty diverse genotype of ber during two consecutive years of 2014-15 and 2015-16 at Asalpur Farm, Department of Horticulture, SKN College of Agriculture, Jobner. Among the evaluated cultivars, maximum plant height was recorded in Chhuhara while, maximum plant spread in E-W and N-S were observed in Saphar Chandni. The highest canopy volume was observed in Chhuhara, whereas, the maximum stem girth was recorded in Meharun. The most important traits, fruit weight and volume of fruit were high in Katha followed by Gola and Thornless. Maximum fruit length was found in Thornless but maximum fruit breadth was observed in Gola. Stone weight was minimum recorded in Ilaichi. The highest pulp weight was observed under Katha, whereas, highest pulp: stone ratio, an indicator of good quality fruit, was recorded in Thornless genotype of ber. The maximum mean specific gravity (1.20) was observed in Katha genotype of ber. Based on the mean value with respect to characters of horticultural importance, cultivar Gola produced the highest fruit yield/ tree and fruit yield/ hectare followed by Katha Bombay and Kheera under semi-arid condition of Rajasthan.

Keywords: Growth, yield, ber, comparative performance.**STUDIES ON THE EFFECT OF LOW TUNNEL POLYHOUSE ON SOLANACEOUS SEEDLINGS DEVELOPMENT****Manoj Singh**

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The experiment was carried out in the department of Horticulture K.A.P.G. College, Allahabad during the year 2014-15. Data were significant in term of seed germination mortality reduction, sapling vigour and transplanting success. All the parameter studies were better over control. Forty percent higher germination was recorded in tunnel over control. Fresh weight, dry weight, number of leaf, leaf area secondary roots were for better in tunnel. Precisely farmers may be use polyhouses tunnel for commercial seedlings production of solanaceous vegetables.

IDENTIFICATION OF TRAINING NEEDS OF RURAL FEMALES IN IMPROVED HOME AND FARM MANAGERIAL PRACTICES IN WESTERN UTTAR PRADESH**Kirti M. Tripathi**

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Training is the most essential mandate in the KVKs. Different disciplines including the capability building of Home Managers who are also the integral part of agricultural practices in western Uttar Pradesh need a call of attention. The different areas include design of high nutrient efficiency (HNE) diets, storage loss minimization techniques, income generation activities, location specific drudgery reduction technologies. Therefore, these are the topics of utmost importance as per the preference of rural females. It is necessary to include all these topics in the training programmes to bridge the technological gap between existing and recommended home and farm managerial practices. The present study which was carried out in five villages of district Bulandshahr through complete enumeration revealed that training in the areas of income generation activities followed by drudgery reduction technologies is utmost essential among the rural women for improved home and farm management practices.

PARTICIPATORY DIAGNOSIS OF DRUDGERY PERCEIVED BY THE WOMEN FARMERS: A MICRO LEVEL ANALYSIS**Kirti M. Tripathi, S.K. Dubey*, U. S. Gautam* and Razia Parvez****

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Drudgery is the universally recognized phenomenon and mostly experienced by most of the women engaged in farming. It is directly proportional to the work intensity. Women intensively participate in agriculture and allied sectors. Present study was conducted to find the magnitude and extent of drudgery, as perceived by the women farmers of district Bulandshahr of western Uttar Pradesh in operating crop production related works, post harvest management activities and livestock management chores. A sample of 120 farm women was



drawn as the respondents from two operational villages of KVK, Bulandshahr. The sample consisted of 40 respondents contributing each in crop production, post harvest management and livestock management related operations. Demographic data and activity profile was recorded using pre-structured interview schedule. The variables like time spent (in minutes), frequency of performance (in man days), degree of difficulty and posture adopted was recorded on 4-point continuum score card. Results showed that harvesting, transplanting and weeding were perceived to be most drudgery prone operations in crop production sector. Threshing of paddy and bagging were intensely drudgery perceived areas in post harvest management related chores. Cutting fodder from field, chaffing and feeding and watering animal with cleaning of shades were recorded as most strenuous in managing the livestock.

Keywords: Drudgery, Farm women, Participatory diagnosis, Crop production, Livestock management, Postharvest operations.

STUDIES ON DIVERSITY AND VARIABILITY IN CLUSTER BEAN [*CYAMOPSIS TETRAGONOLOBA* (L.) TAUB.] GENOTYPES THROUGH MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION

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The present study entitled “Studies on Diversity and Variability in Cluster Bean [*Cyamopsis tetragonoloba* (L.) Taub.] Genotypes Through Morphological and Molecular Characterization” was carried out at the Horticultural Research Farm-I, of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareilly Road, Lucknow, (U.P.) during the Rabi Season of 2012-2013 and 2013-2014. The present study focused on genetic diversity in 30 genotypes of cluster bean belonging Rajasthan and Punjab regions of India were analyzed using 21 ISSR (Inter Simple Sequence Repeat) markers. The amplification using 21 ISSR primers produced a total of 263 total fragments was analyzed using several parameters. Out of the 263 total fragments generated across all germplasm, 204 (77.57%) were polymorphic and 59 (22.43%) were monomorphic. The number of polymorphic fragments per primer ranged from four (markers UBC-854) to fifteen (ISSR-5 and IS-7 marker), with an average of 9.71. The percentage polymorphism ranged from 58.33% (UBC-856) to 100% (UBC-820 and ISSR-8). The average percentage polymorphism for ISSR markers was 77.06. UPGMA tree was constructed using Jaccard's similarity. The observed number of alleles, effective number of alleles, Nei's genetic diversity and Shannon's information index for cluster bean genotypes using 21 ISSR markers were found to be 1.78120 ± 0.4167 , 1.4627 ± 0.3844 , 0.2671 ± 0.1939 and 0.3988 ± 0.268 , respectively. The value of total genotype diversity among population (H_t) was 0.2639 ± 0.0378 whereas diversity within population (H_s) was found to be 0.253 ± 0.035 . Mean coefficient of gene differentiation (G_{st}) value was 0.041 and the estimated gene flow in the population was 11.549. AMOVA was used to analyze variation among and within the populations. The distribution of molecular genetic variation among and within the 30 germplasm of cluster bean was estimated by AMOVA. AMOVA revealed that molecular variances were 8 percent of the total variance was among the subpopulations, while 92 percent was among individuals within the populations respectively. The same trend was observed when the AMOVA estimated based on one cluster bean types in germplasm set. The estimated variance based on ISSR marker data was 0.608 (among the population) and 6.783 (within the population). The average estimated variance was 3.965. Coefficient of variability, estimates of heritability and genetic advance as percent of mean, as well as correlation coefficients among yield attributes of cluster bean observed in the present study substantially reveal the great scope for improvement in many of the desirable economic traits of the crop. Most desirable genotypes screen out on the basis of morphological characterization in this study are IC-421834, IC-421855, IC-421828, IC-421855, HG-365, IC-421809 and IC-421806. In conclusion, this study indicates that ISSR proved to be an efficient marker system for studying genetic diversity and relationships among members of the germplasm characterization. The promising germplasm identified through this study will serve as useful resources for functional and comparative genomics, mapping and cloning genes and in applied breeding for enhancing the genetic potential of the cluster bean. Most desirable genotypes investigate on the basis of molecular characterization in this study are IC-258087, IC-258092, IC-28272, IC-311440, IC-311441, IC-369789 and IC-369868.

Keywords: Genetic diversity, variability, cluster bean, *Cyamopsis tetragonoloba*, ISSR, AMOVA, UPGMA

INHERITANCE OF CHARACTERISTICS AND THEIR INFLUENCE ON DAM PERFORMANCE IN MURRAH BUFFALOES

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India has privilege to possess half of the world population of buffaloes and are the main dairy animal in Indian sub continents, In spite of this the buffaloes did not figure much in literature for scientific know how. Reproduction is the most limiting constraints to efficient production in buffaloes. The information on sex ratio, incidence of abnormal parturition and twinning are required to formulate the breeding plan for genetic improvement. These traits are being affected by genetic and environment. The present study was conducted on Murrah buffaloes maintained at Government Dairy Farm, Hastinapur District Meerut in Uttar Pradesh to know inheritance of calf characteristics and their influence on Dam performance. A total number of 377 calving records were analyzed and available for study. The incidence of abnormal calving was found to be 5.03 percent in Single calving while twin calving was 5.3 percent. In the twin calving 3.1% was male calves and 2.2% was opposite sex. The incidence of still birth was slightly higher (2.91%) than abortion (2.12%). The sex ratio among single birth was found to be 50.59% of male calves. The statistical examination indicates that partially of calving had no effect in sex ratio. The heritability of twinning was very low which indicates that no genetic variability was present. It can be concluded that rate of twinning cannot be changed through sire selection.



EFFECT OF PROCESS AND OPERATIONAL PARAMETERS OF EXTRUSION COOKING OF SORGHUM, HORSE GRAM AND DEFATTED SOY FLOUR BLENDS TO PRODUCE PROTEIN RICH READY – TO – EAT FOOD SNACK**A. L. Basediya, Sheela Pandey *,Ajeet Sarathe *,Puneet Kumar ,and Kamlesh Ahirwar**

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Extrusion cooking of Sorghum, Horse gram and Defatted Soy Flour blends was done to prepare snacks by using a Brabender single – screw laboratory extruder. The combined effect of moisture content, (wb) of feed, blend ratio of feed, barrel temperature and screw speed of extruder on physical parameters extrudate (mass flow rate, volumetric expansion index) and protein content of extrudate was studied. It was observed that 15 % moisture content of feed, 80:10:10 blend ratio, 130 rpm screw speed and barrel temperature of 130 °C gave highest mass flow rate and volumetric expansion index of extrudate. It was further revealed that 15 % moisture content of feed, 60:30:10 of blend ratio, 130 °C barrel temperature and 130 rpm of screw speed gave the highest protein content in the extrudate. Response surface methodology was used to develop prediction model. A central composite rotatable design (CCRD) experimental approach was followed. The significance was established at $p \leq 0.05$.

Keywords: Extrusion cooking, mass flow rate, volumetric expansion index, protein content, sensory evaluation, Sorghum, Horse gram, Defatted soy flour

SHORT TERM RESPONSES OF CROPS TO CADMIUM TOXICITY-AN OVERVIEW WITH REFERENCE TO SORGHUM**Prasann Kumar, Padmanabh Dwivedi*, Ajeet Prakash**, Vinay Kumar*** and Arun Kumar K******

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Cadmium contamination is of major concern in India and other countries. It is one of the significant heavy metals of the antiquity and has achieved considerable attention as a potent environment pollutant as per the recommendation of several scientist in present era. Cadmium is not considered as the essential element of the plant even though it is absorbed by the plants and accumulated in different parts of plant body unacceptably. Plants show a number of different symptoms of cadmium toxicity at morphological, physiological and genetic level. The various responses of the plants to cadmium toxicity are often used as the tools by physiologists in collaboration with biotechnologists for environmental quality assessment and finally to develop tools relevant for ecotoxicological studies. Use of plants that hyperaccumulate specific metals in cleanup efforts have been in practice over the last few decades. Metal accumulating plants can be used for phytoremediation. We have tested sorghum for its potential scavenging capacity of cadmium and on the basis of data obtained we can say that it has a great potential for remediation of cadmium. The results obtained in this direction would be presented and discussed.

Keywords: Detoxification, Efficient, Hyperaccumulators, Lead, Metal, Transgenic

ROLE OF POLYAMINES AND MYCORRHIZA FOR THE MITIGATION OF CADMIUM TOXICITY IN RABI MAIZE VARIETY BIO-9544 WITH SPECIAL REFERENCE TO TOTAL SOLUBLE SUGAR**Prasann Kumar, Padmanabh Dwivedi*, Preethem E*, Ajeet Prakash**, Vinay Kumar*** and Arun Kumar K******

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Degradation of natural resource is one of the gravest lapses of the mankind during its progress of civilization. We studied the harmful effect of cadmium nitrate on the maize and role of polyamines and mycorrhiza for its mitigation. Data were recorded at 30, 60 and 90 days after sowing (DAS) of Maize variety BIO-9544 grown under cadmium toxicity. Putrescine and mycorrhiza were used as mitigating agents for cadmium. The used mycorrhiza was Glomus. After the careful observation, we have observed that the total soluble sugar content was significantly reduced by 22.19%, 18.77% and 21.63% when exposed to $\text{Cd}(\text{NO}_3)_2$ with the concentration of (0.07%)(T6) as compared to control (T0) at 30, 60 and 90 DAS of the interval. Similarly, when plants were exposed to higher doses of heavy metal 0.15% $\text{Cd}(\text{NO}_3)_2$ (T12) than its total soluble sugar content was significantly reduced by 56.25%, 51.33% and 50.37% as compared to control (T0) on the dates of proposed interval. Exogenous application of endomycorrhiza in the soil (T7) showed the mitigation effect by increasing the total soluble sugar content by 0.196%, 1.09% and 1.85% as compared to T6 at 30, 60 and 90 DAS. When treatment, T13 was compared to T12, the total soluble sugar content increased significantly by 0.98%, 3.26% and 1.02% at proposed DAS. In comparison to T6, the exogenous application of putrescine (T8) showed the mitigating effect by increasing total soluble sugar content by 1.13%, 2.71% and 2.71% on proposed DAS. The average total soluble sugar content was significantly enhanced as compared to T6 by 2.36%, 4.41% and 3.43% when treated with high dose of putrescine (T9) with respect to T8. Similarly, when treatment, T14 was compared with T12, the total soluble sugar content increased significantly by 5.61%, 5.69% and 2.87% at proposed DAS. The average total soluble sugar was significantly enhanced as compared to T12 by 9.30%, 7.65% and 3.05% when treated with high dose of putrescine (T15) with respect to T14. The combination of putrescine and mycorrhiza showed the best mitigation effect in treatment T10 by increasing total soluble sugar content by 4.97%, 5.74% and 4.43% with respect to treatment T6 at proposed DAS. When treatment T11 was compared with treatment T6 then significant total soluble sugar content was increased by 5.31%, 10.41% and 12.04%, respectively. A similar effect was seen in the treatment (T16) with respect to treatment T12. In this treatment (T16), the total soluble sugar content was



found to increase significantly by 9.44%, 9.11% and 3.85%, respectively at proposed DAS. The treatment T17 was found to show better results; significant increase in total soluble sugar content by 4.22%, 5.03% and 4.18% with respect to T12 was observed. So, the combination of putrescine and mycorrhiza showed the best combination for the mitigation of cadmium toxicity for the total soluble sugar content.

Keywords: Agriculture, Cadmium, Effect, Sorghum, Toxicity

EFFECT OF FOLIAR APPLICATION OF GA₃ ON YIELD AND QUALITY OF INDIAN MUSTARD [*BRASSICA JUNCEA* (L.) CZERN. & COSS.] UNDER SODIC SOIL

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The Indian mustard (*Brassica juncea* L.) is an important oilseed crop belongs to family cruciferae, the oilseed crop play an important role in agriculture economy of India. Our country is the largest oil economy in the world after the U.S., China and Brazil in term of vegetable oil. India occupies the second position in area after China and third position in production in the world after China and Canada. In India, it is the second most important edible oilseed crop after groundnut sharing 25-30 percent Indian oilseed economy. GA₃ is a manipulate a variety of growth and development phenomena in various crops. For instance, a foliar application of GA₃ has been found to Promoting growth and elongation of cells, stimulating rapid stem/root growth, inducing mitotic division in the leaves of some plants, increasing seed germinating rate, controlling sex differentiation and shoot elongation and inducing flowering. The investigation entitled "Effect of foliar application of GA₃ on yield and quality of Indian mustard [*Brassica Juncea* (L.) Czern. & Coss.] under sodic soil" was conducted during *rabi* season, 2016-2017 at the Main Experiment Station (MES) Farm of Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad-224 229 (U.P.) in randomized block design with eight treatments, three replications and variety Narendra rai (NDR-8501). Various concentrations of GA₃ (15ppm, 30ppm, 45ppm, 60ppm, 75ppm, 90ppm, 125ppm) were taken along with untreated control. Sprayed was done at 30 DAS. Yield contributing traits were taken as number of siliques plant⁻¹, length of silique plant⁻¹, number of seeds silique⁻¹, seed yield plant⁻¹, yield quintal ha⁻¹ after harvest. Foliar sprayed of different concentrations of GA₃ increased yield and quality characters of mustard crop. Yield and quality contributing traits were maximum recorded with foliar sprayed of GA₃ 125ppm followed by foliar sprayed with GA₃ 90ppm over rest of the treatments including control, during the investigation.

EFFECT OF PRE-HARVEST SALICYLIC ACID TREATMENT ON POSTHARVEST QUALITY OF STRAWBERRY FRUIT

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Strawberry is a highly perishable fruit due to its high respiration rate, rapid weight loss and fungal attack after harvest. It has a very limited postharvest life of only 1 – 2 days at ambient condition. In the present study, effect of pre-harvest application of salicylic acid on postharvest life and fruit quality was investigated. Salicylic acid (SA) at the concentrations of 1.0 mM and 2.0 mM were sprayed in strawberry plants (cv. Chandler) at petal fall stage at 10 days interval. Fruits were harvested at ripe stage, packed in punnets and stored at 4°C temperature. The results revealed that fruits treated with SA @ 1.0 mM showed minimum weight loss (14.27%) and decay loss (9.85%) than control (21.18% and 29.33%, respectively). These fruits also retained maximum anthocyanin (27.17 mg/ 100 g), ascorbic acid (44.17 mg/ 100 g) and total phenolics (82.96 mg GAE/ 100 g) than other treatments while these were retained minimum in control. SA @ 1.0 mM treated fruits retained about 1.22-fold higher antioxidant activity than control after 15 days of storage. No significant differences were noted in total soluble solids and titratable acidity among the treatments on the final day of experiment. The findings of this study revealed that pre-harvest application of 1.0 mM SA can preserve delicacy and extend shelf life of strawberry fruit up to 15 days during storage at 4°C.

COMPARATIVE PERFORMANCE OF BER (*ZIZYPHUS MAURITIANA* LAMK.) GENOTYPES UNDER SEMI-ARID CONDITIONS OF RAJASTHAN

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The present studies were conducted on twenty diverse genotype of ber during two consecutive years of 2014-15 and 2015-16 at Asalpur Farm, Department of Horticulture, SKN College of Agriculture, Jobner. Among the evaluated cultivars, maximum plant height was recorded in Chhuhara while, maximum plant spread in E-W and N-S were observed in Saphar Chandni. The highest canopy volume was observed in Chhuhara, whereas, the maximum stem girth was recorded in Meharun. The most important traits, fruit weight and volume of fruit were high in Katha followed by Gola and Thornless. Maximum fruit length was found in Thornless but maximum fruit breadth was observed in Gola. Stone weight was minimum recorded in Ilaichi. The highest pulp weight was observed under Katha, whereas, highest pulp: stone ratio, an indicator of good quality fruit, was recorded in Thornless genotype of ber. The maximum mean specific gravity (1.20) was observed in Katha genotype of ber. Based on the mean value with respect to characters of horticultural importance, cultivar Gola produced the highest fruit yield/ tree and fruit yield/ hectare followed by Katha Bombay and Kheera under semi-arid condition of Rajasthan.

Keywords: Growth, yield, ber, comparative performance.



EFFECT OF DIFFERENT FERTILITY LEVELS AND BIO-FERTILIZERS ON GROWTH AND YIELD OF KNOL-KHOL (*BRASSICA OLERACEA* VAR. *CAULORAPA* L.) UNDER AGRO-CLIMATIC CONDITION OF BIKANER REGION**Mamta Meena, H.D. Choudhary and S.L. Jat**

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A field experiment was conducted of Horticulture Farm College of Agriculture, Bikaner. The experiment consist of 16 treatments viz., four levels of fertility and four different bio-fertilizer inoculations alone and in combination was laid out in RBD with three replications. It was found that the treatment combination 100 per cent recommended dose of NPK + PSB exhibited plant height, number of leaves, yield per plot and total yield significantly higher over control and application of fertilizers and bio-fertilizers alone. It was statistically at par with 150 per cent recommended dose of NPK in combination with other bio-fertilizers inoculations.

Keywords: NPK, PSB, Growth, Yield and Knol-khol.**STUDIES ON EFFICIENCY OF DIFFERENT SUGARCANE GENOTYPES AND FERTILITY LEVELS ON PRODUCTIVITY OF SUGARACENE****Satendra Kumar, I.S Singh and S.C.Singh***

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A field experiments were conducted during 2015-16 and 2016-17 at Research Farm of Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Uttarpradesh. An experiment consists of nine treatments combinations. Two budded sugarcane setts were planted in furrow at 90 cm distance row to row. 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, F3 125% Recommended dose of NPK were tested in factorial randomized block design. Recommended dose of fertilizers were 180, 80, 60 NPK kg per ha and applied as treatments needs. All treatments were replicated three times. During 2015-16 year, the experimental field was medium in organic carbon (0.50 %), medium in available phosphorus (17.73 kg/ha) and low in potash (99.65 kg/ha) with pH 8.02. Effect of genotype/varieties treatments on shoot population, NMC and cane yield were non significant. Germination per cent was observed significantly higher in genotype CoS 09232 as compared to other genotypes/varieties treatments. 125 per cent recommend dose of fertilizer treatment observed significantly higher germination per cent, shoot population, NMC and cane yield as compared to 75 and 100 per cent RDF treatments but shoot population was recorded at par with 100 per cent RDF treatment. During 2016-17, the experimental field was medium in organic carbon (0.65 %), medium in available phosphorus (17.65 kg/ha) and low in potash (109.70 kg/ha) with pH 8.01. Effect of varieties on germination was noted non significant. Variety CoSe 11453 recorded significantly higher shoot population (167.51 thousand per ha) and Cane yield (107.19 t/ha) as compared to CoSe 08452 and at par with CoS 9232 but effect on NMC was recorded significantly in variety CoSe 11453 (144.93 thousand per ha) over remaining both genotypes/varieties. 125 per cent RDF treatment produced significantly higher germination per cent as compared with 75 per cent RDF and at par with 100 per cent RDF. Effect of different levels of fertilizer doses on shoot population was observed significantly higher in 125 per cent RDF as compare to 75 per cent RDF but at par with 100 per cent RDF. NMC (145.02 thousand per ha) and Cane yield (119.18 t/ha) were noted significantly higher in 125 per cent RDF treatment over remaining fertility doses treatments.

Keywords: Sugarcane, Varieties, Productivity, Fertility Level and Genotype**IMPACT OF BALANCED NUTRITION ON NUE AND ECONOMIC FEASIBILITY OF MAIZE (*ZEA MAYS* L.) IN WESTERN UTTAR PRADESH****Satish Prajapati and Adesh Singh***

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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.). 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 nitrogen but medium in available phosphorus and potassium with an electrical conductivity (1:2, soil:water) of 1.7 dS/m. The nine treatments viz; T₁ (Control), T₂ (N), T₃ (NP), T₄ (Recommended NPK), T₅ (NPK+S), T₆ (NPK+S+Zn), T₇ (NPK+S+Zn+Fe), T₈ (NPK+S+Zn+Fe+B) and T₉ (NPK+FYM+PSB) were tested in Randomized Block Design with 3 replications. The maize variety K-25 (Kanchan) was grown and its performance in relation to growth and development, nutrient uptake, economics, soil properties and nitrogen use efficiency as influenced by different treatments were assessed. Results obtained from the study revealed that plant height, number of functional leaves/plant, chlorophyll content, dry matter accumulation/plant, crop growth rate, relative crop growth rate, yields (grain, stover and biological)/ha and uptake of nutrients (kg/ha) in maize were significantly superior with the application of NPK+S+Zn+Fe+B (T₈) as compared to rest of the treatments, except T₅ (NPK+Zn), T₆ (NPK+S+Zn), T₇ (NPK+S+Zn+Fe) and T₉ (NPK+FYM+FYM). However, the grain yield/ha under this treatment (T₈) was increased by 91% and 56% over T₃ (NP) and T₄ (NPK), respectively. The maize also accumulated significantly higher nitrogen, phosphorus, potassium and sulphur in grains, stover as well as total (189.48, 48.95, 178.36 and 61.24 kg/ha, respectively) as compared to T₁ (control), T₂ (N alone) and T₃ (NP). Besides, partial factor productivity, agronomic efficiency and recovery efficiency was improved by 56.1, 99.0, 107.6 and 4.1 per cent, respectively as compared to T₂ (N alone). The application of NPK with Zn+S+Fe+B (T₈) brought Rs 94,320, Rs 63,872/ha and 3.1 as gross, net returns and B:C ratio, respectively, being highest among all the treatments followed by T₇ and T₆.



PHENOLOGICAL PERFORMANCE OF WHEAT (*TRITICUM AESTIVUM* L.) VARIETIES UNDER DIFFERENT DATES OF SOWING IN WESTERN UTTAR PRADEH.**Raju, Vipin kumar** , Kamlesh kumar Yadav* , Rajesh kumar**

Department of Agronomy, Department of soil science* , Department of Pathology**

Wheat (*Triticum aestivum* L.), the 2nd most important food crop of the world and India (29.65 m ha, 93.5 m tonnes & 31.53 q ha⁻¹) suffer severely due to terminal heat stress in large tract of irrigated and fertile indo- gangetic plain zone for different dates of sowing. The study, thus, amid at assessing growth, phenological and yield behaviours of wheat (DBW 17, HD 2967, PBW 343 and PBW 550) under timely dates of sowing (31 October, 10 November, 20 November and 30 November) in during 2013-15. Sowing at different dates resulted in variable thermal regimes at different growth and developmental phases, the mean temperature ranged from 12.10-14.40 °C during tillering to heading temperature were more unfavourable from heading to maturity for 30 November sown crop. GDD (°C days) and PTU (°C day hrs) were in order of dough- maturity > milking – dough > heading – milking > flag leaf- heading > tillering- flag leaf > CRI – tillering > emergence- CRI and > sowing – emergence. The highest GDD (1982.60), PTU (22368.06) were recorded in 10 November sown crop, DBW 17 accumulated highest GDD (1882.49) followed by HD 2967 (1881.05), PBW 550 (1879.68) and PBW 343 (1877.72) respective values for PTU were 20351.41 in DBW 17, 20347.00 in HD 2967, 20340.11 in PBW 343 and 20335.39 in PBW 550.

STUDY ON THE MAJOR MINERAL CONSTITUENTS OF COW AND BUFFALO MILK IN DIFFERENT STAGE OF LACTATION**Devesh Gupta*, Prem Singh and H.C.L.Gupta**

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In present investigation ten animals each from cow and buffalo were selected for different lactation period to study on the major mineral constituents of milk. It was concluded that ash, calcium and phosphorus percentage are influenced by stage of lactation and species of the animal but there was no significant influenced of species and lactation period on sodium and chloride content of milk.

EFFECT OF CINTURING ON FLOWERING, FRUITING, YIELD AND QUALITY IN LITCHI CV. LATE BEDANA**Satish Chand, Hitesh Agarwal, J. C. Chandola and Ranjan Srivastava**

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The present investigation was carried out at Pantnagar, District Udham Singh Nagar, Uttarakhand during October 2015 to June 2016 to study the impact of cinturing on flowering, fruiting, yield and quality in Litchi cv. Late Bedana. Twenty years old litchi trees consisted of 7 treatments with two levels of cinturing severity of 25% primary branches and 50 % primary branches with the combination of cinturing width of 2 mm, 4 mm and 6 mm along with control which are tested under randomized block design with three replications. The results indicated that all the litchi trees which were subjected to different severity and width of cinturing have more fruit set (%), fruit retention (%), yield and fruit quality as compared to control. However, the treatment with cinturing of 50% of primary branches + 4 mm wide had significant effect on improving the flowering intensity (57.70 %) and minimizing the sex ratio (1.61%). The treatment also improved the fruit set (38.44%), fruit retention (14.07 %), fruit yield (57.02 kg/tree) and quality significantly.

TAXONOMIC STUDIES OF MAJOR MANGO LEAFHOPPERS FROM INDIA**Srinivasa. N and Naresh M Meshram**

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Mango, *Mangifera indica* Linnaeus is national fruit of India, known as the 'King of Fruits', infested by number of insect pests. Among these leafhoppers are economically most important pest that cause an estimated yield loss of 25 to 60 percent. In India, mango leafhoppers occur throughout the year. Leafhoppers belongs to the family Cicadellidae of the order Hemiptera. These are small wedge shaped insects of various form, colour and size and distinguished by having one or more rows of small spines extending the length of hind tibia. Nearly eighteen species of leafhoppers have been reported as pests of mango in the world. Among these, five species belonging to the subfamily Idiocerinae; *Idioscopus clypealis* (Lethierry), *I. niveosparsus* (Lethierry) [now *I. nitidulus* (Walker)], *I. nagpurensis* (Pruthi), *Amritodus atkinsoni* (Lethierry) and *A. brevistylus* (Viraktamath) are the most important leafhopper pests reported from mango. Many isolated literatures and inadequate descriptions do exist to identify these pests. However, there is a lack of quick and detailed adult diagnostic tools for identifying these groups. Hence, the present study was conducted to develop photographic illustrations to identify pests by non-specialists. Mango leafhoppers were collected from mango orchards through sweep net, aspirator and light trap from various parts of the country, namely, New Delhi (Delhi), Kolar (Karnataka), Nauni (Himachal Pradesh) and Ranchi (Jharkhand) during 2014-15 . For redescription we focused on the characters of head, pronotum, wing and emphasis made on male genitalia variation to delineate the species and measurements were taken. Well illustrated photographic plates are prepared for all five species that may help for easy identification and species specific management.



PHYSIOLOGICAL RESPONSE OF RICE GENOTYPES TO SALINITY

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Soil salinity is a serious threat in many parts of India, which negatively affects plant growth and production. In order to investigate response of rice to salinity, two genotypes, 'CSR 36' (salt tolerant) and 'IR 29' (salt sensitive), were grown in hydroponic conditions, exposed to various salinity levels (0, 5, 10, 15 and 20 mmol NaCl) in a split split plot based on randomized complete block design with three replications of each treatment. Salinity stress decreased relative water content (RWC), potassium content, potassium/sodium ratio, chlorophyll a (chl a), chlorophyll b (chl b), and total chlorophyll contents and membrane stability index (MSI), and increased sodium, proline and soluble sugars concentrations and ratio of chl a/chl b in both genotypes. The decrease in RWC, chl a, chl b and MSI were significantly higher in 'IR 29' than 'CSR 36'. 'CSR 36' showed higher content of potassium, potassium/sodium ratio, proline, and soluble sugar concentrations as well as lower sodium content as compared with 'IR 29'. The salinity tolerance of 'CSR 36' is associated with higher RWC, potassium content, osmolyte concentrations, chlorophyll contents and maybe more vacuole sequestration of sodium.

MOLECULAR CLONING AND EXPRESSION ANALYSIS OF ALDOLASE GENE UNDER ABIOTIC STRESS CONDITIONS IN LENTIL (*LENS CULINARIS*)

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Lentil (*Lens culinaris*) is an important cool season food legume, encounters numerous biotic and abiotic stresses. Lentil contains asset of genes/proteins which helps this crop to overcome abiotic stresses. Improving stress tolerance in lentil requires detailed knowledge of the effects that various abiotic stress factors (drought, salinity) have on lentil at a molecular level. In the present study, primer for abiotic stress tolerant gene namely *aldolase* was designed by Fast-PCR and validated by Primer-BLAST online tool. Salinity stress treatment at different concentrations (100 mM, 150 mM, and 200 mM) for (3, 6 and 12 h) was given to lentil seedlings. Total RNA was isolated followed by cDNA synthesis. The *aldolase* gene was identified through PCR which resulted in amplicon size of ~750bp. The gel eluted *aldolase* was cloned in pTZ57R/T vector. Cloning was confirmed by colony PCR and restriction digestion approaches. The confirmed clones were sequenced. The sequence of *aldolase* having 750 bp, was submitted to NCBI with accession no. MF421715 after BLAST analysis. The sequence was further analyzed through bioinformatics softwares viz. BioEdit, NEB Cutter, Mega5. Nucleotide composition, multiple sequence alignments were obtained and phylogenetic tree, restriction map were constructed. These nucleotide sequence was also translated to protein sequence to know their total amino acid composition. The expression levels of *aldolase* gene was measured by Q-PCR using *cox* gene as an internal control. Gene expression was assessed by using cDNA from all the salinity stressed and unstressed lentil cotyledons when subjected to salinity stress at different concentrations i.e., 100 mM, 150 mM, and 200 mM for 3, 6, and 12 h respectively. The relative expression of *aldolase* of salinity stressed versus control (unstressed) of lentil cotyledons was calculated using BioRad IQ-5 software. The highest level of *aldolase* gene expression was recorded after 3, 6 and 12 hr at 100 mM, 150 mM, 200 mM of salinity stress respectively. From these studies it can be concluded that *aldolase* gene present in lentils which can be exploited in overcoming the salinity stress for obtaining the higher productivity in crop plants through genetic engineering under stress conditions.

STUDY OF GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN TUBEROSE (*POLIANTHES TUBEROSA* L.) GENOTYPES.

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The present study consists of twenty one tuberose genotypes to find out the estimates of genetic variability, heritability and genetic advance. The trial was laid out in Randomly Block Design (RBD) and replicated thrice each during *Kharif* season 2015-2016 at the HRC of S.V.P.U.A.T., Meerut (250110), (UP), India. The highest genotypic coefficient variation (GCV) and phenotypic coefficient variation (PCV) magnitude was observed for yield of bulb per plant (gm), yield of bulb (q/ha), concrete (%), absolute (%) and weight of bulbs (gm). Among the traits studied the highest heritability estimates was recorded in yield of bulb (q/ha), weight of bulb (gm), yield of bulb per plant (gm), concrete (%) and absolute (%), indicating lesser effect of environment on these traits. The genetic advance as percent of mean varied from 4.70% to 99.47%. Genetic advance was highest for yield of bulb (q/ha), yield of bulb per plant (gm). High heritability combined with high genetic advance was noticed for yield of bulb per plant (gm), yield of bulb (q/ha), weight of bulb (gm) indicating additive gene action which suggested that improvement of these traits would be effective for further selection of superior genotypes.



BIO EFFICACY OF NEWER MOLECULES OF INSECTIFIED AND BIOPESTICIDES AGAINST EGGPLANT/BRINJAL SHOOT AND FRUIT BORER (EFSB) (*LEUCINODES ORBONALIS*) GUENEE LEPIDOPTERA PYRALIDAE

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Egg plant *solanum melongena* L is an important vegetable crop of subtropics and tropic with fuel. Nutritional and Ayurvedic Medicinal value in India it is cultivated in almost all states. Damage of Egg plant is caused by larvae. The feeding stage of the pest (Novasero and calilung. 1990) early instar bore into tender shoot of egg plant and feed causing wilting or breaking and eventually drying up of affected shoots, Newly hatched larvae may directly bore in to fruits and its entry heals as the fruit develop. Among the thirteen insecticides and biopesticide evaluated against brinjal shoot and fruit borer (*L. orbonals*), Emamectin benzoate 5 SG @ 12.5g a.i./ha treated plots showed lowest infestation and gave higher fruit yield (253.12 q/ha) followed by Flubendiamide 480 SC (249.33 q/ha) and Novaluron 10 EC (243.63 q/ha). The biopesticide NSKE 5% was found most effective followed by *Bacillus thuringensis*, *Verticellium lecanii* and *Beauveria bassiana*. On the basis of per cent shoot infestation flubendiamide 480 SC @ 190 g. a.i./ha was found most effective insecticide with lower infestation followed by Emamectin benzoate 5 SG > Novaluron 10 EC > Spinosad 45 SC > Indoxacarb 14.5 SC > Fipronil 5SC > Imidacloprid 17.8 SL > Dimethoate 30 EC > NSKE 5% > Abamectin 1.9 EC > *Bacillus thuringensis* > *Verticellium lecanii* > *Beauveria bassiana* as compared to control. Based on per cent fruit infestation Emamectin benzoate 5SG @ 12.5 g a.i./ha was most effective followed by Flubendiamide 480SC > Novaluron 10EC > Indoxacarb 14.5 SC > Spinosad 45SC > Fipronil 5SC > Dimethoate 30 EC > Imidacloprid 17.8 SL > Abamectin 1.9 EC > NSKE 5% > *Bacillus thuringensis* > *Verticellium lecanii* > *Beauveria bassiana* > control. Emamectin benzoate was found significantly superior to other insecticides, Flubendiamide and Indoxacarb were found next effective insecticides. The highest cost : benefit ratio of (1:24.40) was obtained from NSKE 5% followed by Indoxacarb 14.5 SC (1:24.13) and Emamectin benzoate 5 SG (1:24.03).

EVALUATION OF BIOPESTICIDE FOR MANAGEMENT OF INSECT-PESTS COMPLEX WITH SAFETY TO NATURAL ENEMIES ON INDIAN MUSTARD *BRASSICA JUNCEA* (L.) OF NORTH EASTERN UP

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Field experiments were conducted in six locations at farmer's fields of Captainganj and Ramkola, block in KushiNagar district to evaluate the performance of biopesticide, *Metarhizium anisopliae* including other components (IPM field) against insect-pests and natural enemies in mustard. Result revealed that the IPM field proved to be effective with lowest incidence of major insect-pests viz., aphid (*Lipaphis erysimi*), sawfly (*Athalia lugens proxima*), painted bug (*Bagrada cruciferarum*) and leaf miner (*Phytomyza horticola*) with higher grain yield and monetary benefit as comparison to Non IPM field. The maximum yield was recorded in IPM 15.28q/ha) than Non IPM (13.23 q/ha) field. The IPM field was ultimately the promising one with better net return (Cost benefit ratio 1:2.43) than Non IPM (Cost benefit ratio 1:1.99). The population of natural enemies viz., lady bird beetles, Syrphid fly and preying spider and honey bee over non-IPM plot. Therefore, the IPM technology used was not only directly environment friendly but also more sustainable vide increase in biodiversity (natural enemies, soil flora & fauna).

Keywords: Mustard, IPM module, *Metarhizium* sp., Insect Pests, predators, grain yield.

EFFECT OF SEED RATE AND WEED CONTROL METHODS ON YIELD OF DIRECT SEEDED RICE (*ORYZA SATIVA* L)

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A field experiment entitled “Effect of seed rate and weed control methods on yield of direct seeded rice (*Oryza sativa* L.)” was conducted during kharif season of 2013-14 at Agronomy Research Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) to evaluate the efficacy of different herbicides viz., pendimethalin @ 1.0 kg ha⁻¹ (Pre.em.), bispyribac-sodium @ 25 g ha⁻¹ (Po.em) at 30 DAS and ready mix chlorimuron-ethyl @ 4 g ha⁻¹ (Po.em.) at 30 DAS with three seed rate 40,50,60 kg ha⁻¹ to see their effect on weeds, crop growth, yield and economics of rice. Weed free and weedy check were also included in the experiment. The field experiment was layout in randomized block design (factorial) with three replications. Rice variety “NDR-97” was sown by direct line sowing method with recommended doses of fertilizers, 120 kg N, 60 kg P₂O₅ and 60 kg K₂O per hectare. *Echinochloa colona* & *E. crusgalli* among grasses, *Commelina benghalensis* among non-grasses and *Cyperus rotundus* among sedges were the predominant weeds in experimental field. Uncontrolled weeds in weedy check plots caused an average reduction in grain yield 66.07 per cent over weed free plots. The lowest weed population and dry weight and highest yield attributes and yield 25.39 q ha⁻¹ were recorded under 60 kg ha⁻¹ seed rate. In chemical control Post-emergence application of bispyribac-sodium @ 25 g ha⁻¹ at 30 DAS, produced highest grain yield (24.45 qha⁻¹). Followed by Pendimethalin @ 1.0 kg ha⁻¹ Pre.em .reducing population & dry matter of weeds and it lead to highest grain yield which ultimately fetched highest net return.

MITROCHONDRIAL CYTOCHROME OXIDIZE I(MT COI) DIAGNOSTIC TECHNIQUE FOR THE QUICK IDENTIFICATION OF BIOTYPES WHITEFLY, *BEMISIA TABACI* (GENNADIUS) ON DIFFERENT CROPS

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Bemisia tabaci (Genn.) is one of the important pest and affects a board range of agricultural crops in the world having many biotypes. Based on the mitochondrial cytochrome oxidize I (mtCO I) sequence, there is evidence that *B. tabaci* should be considered a cryptic complex



species of 11 well-defined groups containing at least 24 morphologically indistinguishable species. Its populations differ biologically with respect to insecticide resistance, virus transmission and host range. Therefore, understanding genetic variation among populations is important for management. In present study, the mtCO I sequence of *B. tabaci* was analyzed from population sample collected from different host plants from different area, Uttar Pradesh, India. Results obtained showed that amplification of mtCO I gene fragment using the primers (C1-J-2195 and L2-N-3014) produced *B. tabaci* specific ~800bp band in all the samples of whitefly. Further Sequencing, homology search by Blast and comparison against the consensus sequences of Dinsdale or Ellango, revealed that these samples belong to group Asia II 1 which includes K, P, PCG-1, SY, ZHJ2 and PKI, respectively from different region. It is highly probable that these all biotypes are the same entity, but have been assigned different names either as a consequence of the use of different methods of identification or a failure to broadly consider the available data in sources such as Genbank. Moreover, Asia II 1 was associated with high incidences of ALCV, whereas regions where Middle East-Asia Minor 1 was present had a lower incidence.

Keywords: Biotypes, COI, amplification, *Bemisia tabaci*

DEVELOPMENT OF TRANSGENIC CHICKPEA (*CICER ARIETINUM* L.) PLANTS WITH *OSRUVB* GENE FOR SALT STRESS TOLERANCE

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Chickpea (*Cicer arietinum* L.), also known as bengal gram or channa, is an edible legume. It is a self pollinating diploid ($2n=2x=16$) with genome size of 740 Mb. In India, it tops the list of pulse crops with a total production of 8.83 million tons with an average yield of 925.5 during 2015-16. In addition to biotic stresses, chickpea faces various abiotic stresses such as drought, cold, terminal heat and salinity etc. Chickpea production is adversely affected due to salinity in arid and semi-arid regions of the world as salt stress reduces water potential, creates imbalance in ion concentration and causes toxicity. RuvB is a helicase found in bacteria but now several reports show its presence in plants like *Oryza sativa* where it is required for normal levels of genetic recombination and DNA repair, by which the plant overcomes salt stress. We have developed transgenic chickpea plants with *OsRuvB* gene for salinity tolerance by using in planta transformation method for which patent has been granted (Kharb *et al.*, 2012). The putative T_0 plants were screened by PCR analysis and the PCR positive plants with transformation efficiency of 24% were observed. The plants are further being characterized for integration, expression and transgene copy number using suitable molecular technique.

RECENT DEVELOPMENT IN AGRICULTURE SECTOR OF AGER COMMUNITY IN COSTAL KARNATAKA, INDIA.

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There has been wide consensus that the rural development should be inclusive and sustainable in order to alleviate the poverty. Focus area of the 12th Plan will be improving Viability of Small farms. Agriculture now accounts for only 14 per cent of Gross Domestic Product (GDP); it is still the main source of livelihood for the majority of the rural population. As such rapid growth of agriculture is critical for inclusiveness. Important structural changes are taking place within the sector and there are definite signs of improved performance. Dependence on Agriculture in rural areas farmers are shifting to non-agricultural work and tightening the labour market in agriculture and putting pressure on farm wages. An attempt is made on study of Ager community and their livelihood base on agriculture practice in Coastal Karnataka. The questionnaire method has been adopted to elicit the opinion of Ager communities about the recent development in Agriculture sector in Ankola Taluk of Uttara Kannada district of Karnataka. Among 100 families 92 responded representing 92 percent. The simple random sampling technique was used for selecting the sample users. After the selection of sample users the collected data is analyzed using statistical methods and necessary conclusions will be drawn. This paper deals with the Practice of Agriculture among Ager Community in Coastal Karnataka.

Keywords: Agriculture, Gross Domestic Product, Ager community, Ankola, Uttara Kannada.

EFFECT OF SEED RATE AND WEED CONTROL METHODS ON YIELD OF DIRECT SEEDED RICE (*ORYZA SATIVA* L)

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A field experiment entitled “Effect of seed rate and weed control methods on yield of direct seeded rice (*Oryza sativa* L.)” was conducted during kharif season of 2013-14 at Agronomy Research Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) to evaluate the efficacy of different herbicides viz., pendimethalin @ 1.0 kg ha⁻¹ (Pre.em.), bispyribac-sodium @ 25 g ha⁻¹ (Po.em) at 30 DAS and ready mix chlorimuron-ethyl @ 4 g ha⁻¹ (Po.em.) at 30 DAS with three seed rate 40,50,60 kg ha⁻¹ to see their effect on weeds, crop growth, yield and economics of rice. Weed free and weedy check were also included in the experiment. The field experiment was layout in randomized block design (factorial) with three replications. Rice variety “NDR-97” was sown by direct line sowing method with recommended doses of fertilizers, 120 kg N, 60 kg P₂O₅ and 60 kg K₂O per hectare. *Echinochloa colona* & *E. crusgalli* among grasses, *Commelina benghalensis* among non-grasses and *Cyperus rotundus* among sedges were the predominant weeds in experimental field. Uncontrolled weeds in weedy check plots caused an average reduction in grain yield 66.07 per cent over weed free plots. The lowest weed population and dry weight and highest yield attributes and yield 25.39 q ha⁻¹ were recorded under 60 kg ha⁻¹ seed rate. In chemical control Post-emergence application of bispyribac-sodium @ 25 g ha⁻¹ at 30 DAS, produced highest grain yield (24.45 qha⁻¹). Followed by Pendimethalin @ 1.0 kg ha⁻¹ Pre.em .reducing population & dry matter of weeds and it lead to highest grain yield which ultimately fetched highest net return.



EFFECTS OF SURFACE STERILIZATION AGENTS ON *IN VITRO* PLANT GROWTH IN BANANA CULTIVAR “GRAND NAINÉ”**Anil Kumar Yadav and Yogesh Prasad**

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In the present study, the effects of three different surface sterilization agents i.e. mercuric chloride, bavistin and ethanol were tested on the contamination-free establishment of banana cv. Grand Naine under *in vitro* conditions. All the sterilization agents performed better results when used individually for different time intervals. The combination of 0.1% HgCl_2 with 70% ethanol was also found effective for sterilization of banana explants. Best results with lower contamination and higher explant survival % were recorded with 0.1 % HgCl_2 . The present study concludes the use of 0.1 % HgCl_2 for different time intervals to generate contamination-free plants in banana cv. Grand Naine with higher explant survival percentage.

Keywords: Aseptic Technique, Explant, *In-Vitro*, Musa, Sucker.**PHYSICO-CHEMICAL PROPERTIES OF PUMMELO[CITRUS GRANDIS (L.) OSBECK] GROWN UNDER NORTHERN PARTS OF WEST BENGAL****Nilesh Bhowmick, Arghya Mani*, Prodyut Kumar Paul, V.S.S.V. Prasanna**

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A study was conducted to identify the elite pummelo genotypes among its natural population from different locations of North Bengal. The fruits from 22 different accessions were collected in ripe condition and their physio-chemical characteristics were assayed. The study showed that a wide variability exists among different fruit samples collected from distinct locations. The result shows that the fruit skin colour shows variation from greenish-yellow to orange, most of the fruits are round shaped whereas some fruits are oval as well. The placental tissues shows colour variability from whitish to pink and even reddish as well. The taste of the juice are classified as sour in some occasions to sweet in many occasions and very sweet in few occasion. Accession-17 showed the maximum average weight of fruit whereas the minimum fruit weight was observed in accession-16. The length and breadth of the fruit was found maximum in accession 17 and 20 and minimum in accession 14 and 11 respectively. The peel-pulp ratio was maximum in accession 13 and minimum in accession 3. Juice content was found maximum in accession 4 and minimum in accession 3. The TSS was found maximum in accession 15 and minimum in accession 13.

Keywords: Pummelo, Variability, Physio-chemical, North Bengal**STUDY OF PREFERRED INFORMATION SOURCES AND CHANNELS BY THE RAPESEED-MUSTARD GROWERS****Saurabh Sharma, D.V. Rai, Deepika Saini, and Surjeet Kumar Arun**

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An effective communication or information is pre-requisite for adoption of an innovation or a technology. The Present study was conducted in Siyana block of Bulandshahr district of Uttar Pradesh (India) during 2015-2016. The data were collected personal localite sources like neighbors, friends, progressive farmers and opinion leaders were playing important role in transfer of rapeseed-mustard technologies to the fellow farmers with the help of structured interview schedule through 120 farmers (Rapeseed /Mustard growers) selected on the basis of simple random sampling. These sources with high credibility were widely used by majority of the respondents. The most revealing finding of the study is that VLWs or Agriculture Supervisors had lost their credibility among the farmers while the input dealers and agents of commercial seed, fertilizers, plant protection, etc., played a critical role in information network of rapeseed mustard farmers, however their credibility is low. It was important to note that scientists and agriculture officers were perceived a much credible source of information by rapeseed-mustard farmers, however these sources were less accessible to the farmers. Further, the increasing literacy rate and easy accessibility of the mass media channels resulted in increased utilization of these media by the farmers. The findings of the investigation indicate that television was & observed the most effective and credible channel of communication to transfer the improved rapeseed/ mustard technology. The progressive farmer and radio were preferred in order to communicate the technology. R.A.E.O also plays important role in communicating to the improved Rapeseed/ mustard technology. A significant association between utilization of communication channels and caste groups was also observed.

Keywords: Television, Information sources and channels, Utilization, Credibility, Adoption.**EVALUATION OF PLANT PRODUCTS AGAINST TOBACCO CATERPILLER, *SPODOPTERA LITURA* (FABRICIUS) ON SOYBEAN****V. K. Soni, Bhupesh Joshi, V. K. Dubey and R. K. Dwivedi**

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Soybean, *Glycine max* (L.) occupied first rank in the world edible oil production. India ranks third in respect of area and production. The tobacco caterpillar, *Spodoptera litura* is most serious pest of soybean at Dist. Kabirdham. Excessive and indiscriminate use of pesticide come several problems like development of resistance in targeted species, resurgence of secondary pest, elimination of natural enemies and contamination of soil, water and food chain. Plant products or botanical pesticides are the important alternatives to minimize or replace the use of synthetic pesticides. The present study was conducted during *kharif*, 2016 at S K College of Agriculture and Research station, Kawardha



(Kabirdham) Chhattisgarh. The experiment was carried out in RBD design with eight treatments and three replications. Tobacco caterpillar, *S. litura* is the most damaging insect pest of soybean. In the evaluation of plant products against *S. litura* NSKE @5% was found second most effective after recommended insecticide on soybean after both the sprays 1st as well 2nd with benefit cost ratio of 1.14.

Keywords: Botanicals, soybean, *Glycine max* (L.) and *Spodoptera litura*.

RESPONSE OF CAPSICUM TO DRIP IRRIGATION LEVELS AND BLACK PLASTIC MULCH UNDER NATURALLY VENTILATED POLYHOUSE

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Bell pepper (*Capsicum annum* L. var. *grossum*) is a popular vegetable of the family Solanaceae. Despite its economic importance, production of good quality capsicum under open field condition is not easy due to its specific climatic requirements. However, it can successfully be cultivated under protected condition in Uttarakhand. For getting the maximum return from capsicum under naturally ventilated polyhouse, optimum nutrient management through fertigation and management of hydrothermal regime in the soil through mulching are important aspects need to be considered as soil moisture stress during the growing period reduces the yield and quality. In present conditions, water has become scarce natural resource due to rapid population growth, industrialization and urbanization. Keeping the above concerns, judicious use of irrigation water through drip system along with plastic mulch in naturally ventilated polyhouse has become inevitable. Therefore, the present investigation was carried out to evaluate the effect of drip irrigation levels and black plastic mulch on capsicum production under naturally ventilated polyhouse. The present investigation was carried out in Randomized Block Design with four drip irrigation levels (100, 80, 60 and 40 % of crop water requirement) and surface irrigation in conjunction with or without plastic mulch. The outcome of study indicates, drip irrigation at 80 percent of crop water requirement with black plastic mulch showed the highest yield of fruits (88.99 t/ha), whereas, yield was noticed minimum in surface irrigation (66.99 t/ha). It was also observed that drip irrigation both with or without plastic mulch registered much higher WUE compared to surface irrigation. As far as net return and Benefit Cost ratio was concerned, maximum net return of Rs 19,026.04 /100 m² and benefit cost ratio of 2.56 was also noticed in treatment receiving irrigation at 80 percent crop water requirement through drip system under plastic mulch.

EXPLOITATION OF CMS BASED PIGEONPEA (*Cajanus cajan* L.) HYBRIDS FOR YIELD AND ITS CONTRIBUTING TRAITS

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The present investigation entitled “Exploitation of CMS based pigeonpea (*cajanus cajan* l.) hybrids for yield and its contributing traits” was undertaken to estimate the extent of heterosis, combining ability effects and thereby to find out promising cross combinations using Line x Tester mating design (Kempthorne, 1957). The set of 10 parents, two females (cms lines) viz; AKCMS-92A, AKCMS-87A, and 8 males (Testers) viz., AKPR-364, AKPR-324, AKPR-372, AKPR-303, AKPR-057, AKPR-359, AKPR-215, AKPR-277 their 16 crosses along with two checks PKV-TARA and ASHA were evaluated in randomized block design with three replications at the field of Pulses Research Unit, Dr. PDKV, Akola during Kharif 2015-2017. The data were recorded on the characters viz., days to 50 per cent flowering, days to maturity, plant height (cm), number of branches, number of clusters, number of pods, number of seeds per pod, 100 seed weight (g), grain yield per plant (g) and plant fertility (%). Among female parents, ICPA-2047A recorded significant gca effect for maximum six characters such as grain yield per plant, plant height, number of clusters, number of seed per pod, 100 seed weight and days to 50% flowering. The male parent AKPR-324 was found to possess highest gca effect for plant height, number of clusters, 100 seed weight and grain yield per plant. The cross ICPA-2047A X AKPR-324 depicted high mean performance (33.67) high magnitude of useful heterosis (17.72% over check PKV-TARA and 23.17% over check ASHA), positive sca effect and both the parents involved revealed high gca effects. This cross could be successfully utilized to obtain the superior segregants in further segregating generations. Another cross ICPA-2047A X AKPR-372 revealed high mean performance (33.00g), high magnitude of useful heterosis (15.38 % over check PKV-TARA and 20.73% over check ASHA) and high sca effect. One of the parents (AKPR-372) though low combiner for grain yield but it was good combiner for number of branches, number of pods, number of seed per pod and days to 50% flowering. This cross may be employed to exploit non-additive component along with high heterotic response. However, the performances of this cross have to be evaluated in large scale trials.

Keywords: Pigeonpea, Heterosis, Combining ability, Line x Tester Analysis, CMS.

BIO-EFFICACY OF ECO-FRIENDLY PESTICIDES ON THE MANAGEMENT OF AGAINST DIAMONDBACK MOTH, *PLUTELLA XYLOSTELLA* (L.) ON CABBAGE, *BRASSICA OLERACEA*, VAR. *CAPITATA* (L.)

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An experiment was conducted in Rabi season during 2014-2015 study the relative efficacy of different eco-friendly pesticides comprising of three neem product (Neem oil 4%, NSKE 5% and Neem leaf extract 10%), one Bt products (*Bacillus thuringiensis* var. *Kurstaki* 2%), one Entomopathogenic fungus two concentrations, *Beauveria bassiana* (biorin 3%, 5%) and a chemical pesticide check standard (Cypermethrin 25 EC 0.05%) against diamondback moth (*Plutella xylostella* Linn.). All pesticides were superior in controlling the diamondback moth population in comparison to untreated control. Amongst the different treatments, T7 Cypermethrin check recorded the highest larval population reduction (71.10%) and proved to be the most effective treatment, followed by T2 *B. thuringiensis* 2% and T5 *B. bassiana* 5% with larval populations reduction of (57.34%) and (55.80%) respectively, as against (0.00%) in untreated control. T3 Neem leaf extract 10% was found to be the most inferior pesticide by recording the highest population of (46.98). Highest mean yield of cabbage was recorded in T7 Cypermethrin 0.05% (273.32 q/ha) followed by T2 *B. thuringiensis* 2% and T4 Neem oil 4% (242.15 q/ha) and (228.87 q/ha) respectively, as against



(96.84 q/ha) in untreated control. The cost benefit ratio of (1:6.17) was recorded in T7 Cypermethrin 0.05% and proved to be effective among the treatments. However, recorded second highest cost benefit ratio of T2 *B. thuringiensis* (1:5.59) followed by T4 Neem oil 5% (1:4.98), T5 *B. bassiana* 5% (1:4.38), T6 NSKE 5% (1:4.01) T1 *B. bassiana* 3% (1:3.78), T3 Neem leaf extract 10% (1:3.51).

Keywords: Cabbage, diamondback moth, *Plutella xylostella* (L.), botanicals, bio-pesticides.

HETEROSIS AND INBREEDING DEPRESSION IN RELATION TO HETEROTIC PARAMETERS IN BREAD WHEAT (*TRITICUM AESTIVUM* L.) UNDER LATE SOWN CONDITION

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The present investigation on heterosis and inbreeding depression was conducted on genetically diverse 10 parent diallel crosses of bread wheat. The experimental materials comprised 10 genotypes including 10 parents and their F1s and F2s progenies and trial was conducted in randomized complete block design with three replication at Economic Botanical Research Farm, Nawabganj of C.S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India, during 2013-14 and 2014-15. The analysis of variance revealed that the all components of variances showed significant differences for almost the traits under studied over both generations. The result of economic heterosis revealed that the cross combinations, DBW 14/K 0424, K 9162/K 9423, K 9533/K 0307, K 1114/K 0424 and K 1114/NW 2036 were good for grain yield per plant along with range of -88.54 (K 0424/K 0911) to 28.52 per cent (DBW 14/K 0424) and other traits compared to 45 F1s whereas, all these cross combinations also had significant grain yield demission in F2s results of increase of homozygosity among the crosses in succeeding generations. The range of inbreeding depression varied from - 50.36 (K 1114/K 9423) to 49.12 percent (K 0911/K 0307) in F2s. Accordingly, these cross combinations may be utilized for improving grain yield as well as production of better transgressive segregants in advance generations for maintain of specific gene pool of bread wheat through breeding program in future.

PRODUCTIVITY OF SOME BREAD WHEAT CULTIVARS UNDER DIFFERENT NITROGEN FERTILIZER LEVELS

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Two field experiments were carried out during 2014/2015 and 2015/2016 seasons at the Agricultural Experimental and Research Station, Faculty of Agriculture, Cairo university at Giza, Egypt to study the performance of three wheat cultivars (Sakha-94, Gemmiza-9 and Giza-168) under three nitrogen fertilizer levels (75, 100 and 125 kg N/fed. A split-plot design with three replications was used in both seasons. Nitrogen levels had a significant effect on number of spikes/m², number of grains/spike and grain yield in both seasons and grains weight /spike in the first one. On the contrary, spike length, 1000-grain weight and harvest index were not significantly affected by nitrogen levels in both seasons. In general, all previous characters were increased by increasing nitrogen levels up to 125 kg N/fed. Moreover, all studied characters significantly affected by cultivars in both seasons. Sakha-94 significantly surpassed the other two cultivars in grain yield in both seasons. Nitrogen levels × cultivars significantly affected grain protein content in both season, number of spikes/m², 1000-grain weight, grain yield/fed. and harvest index in the second season. Significant positive correlation was detected between grain yield and each of number and weight of grains/spike, 1000-grain weight and number of spikes/m² in both seasons.

Keywords: Wheat, N levels, cultivars and grain protein.

EFFECT OF MANURES AND FERTILIZERS ON GROWTH, FLOWERING AND YIELD PARAMETERS OF OKRA (*Abelmoschus esculentus* L. Moench)

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Sole application of chemical fertilizers to meet the crop nutrient demand is deleterious for both soil and environment health. It is costly input and usually unavailable to farmers at peak season. Hence, organic manures from different sources could be an effective substitute of chemical fertilizers which improve the crop yield and soil properties. It has also been proved that organic sources contribute a lot of organic matter percentage in the soil. Among the different organic manures, pressmud and vermicompost are the important sources of nutrients and organic matter. Hence, keeping these facts in view, present investigation entitled “Effect of manures and fertilizers on growth, flowering and yield parameters of Okra (*Abelmoschus esculentus* L. Moench)” was carried out during the summer session in 2016, at the Agricultural Research Farm, Department of Agricultural Sciences & Engineering, IFTM University, Moradabad (UP). There were 8 treatment combinations i.e. T₁ (100% RDF), T₂ (100% RDF + Vermicompost @5t/ha), T₃ (50% RDF+Vermicompost@5t/ha), T₄ (Vermicompost@5t/ha), T₅ (100% RDF + Pressmud@5t/ha), T₆ (50% RDF + Pressmud@5t/ha), T₇ (Pressmud@5t/ha) and T₈ (control). All treatments were replicated three times in randomized block design. Maximum plant height (39.87cm) at 30 DAS and 79.47 cm plant height at 60 DAS, maximum no. of leaves/ plant (17.13) at 30 DAS and 38.67 leaves/plant at 60 DAS, maximum fresh weight of single pod (19.77g), maximum no. of pods/ plant (22.00), maximum fresh weight of pods/ plant (20.26g) and maximum pod yield (361.80 q/ha) were recorded under the treatment T₅ (100% RDF + Pressmud@5t/ha) while minimum days for appearance of first flower (47.93 days) and minimum days taken for pod appearance (50.17 days) were recorded under the treatment T₄ (Vermicompost @ 5 t/ha).



EFFECT OF MICRONUTRIENT AND BIOFERTILIZER ON GROWTH AND YIELD OF CAULIFLOWER (BRASSICA OLERACEA L. VAR. BOTRYTIS)**Krishan Pal, Manjeet Kumar and Vinod Kumar Dhangra**

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The indiscriminate use of chemical fertilizers has simultaneously resulted in many problems like degradation of soil productivity, environment pollution, depletion of non-renewable source of energy etc. Hence, the use of chemical fertilizers should be reduced to the minimum and may be substituted with integrated use of manures, fertilizers, green leaf manure and bio-fertilizers. The approach of integrated plant nutrient system aims at sustaining productivity with minimum deleterious effects of chemical on soil health and environment. In this direction, the applications of bio-fertilizers in vegetable crops have been found very effective. Keeping the above points into consideration the present investigation entitled “Effect of Boron and Azotobacter on growth and yield of Cauliflower (*Brassica oleracea* L var. *botrytis*)” carried out at Research Farm, Department of Agricultural Sciences and Engineering, IFTM University, Moradabad. There were total 9 treatment combinations i.e. A_1 (Azotobacter@750ml/ha), A_1B_1 (Azotobacter@750ml/ha+Boron@10kg/ha), A_1B_2 (Azotobacter@750ml/ha+Boron@15kg/ha), A_2 (Azotobacter@1000ml/ha), A_2B_1 (Azotobacter@1000ml/ha+Boron@10kg/ha), A_2B_2 (Azotobacter@1000ml/ha+Boron@15kg/ha), B_1 (Boron@10kg/ha), B_2 (Boron@15kg/ha), A_0B_0 (Control). Maximum plant height i.e. 21.14 cm and 36.21 cm, maximum leaf length i.e. 16.79 cm and 30.95 cm and maximum no. of leaves / plant i.e. 9.73 and 14.33, respectively were recorded at 30 DAT and 45 DAT. Maximum leaf width (7.32 cm) was recorded at 30 DAT under the treatment A_1B_1 (Azotobacter @750ml/ ha + Boron @ 10 Kg/ ha), while maximum leaf width (14.45 cm) at 45 DAT was recorded under the treatment A_2B_2 (Azotobacter @1000ml/ ha + Boron @ 15 Kg/ ha). Minimum days recorded for curd initiation (77.80 days), maximum curd diameter (17.58 cm), maximum curd weight/ plant (1039g) and maximum curds yield (428.00 q/ha) were recorded under the treatment A_2B_2 (Azotobacter @1000ml/ ha + Boron @ 15 Kg/ ha).

EFFECT OF POTASH MANAGEMENT THROUGH GLIRICIDIA GREEN LEAF MANURING ON SOIL FERTILITY AND NUTRIENT BALANCE IN VERTISOLS OF MAHARASHTRA**V. H. Jadhao and V.V. Gabhane**

AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola - 444104, Maharashtra, India

A field experiment was conducted to assess the effect of potash management through gliricidia green leaf manuring on soil fertility and nutrient balance during Kharif 2016 at Research field of AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The soil of the experimental site was Vertisol which was moderately alkaline in reaction, low in available nitrogen, medium in available phosphorus and high in available potassium. The six treatments replicated four times in randomized block design comprised of control, 100% RDF (30:75:30 NPK kg ha⁻¹), 75% and 50% N and 100% P through chemical fertilizers and the combinations of 15 and 30 kg K ha⁻¹ through gliricidia green leaf manure at 30 DAS and remaining recommended dose of potassium as basal dose through inorganic fertilizers. The results indicated that the significant improvement in soil fertility was recorded with application of 75% N +100% P+15 kg K through chemical fertilizers +15 kg K through gliricidia green leaf manuring and the data on nutrient balance indicated the higher gain of available phosphorus with application of 100 % RDF (30:75:30 NPK kg ha⁻¹), while higher gain of available nitrogen and potassium was observed with application of 75% N +100%P+15 kg K (inorganic)+15 kg K through gliricidia green leaf manuring, indicating the important role of gliricidia green manuring in nutrient dynamics. In view of the above, it can be stated that the use of gliricidia green leaf manuring at 30 DAS in conjunction with chemical fertilizers recorded improvement in soil fertility and higher nutrient balance. Hence, it is concluded that conjunctive application of 75% N +100% P+15 kg K through chemical fertilizers +15 kg K through gliricidia green leaf manuring at 30 DAS resulted in improvement in soil fertility and higher nutrient balance in Vertisols under rainfed conditions of Maharashtra.

Keywords: Gliricidia green leaf manure, nutrient balance, potash management, Vertisols.**PERFORMANCE OF WHEAT TO NITROGEN, ZINC AND IRON FERTILIZERS****Ola Z. EL-Badry and Gheith, E. M. S.**

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To evaluate the effect of nitrogen, zinc and iron as soil application on yield and yield component of wheat, the present study was conducted at agricultural and experimental research station at Giza, faculty of agriculture Cairo University, Egypt during 2014/2015 and 2015/2016 seasons. The experimental design was split-plot in randomized complete block design with three replications. Results showed that there was positive significant effect on plant height, number of spike/m², spike length; number of grain per spike, grain yield per unit area in both seasons and grain protein content in one season were achieved by application of N and the two micronutrients. Whoever, the highest significant in the above mentioned characters was obtained either by application the highest N levels (100kg N/fed.) in addition to mixture of Zn and Fe. The interaction between the studied factors had significant effect on plant height and grain yield in both seasons as well as on grain protein content in the second season, where the highest values of these parameters were recorded by application of 100kg N/fed., Zn and Fe as mixture.

Keywords: Wheat Yield, Nitrogen, Zinc and Iron**ANTITRANSPIRANTS FOR CONTROL OF ABIOTIC STRESS****Ashutosh Kumar, Anupam Adarsh, Durgesh Singh* and Randhir Kumar**

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Transpiration is the evaporation of water from the aerial parts of plants. Of all the water plant absorbs, over 95-99% is transpired to the air as water vapor. Aerial parts of whole young plant. Lenticels (lenticular transpiration) 0.1%. Cutin (cuticular transpiration) 3%~10% Stomatum (stomatal transpiration) ~ 90%. Any material applied to plants for the purpose of retarding transpiration. Useful for reducing transplantation shock of nursery plants (Horticultural plants) Applied to transpiring plant surfaces for reducing water loss from the plant. Types of antitranspirants: a) stomatal closing type b) film forming type c) reflectance type and d) growth retardant. Stomatal closing type anti-transpirants comprises fungicides like phenyl mercuric acetate (PMA) and herbicides like Atrazine in lower concentration serve as anti transpirants by inducing stomatal closing, these reduce the photosynthesis. PMA was found to decrease transpiration than photosynthesis. ABA induces closure of stomata. Film forming type are Plastic and waxy material which form a thin film on the leaf surface which results in reduction of transpiration rate and photosynthesis. For e.g.: Silicone oils, Ethyl alcohol, Polyvinyl chloride, Polyethylene and polypropylene. Reflectance type anti-transpirants are white materials which form a coating on the leaves and increase the leaf reflectance (albedo) for e.g. Kaoline @ 5% spray reduces transpiration loss, Diatomaceous earth (Celite) Hydrated lime, Calcium carbonate, Magnesium carbonate, Zinc sulphate. Growth retardant also comes under anti-transpirant as they reduce shoot growth and increase root growth. It enables plant to resist drought and induce stomatal closure. For e.g. Cycocoeol, useful for improving water status of the plant. Water loss due to transpiration can be reduced by use of radiation reflectants, stomata closing chemicals and plastic films. Spraying of 4 to 6% kaolin, 0.5-1.0% liquid paraffin, and 1.5% power oil, after occasional rains in low rainfall areas, considerably reduce plant water losses. Planting of shelterbelt and windbreaks can reduce evapo-transpiration by reducing the wind speed and stabilizing microclimate.

AGRICULTURE PROCESSING IN INDIA: SCOPE, OPPORTUNITY, FUTURE AND CONSTRAINT

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Indian agriculture is an approach of existence and it provisions about 60 per cent of population for their livelihood and contributes 17% of GDP in India. Engineering inputs are vivacious for modernization of agriculture, agro-processing and rural living. It is needed for development and optimal utilization of natural resources, appropriate mechanism of unit operations of agriculture for increasing production, productivity with reduced unit cost of production for greater profitability, economic competitiveness and sustainability. Mechanism also imparts capacity to the farmers to carry out farm operation with dignity, with ease and freedom from drudgery, making the farming agreeable vocation for educated youth as well. It helps the farmers to achieve timeliness and precisely mater and apply costly input for better efficacy and efficiency, achieving higher productivity with reduced application of inputs.

DEVELOPMENT OF BIOPESTICIDES: AN IMPORTANT ORGANIC INPUT FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS OF SIGNIFICANCE

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Three biopesticides based on *Trichoderma harzianum*, *Pochonia chlamydosporia*, *Bacillus subtilis* and *Pseudomonas fluorescens* were developed by involving a novel technology patented in USA and India. The biopesticides were developed into two steps. In first step, stock culture of biocontrol agents was developed on sawdust, soil and 5% molasses in the ratio of 15:5:1 (w/w) and in the second step, carrier for biocontrol was developed on flyash, soil and 5% molasses in the ratio of 5:3:1 (w/w). One (1) part of stock is mixed with twenty (20) parts of carrier for the development of biopesticides. Greatest CFU counts of the microorganisms were recorded at 25°C or room temperature during 2–12 weeks of 32 weeks long shelf life test. Seed treatment with the biopesticides @ 5 g/kg seeds carried 10^{3-6} CFU/g seed of chickpea and pigeonpea. The treatments with *T. harzianum* and *P. chlamydosporia* effectively controlled the wilt (*Fusarium oxysporum* f. sp. *ciceri*, *Fusarium udum*) and root knot (*Meloidogyne incognita*) on chickpea (*Cicer arietinum* L.) and pigeonpea (*Cajanus cajan* L.) and greatly reduced the soil population of the pathogens. The biocontrol agents established in the soil and their CFU increased significantly being greater in pathogen infested soils than non infested soil during 4 months period.

MOLECULAR CHARACTERIZATION OF *TRICHODERMA* SPECIES ISOLATED FROM TEMPERATE REGION OF INDIA AND THEIR ANTIFUNGAL ACTIVITY AGAINST *DEMATOPHORA NECATRIX* CAUSING ROOT ROT OF APPLE

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Sixteen isolates of *Trichoderma* species isolated from different vegetable fields were tested for chitinase activity. All sixteen isolates were amplified using primers of three genes, viz., *its* (its1-4), *rpb2* (RNA Polymerase B gene) and *tef* (eEF1a1) (Translation elongation factor-1a) with amplicon size of 650bp, 1.2kb, 900bp respectively and were characterized as *Trichoderma harzainum*. Out of sixteen isolates, eight isolates were found to have chitinase activity ranging from 1.13 to 3.38 units/ml and were identified as *Trichoderma harzainum*. All these eight isolates after optimized under different set of conditions showed highest colloidal chitin concentration at 1.5% and pH of 6. The chitinase production increased linearly from 15 to 30 °C and then decreased beyond this temperature, maximum was observed at 30 °C in almost all the isolates. Among the nitrogen sources, casein yielded the highest enzyme activity in all the isolates reaching as high as 5.56 u/ml. Presence of glucose, sucrose, galactose, maltose, arabinose and raffinose in the culture media in addition to colloidal chitin predominantly influenced chitinase activity with glucose inhibited chitinase production in six isolates. The effects of incubation period on chitinase activity clearly indicated that there was progressed increase in chitinase production up to six days and then fall except in two isolates. Similarly presence of Mg^{+} and Ca^{2+} and



Na⁺ metal ions caused increased chitinase activity and activity was markedly inhibited by Zn²⁺, Hg²⁺, Fe²⁺, Ag⁺ and K⁺. All the chitin producing *Trichoderma* isolates inhibited the growth of tested pathogens. *Trichoderma* isolates AT2, AT3, BT2 and BT3 caused maximum inhibition of *Dematophora necatrix*, at 25% culture free filtrate concentration.

EFFECT OF ZINC LEVELS ON GROWTH, YIELD AND QUALITY OF SPROUTING BROCCOLI (BRASSICA OLERACEA VAR. ITALICA L.)

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The field experiment was conducted at Horticulture Farm, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.) during *Rabi* season 2016-17. The experiment consisting four levels of each zinc (0, 10, 20 and 30 kg/ha). The total treatment combinations were tested in randomized block design with three replications. The growth parameters show that the increasing levels of zinc upto 30 kg/ha being at par to 20 kg/ha significantly increased the plant height (55.16 cm), number of leaves (16.90) per plant, width of leaves (37.91cm) and total chlorophyll content (2.58 mg/g) in leaves as compared to preceding levels. The fresh weight of curd (420.07g), curd diameter (12.72 cm), yield (4.34 kg / plot) and yield (215.05 q/ ha) increased significantly upto application of 30 kg/ha but at par with 20 kg/ha. The quality parameters showed that the T.S.S. (12.72⁰Brix), vitamin C (87.31 mg/100 g), total sugar (3.44%), reducing sugar (2.66%) and non- reducing sugar (0.75%) were found significantly higher with application of 30 kg/ha zinc being at par with 20 kg/ha zinc.

Keywords: Broccoli, Growth, yield, Quality, Chlorophyll and Zinc.

AGRICULTURE PROCESSING IN INDIA: SCOPE, OPPORTUNITY, FUTURE AND CONSTRAINT

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Indian agriculture is an approach of existence and it provisions about 60 per cent of population for their livelihood and contributes 17% of GDP in India. Engineering inputs are vivacious for modernization of agriculture, agro-processing and rural living. It is needed for development and optimal utilization of natural resources, appropriate mechanism of unit operations of agriculture for increasing production, productivity with reduced unit cost of production for greater profitability, economic competitiveness and sustainability. Mechanism also imparts capacity to the farmers to carry out farm operation with dignity, with ease and freedom from drudgery, making the farming agreeable vocation for educated youth as well. It helps the farmers to achieve timeliness and precisely mater and apply costly input for better efficacy and efficiency, achieving higher productivity with reduced application of inputs.

EFFECT OF NPK DOSES AND CUTTING MANAGEMENT ON GREENS AND SEED YIELD OF CORIANDER (CORIANDRUM SATIVUM L.)

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Coriander (*Coriandrum sativum* L.) is a most important spice crop and considered as seed spice categories. It is grown for green leaves and seed. It is treated as dual purpose of seed spice crop because it yielded green leaves and seed. Coriander is a low volume crop and high price in terms of yield. It is used in various Indian and continental dishes as flavouring agent and add the taste. Green leaves are used to making green chutney, garnishing and seasoning of various dishes. Keeping the above dual utility of crop an investigation entitled "Effect of NPK doses and cutting management on greens and seed yield of Coriander (*Coriandrum sativum* L.)" was carried out at Horticulture Research Centre of SVPUAT, Meerut during 2016-17 in Randomized Block Design (RBD) with three replications to study the Effect of NPK doses and cutting management on greens and seed yield of coriander. Total nine treatment viz. **T₁**- NPK 60:40:30 + no cutting, **T₂**- NPK 60:40:30 + Ist cutting after 25 days, **T₃**- NPK 60:40:30 + IInd cutting after 25 days of Ist cutting, **T₄**- NPK 80:60:40 + no cutting, **T₅**-NPK 80:60:40 + Ist cutting after 25 days, **T₆**-NPK 80:60:40 + IInd cutting after 25 days of Ist cutting, **T₇**-NPK 100:80:50 + no cutting, **T₈**-NPK 100:80:50 + Ist cutting after 25 days, **T₉**-NPK 100:80:50 + IInd cutting after 25 days of Ist cutting were tried during investigation. Out of these the treatment like NPK 100:80:50 + no cutting was found superior in terms of higher yield as compared to other treatment NPK 60:40:30 + IInd cutting after 25 days of Ist cutting and other treatments. However, the highest greens yield was found in NPK 100:80:50 + IInd cutting after 25 days of Ist cutting as compared to NPK 60:40:30 + Ist cutting after 25 days. On the basis of above findings, it was suggested that treatment NPK 100:80:50 + no cutting may be recommended for better yield of Coriander especially for Western U.P. conditions.

EFFECT OF DIFFERENT POST HARVEST TREATMENT AND WRAPPING MATERIALS ON VARIOUS PHYSICAL CHARACTERS OF MANGO FRUIT CV. DASHEHARI

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Mango (*Mangifera indica* L.) belongs to family Anacardiaceae and known as King of Fruit. It has a delicious fruit with mild fragrance and attractive colour. It is a good source of various essential health nutrients like vitamin A, B and C, protein, fat, carbohydrates, calcium,



phosphorous, iron etc. It is a highly perishable fruit and reported huge post-harvest losses in mango. The estimated loss of fresh fruit is to be 5-25% in developed countries and 20-50% in developing countries. The above percentage of losses is due to the improper handling of produce after post-harvest practices. Keeping the above facts that a laboratory experiment was conducted in two consecutive years to minimize the post-harvest losses. Total 22 different treatments including control were tried with the combinations of ethrel, bavistin, pedicellate fruit covered with brown, tissue paper and butter paper. The above experiment was laid out in Complete Randomized Design with tree replications. The experimental results showed that the treatment ethrel 1000 ppm + brown paper was found most significant in terms of fruit skin colour (yellow), pulp colour (yellowish red to dark red), pulp quality (soft and very soft pulp), skin shriveling (minimum), flavour/aroma (excellent), organoleptic taste (highest rating 5.00) and marketability (98.64 %) upto 8th day of storage as compared to control and other treatments. It was observed that the above physical traits were slightly declined with advancement of storage period upto 12th day of storage in all respective treatments.

ASSESSMENT OF MULTIPLE TOLERANCE INDICES FOR SALINITY STRESS IN CHICKPEA (*CICER ARIETINUM* L.)

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Soil salinity is one of the major abiotic factors reducing plant growth and development worldwide and affects about 7% of world's total land area. In India, about 6.73 million hectare of land area is salt affected. India has first ranked in the world, contributing 68% of the global chickpea production. Multiple tolerance indices comprising of stress stability index (SSI), tolerance index (TOL), yield index (YI) mean productivity (MP), geometric mean productivity (GMP), stress tolerance index (STI), and yield stability index (YSI) were calculated in this investigation for salinity and its ability to understand which one or more predictor among studied indices based on correlation, principal component analysis (PCs) and cluster analysis. Fifteen chickpea genotypes were evaluated in two successive growing seasons (2013-2015), with the complete randomized design with three replications under both salinity stress (40 mM and 60 mM) and non-salinity to identify salt tolerant genotypes at vegetative (30 DAS) and reproductive phase to the target environment. Several indices for salt tolerance were calculated based on the potential yield (Yp) under non-stress and yield (Ys) under stress conditions. The Ys and Yp showed highest significant and positive correlations with GMP, MP and STI among indices studied. Therefore, these indices were considered as a better predictor of Ys and Yp than SSI, TOL and YSI. Principal component analysis classified the genotypes into two groups. The first and second PCs explained 91.35% of total variation in the control condition. While under salt stress at salinity level 1 (S1), the two major PCs is explained 84.59% of the total variation and at salinity level 2 (S2), the two major PCs is explained 88.85% of total variation. The cluster analysis sequestered fifteen genotypes into two clusters based on Ward's method. The result showed that the salinity significantly reduced the yield of some genotypes while some were found tolerant to stress indicating sufficient genetic variability for salinity tolerance among the studied genotypes. It could be implicated in selection of salinity tolerant chickpea genotypes for the development of chickpea varieties.

Keywords: Chickpea, salt stress, grain yield, principal component, and salt tolerance indices.

SCREENING TECHNIQUES FOR IDENTIFYING RHIZOBIA: CURRENT STATUS AND FUTURE STRATEGIES

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Rhizobia are gram negative bacteria capable to colonize the soil immediately surrounding roots under the influence the plant "rhizosphere". The study of this bacteria group is important because they are found in root nodules and well known for their capacity to establish a symbiosis with legumes. Distinct procedures for characterization of isolated pure cultures are colony morphology analysis, cellular morphology, biochemical properties including gram-staining, catalase test, methyl red test and citrate utilization and nitrate reduction pattern. Now these days, molecular methods are generally preferred over traditional method in various reputed research laboratories because these techniques provide comparatively faster results and are more accurate means of detecting and monitoring species. Molecular techniques include DNA extraction, isolation and gel-electrophoresis. The presence of nif and nod gene could be identified by using molecular techniques such as PCR, dot blot etc.

Keywords: rhizobia, rhizosphere, gel-electrophoresis, dot blot, PCR.

RECENT DEVELOPMENT IN AGRICULTURE SECTOR OF AGER COMMUNITY IN COSTAL KARNATAKA, INDIA.

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There has been wide consensus that the rural development should be inclusive and sustainable in order to alleviate the poverty. Focus area of the 12th Plan will be improving Viability of Small farms. Agriculture now accounts for only 14 per cent of Gross Domestic Product (GDP); it is still the main source of livelihood for the majority of the rural population. As such rapid growth of agriculture is critical for inclusiveness. Important structural changes are taking place within the sector and there are definite signs of improved performance. Dependence on Agriculture in rural areas farmers are shifting to non-agricultural work and tightening the labour market in agriculture and putting pressure on farm wages. An attempt is made on study of Ager community and their livelihood base on agriculture practice in Coastal Karnataka. The questionnaire method has been adopted to elicit the opinion of Ager communities about the recent development in Agriculture sector in Ankola Taluk of Uttar Kannada district of Karnataka. Among 100 families 92 responded representing 92 percent. The simple random sampling technique was used for selecting the sample users. After the selection of sample users the collected data is analyzed using statistical methods and necessary conclusions will be drawn. This paper deals with the Practice of Agriculture among Ager Community in Coastal Karnataka.

Keywords: Agriculture, Gross Domestic Product, Ager community, Ankola, Uttar Kannada.



INDIGENOUS AND TRADITIONAL USE OF MEDICINAL PLANTS BY LOCAL PEOPLE IN DHARWAD DIST, KARNATAKA, INDIA.**E. B. Sedamkar, S. R. Shirodkar* and Ashok Kumar A.****

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The indigenous and traditional knowledge of medicinal plants in rural areas plays an important role to treat common diseases. The local peoples believed in the herbal medicine as home remedies for primary health care due to better compatibility and lesser or no other side effects. The documentation and preservation of indigenous and traditional knowledge of medicinal plants from every corner of the country by senior most citizens and an ayurvedic practitioner has become an urgent need for the present scenario. In this regard we made survey of indigenous and traditional uses of some important herbaceous medicinal plants of Dharwad district, analyzed and confirmed with the local people knowledge to rural ayurvedic practitioners. Totally 40 medicinal plant species and its information were recorded. And on the base of this a paper has been prepared.

Keywords: Indigenous, Traditional, Medicinal plant, Herbal medicine, Dharwad, Karnataka,

SUR HONNE (*CALOPHYLLUM INOPHYLLUM*) OF KARNATAKA COAST, A POTENTIAL PLANT FOR BIODIESEL**Shirodkar S. R., Ashok Kumar A.* and E. B. Sedamkar****

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Biodiesel is a renewable fuel that can be extracted from biological sources. Due to diminishing petroleum reserves, vegetable oils have attracted attention as a potential renewable source for the production of alternatives to petroleum based fossil fuel. Many researchers have concluded that vegetable oils hold promises as alternative fuels for diesel engines. More than 84% of world's biodiesel is made from edible oil. By converting edible oils into biodiesel, food resources are actually being converted into automotive fuels. It is believed that large scale production of biodiesel from edible oils may bring global imbalance to food supply and demand. In Karnataka more than 26 spp are identified as most suitable for use in Biodiesel extraction. In the coastal Karnataka, *Calophyllum inophyllum* commonly called as Sur Honne grows very well on the sand dunes. The oil extracted from the *Calophyllum inophyllum* is non-edible and can be used for the production of biodiesel. The seed with its high oil content can be judiciously used as a potential alternative for renewable energy source. The quality of fatty acid methyl ester of oil was found most suitable for use as biodiesel. The diesel so produced can be blended with the fossil diesel and used in engines. The oil content helps lubrication of engine and the emission of CO₂ is at minimum and more environmentally sound. Protein content in Sur Honne seed is higher than other oil yielding plants like Pongamia and Jatropa. An average yield from these plants is up to 120 kg fruits and the oil yield from these fruits is about 25 kg and also same quantity of cake is produced as residue. The oil quality of the species is higher compared with other oil yielding plants like Jatropa and Pongamia and the findings reveal that the *Calophyllum* oil is better for conversion and use as biodiesel. This plant is a very good sand binder and grows well on the sand dunes. Thus, can serve as wind breaker and prevent erosion and protect the coastline from natural calamities like tsunami and provide a good ecotourism.

Keywords: Biodiesel, Vegetable oils, Non-edible oils, Fatty acid, Sand dune, Fossil fuels.

EFFECT OF POLLINATION METHOD ON FRUIT SET IN COMMERCIAL CULTIVARS OF LITCHI**Shweta Kumari, J.C. Chandola*, Ruby Rani and Hidayatullah Mir**

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An experiment was conducted to study the effect of pollination methods on fruit set at Horticulture garden, BAU, Sabour. The effect of self, open and cross-pollination was studied in the four cultivars of litchi i.e. Deshi, Purbi, Bedana and Kasba. Five panicles/replication were bagged at flowering stage for selfing. Some panicles were tagged and left opened for open-pollination and some panicles having female flowers were bagged for making cross-combinations. It was clearly seen that in Deshi cultivar when open-pollinated having 222 female flowers, total fruit set was 47; in Purbi 314 flowers were kept for open-pollinated and in case of cv. Bedana when the number of female flowers were 141, the number of fruit set was 09 whereas in case of Kasba when 218 female flowers were left for open-pollination, the total number of fruit set was recorded to be 10. When five panicles were left for self-pollinated in all the four cultivars, the number of initial fruit set was maximum in case of Purbi (09) followed by Deshi (08), the minimum was found in Kasba (02). Due to the short time availability of flowers and lack of synchronization with respect to stages of flowering in four cultivars under study the possible cross-combinations were made. The numbers of flowers crossed in Deshi x Bedana were 60 and the number of initial fruit set was 17. Similarly Purbi x Bedana, Purbi x Deshi and possible crosses were made and it was observed that when 12 flowers were crossed in the combination Kasba x Bedana, the fruit set was nil. Similar was the case with Kasba x Purbi.



WEEDY RICE: A THREAT FOR DIRECT SEEDED RICE**Neelam Bisen and C. P. Rahangdale***

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Rice (*Oryza sativa* L.) is a staple food for more than half of the world population and grown on approximately 153 M ha globally, of which 90% of area only in Asia. The current evidence shows declining factor productivity and rice production due to looming water crisis, escalating labour costs, deplete soil health and changing climatic conditions drive the search for alternative management methods to increase water productivity in rice cultivation. Direct seeded rice (DSR) has received much attention because of its low-input demand, easy and quick planted, mature 7-10 days earlier and has fewer methane emissions. Although these benefits, the weeds are major constraint in DSR. Among the weeds, weedy rice is the major threat and difficult to control weed causing huge loss to rice production. Weedy rice evaluated as acute problem in countries like Sri Lanka, Malaysia, Thailand, Vietnam and Korea, where transplanting is replaced by DSR and India is the next one which suffer by the weedy rice. Therefore ecological based management studies are needed to be developed in advance to counter this threat in DSR. Weedy rice is introgressed form of wild and of cultivated rice (*Oryza sativa* L.). It aggressively competes with rice crop and making its identification and control difficult because of its similarity with cultivated rice at early growth stage. The distinguish traits of weedy rice is rapid and early growth, taller canopy, high tillering capacity, spreading with long drooping leaves, tolerance to shade, asynchronous maturation, seed shattering, prorogated dormancy and logivity, red pericarp and grater nutrient responsiveness causes its rapid spread. Weedy rice causes loss in yield, high production cost; reduce milling quality and market value of the rice. To manage the weedy rice it needed to integrate weed management strategies to target at several phases of the life cycle of weed. By the understanding of the biology and ecology of weedy rice biotypes, and identification of weak point of weedy rice life cycle this target can be managed. Preventive measures such as clean seed, machines, cultural methods like stale seed bed, crop rotation, minimum or no tillage, water seeding, co-culture, mechanical weeder, chemical and biotechnological such as herbicide resistant cultivars can be adopted for the management of this threat.

Keywords: direct seeded rice, integrated weed management, traits, weedy rice

ECONOMICS OF DIFFERENT NITROGEN SOURCES (ORGANIC AND INORGANIC) IN KHARIF PEARMILLET**Shobha Kumari, Vikram Singh, Neha and Preeti Choudhary**

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Among the response of different source of nitrogen, treatment T_{10} (25% RDN through VC + 75 % N through Urea + Azotobactor) recorded maximum plant height (277.17cm), plant dry weight (105.30g), tillers plant⁻¹ (3.40), crop growth rate (2.74 g m⁻² day⁻¹), relative growth rate (0.04 g g⁻¹ day⁻¹), ear plant⁻¹ (3.57), length of ear (31.85), no. of grains ear⁻¹ (3433.33), test weight (8.39 g), grain yield (4.97 t ha⁻¹), straw yield (12.99 t ha⁻¹), protein content (13.03%) and harvest index (27.67%). Whereas the lowest value in terms of plant height (246.33cm), dry weight (98.83g), number of grains (2803.33 ear⁻¹) grain yield (2.51 t ha⁻¹) and stover yield (9.30 t ha⁻¹) was observed in the treatment T_3 i.e., (100% RDN through VC). Further, number of tillers (2.03 plant⁻¹), crop growth rate (2.29 g m⁻² day⁻¹) relative growth rate (0.03 g g⁻¹ day⁻¹), number of ear (2.33 plant⁻¹), length of ear (26.07cm), test weight (7.15g), protein content (9.15%), harvest index (21.06%) was recorded in the treatment T_1 (100 % RDN through Urea). The highest gross return (₹85620.00 ha⁻¹), net return (₹59522.00 ha⁻¹) and benefit cost ratio (2.28) were registered in treatment T_{10} (25% RDN through VC + 75 % N through Urea + Azotobactor). However, the lowest of value (₹49900.00 ha⁻¹), (₹5884.00 ha⁻¹) and (0.13) respectively in the treatment T_3 (100 % RDN through VC).

Keywords: Kharif hybrid pearlmillet, plant height, weight and yield

EFFECT OF VARYING NITROGEN LEVELS ON YIELD OF PEARL MILLET [*Pennisetum glaucum* (L.)] AND SOIL PROPERTIES**Neha, Gautam Ghosh and Preeti Choudhary**

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A field experiment was conducted during *Zaid* season, 2015 at Crop Research Farm, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (U.P.). Application of V_3 (Pioneer 86 M 32) + 100:45:45 kg ha⁻¹ NPK which give highest seed yield (3.72 t ha⁻¹), uptake of nitrogen (223.3 kg ha⁻¹), phosphorus (22.50 kg ha⁻¹), potash (347 kg ha⁻¹), Organic Carbon (0.46%) and benefit cost ratio (2.65) compared to V_1 (Pro Agro 9444) and V_2 (Ganga Kaveri 86 M 32) in *zaid* pearlmillet varieties.

Keywords: Yield, nutrient uptake, *zaid*, pearlmillet

STUDIES ON INTERACTION BETWEEN *MELOIDOGYNE INCOGNITA* AND *FUSARIUM OXYSPORUM* F.SP. *LYCOPERSICI* IN TOMATO**Naresh Kumar, Kamlesh Kumar Jat and Lalita Lakhran**

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The present study entitled “Studies on Interaction between *Meloidogyne incognita* and *Fusarium oxysporum* f.sp. *lycopersici* in Tomato was conducted in the Department of Plant Pathology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P) with major objectives to study the best The root knot nematode (*Meloidogyne incognita*) caused reduction in plant height, root length fresh and dry weights of shoot and



roots. Maximum root galls and egg masses were observed with the increasing levels of nematode inoculum. Highest level of nematode inoculum indicated inhibitory and damaging potential on plant growth parameters. One thousand nematode juveniles per 500 g of soil were found to be a damaging level of this nematode on Tomato. Significant reduction in plant growth parameters at all stages of plant growth was observed. Maximum numbers of galls were observed at seven days old seedling stage. The treatments receiving the nematode inoculation prior to fungus resulted in higher reduction and plant growth than the other treatments. When nematode inoculation was done seven days prior to fungal inoculation, it showed maximum synergistic effect followed by treatment where both the pathogens were inoculated simultaneously. Presence of nematodes not only predisposed the host but also shortened the incubation period for disease expression. *Paecilomyces lilacinus* significantly increased the growth of the tomato viz., plant height, root length, fresh and dry weight of shoot and roots with significant decreases in the number of galls and final nematode population. *Bacillus subtilis* was also noted to be superior and took second rank in improving the plant growth and reduced nematode population.

Keywords: Interaction, Tomato, *Paecilomyces lilacinus*, *Bacillus subtilis*, *Meloidogyne incognita* and *Fusarium oxysporum*

THREAT AND CHALLENGE OF *SCLEROTINIA SCLEROTIUM* IN THE VEGETABLE CROPS

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Sclerotinia sclerotiorum (Lib) de Bary is a soil borne plant pathogen, capable of infecting more than 500 host plants world wide. It is a major pathogen that plays a crucial role in reducing the yield in economically important crops. It causes stem & crown rot, wilt leaf & petiole rot, blossom blight, fruit rot and damping off diseases in crops. The initial mycelial infection at the base of the stem is an appearance of elongated water soaked lesions that expand rapidly. Ascospore infection is quite general and occurs on the other plant parts. Effective pathogenesis by the *S. sclerotiorum* requires the secretion of oxalic acid and lytic enzymes. Germination of overwintered sclerotia, and release, survival and germination of ascospores are important factors for the development of disease. The capability of sclerotia to survive for more than 5 years, so it becomes very difficult to manage the *Sclerotinia* diseases. Management of *S. sclerotiorum* is a major challenge, and the best being the integration of various measures like, cultural practices, chemical, biological and resistance varieties. The review summarizes current information on morphology, symptomatology, disease cycle and management of the disease. In addition, current research and management strategies to combat *S. sclerotiorum* are also discussed.

Keywords: *Sclerotinia sclerotiorum*, Vegetable crops, Infection, Threat and Challenge

EFFECT OF NUTRIENT MANAGEMENT ON PRODUCTIVITY AND ECONOMICS OF SOYBEAN

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A field experiment was conducted during *kharif* season of 2015 on silty clay loam soil at MPKV, Rahuri (MS), to study the varying nutrient management levels on productivity and economics of different soybean varieties. The experiment was laid out in factorial randomized block design with 15 combinations of three varieties (KDS-344, JS-9305 and KS-103) and five nutrient management levels (GRDF, 75% GRDF + 0.5% foliar spray of grade IInd at 30 and 45 DAS, 100% GRDF + 0.5% foliar spray of grade IInd at 30 and 45 DAS, N₄: 125% GRDF + 0.5% foliar spray of grade IInd at 30 and 45 DAS and 50:75:30 N, P₂O₅, K₂O kg ha⁻¹ + 5 tons FYM ha⁻¹). The variety KDS-344 and application of nutrient management dose 125% GRDF + 0.5 Grade IInd foliar spray at 30 and 45 DAS recorded significantly the highest growth and yield attributes viz., plant height (cm), number of branches, number of root nodules, number of pod plant⁻¹ and weight of seeds plant⁻¹ (g). The variety KDS-344 recorded highest grain and stover (3.66 and 4.64 t/ha) yield and highest economic indices like cost of cultivation (₹ 40,623), net monetary returns (₹ 87,355) and net returns per rupee invested (3.17). The grain yield (4.34 t/ha) and stover yield (4.53 t/ha) of soybean was significantly higher by application of fertilizer dose of 125% GRDF + 0.5% Grade IInd foliar spray at 30 and 45 DAS than rest of treatments, but it was also at par with 75% GRDF + 0.5 Grade IInd foliar spray at 30 and 45 DAS and 100% GRDF + 0.5% Grade IInd foliar spray at 30 and 45 DAS. Similarly, variety KDS-344 and application of nutrient levels of 75% GRDF + 0.5% Grade IInd foliar spray at 30 and 45 DAS recorded the highest net returns (₹ 82,756) and net returns per rupee invested (3.24) in soybean due to reduction in cost of cultivation (₹ 36,931) and nutrient losses.

Keywords: Varieties, Nutrient management, Grain yield and Economics

EFFECT OF BIO-REGULATORS ON GROWTH, FLOWERING AND FLOWER YIELD OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.) CV. PUSA NARANGI GAINDA

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Total ten treatments viz, T₁ (Control), T₂ (GA₃ 100 ppm), T₃ (GA₃ 200 ppm), T₄ (GA₃ 300 ppm), T₅ (MH 200 ppm), T₆ (MH 300 ppm), T₇ (MH 400 ppm), T₈ (Ethrel 200 ppm), T₉ (Ethrel 300 ppm), T₁₀ (Ethrel 400 ppm) were tried in RBD (Randomized Block Design) and replicated thrice. All the observations on growth, flowering, flower yield and its attributing parameters were recorded during the proceeding of crop. Out of these GA₃ 300 ppm was found superior in terms of opening of first flower, maximum plant height, spread of plant, duration of flowering, length of flower stalk, number of flower per plant, weight of flower, diameter of flower, flower yield per plant and yield per hectare except early bud initiation with GA₃ 200 ppm. However; ethrel 400 ppm resulted in maximum number of branches and benefit cost ratio. Hence, on the basis of result obtained from the present investigation it can be concluded that foliar application of GA₃ 300 ppm one month after transplanting



was found most effective with respect to vegetative growth, flowering behavior, and maximum flower yield of African marigold and can be recommended to farmers for commercial cultivation of African marigold cv. Pusa Narangi Gaiinda.

MOLECULAR ANALYSIS OF PHOSPHINE RESISTANCE IN POPULATIONS OF LESSER GRAIN BORER *RHYZOPERTHA DOMINICA* (FABRICIUS) FROM UTTAR PRADESH, INDIA REGION

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Rhyzopertha dominica (F.) is a destructive insect pest of stored grains mainly wheat, corn, rice and millet. The adults are 0.1 inch long, brown to black beetles with cylindrical bodies and numerous small pits on the wing covers. The head is directed downward and covered by the prothorax. The creamy white larva is a c-shaped grub with a small dark head that is partly retracted into the thorax. Both larvae and adults of the pest attack whole, sound grain and cause extensive damage. Larvae are internal feeders producing lots of flour, and are immobile when mature. Adults are long lived, free and bore into the commodity and can fly. Fumigation is the main strategy to manage this insect pest of stored grain. There are several insecticides available in the market but Methyl bromide and phosphine achieved great success in the management of stored grain insect pest. Fumigation with methyl bromide has phased out for causing ozone depletion. So phosphine is the only option to control this insect pest. These pests have been controlled successfully by fumigation with phosphine for the last several decades, but strong resistance to phosphine in many countries has raised concern about the long term usefulness of this control method. In order to understand the evolution of phosphine resistance and to isolate the responsible genes the insects were collected from Bareilly, Allahabad and Jhansi, Uttar Pradesh, India from Food Corporation of India and Central warehousing corporation godowns. The resistance in field populations to phosphine was detected by exposing the insects to a discriminating dose phosphine fumigant under controlled conditions. Genotyping of phosphine resistance levels in *R. dominica* populations was done by using the marker for phosphine resistance gene, *rph2*. We explored the utility of cleaved amplified polymorphic sequence (CAPS) Markers, prevalence of strong resistance to phosphine was detected in all the tested populations and the molecular diagnostics using CAPS markers have confirmed the prevalence of high percentage of R alleles in the resistant population.

Keywords: CAPS marker, Phosphine, *rph2*, Resistance genes, *Rhyzopertha dominica*

FLOWERING, FRUITING AND PHYSIO-CHEMICAL CHARACTERISTICS OF BAEL (*AEGLE MARMELOS* CORREA.) GROWN IN NORTHERN DISTRICTS OF WEST BENGAL

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A study was conducted during the fruiting season of bael, an important minor fruit of West Bengal on religious aspects. This was done to determine the flowering, fruiting and physio-chemical properties of the fruits and to evaluate the best accession collected from different locations. The fruits were harvested from distinct locations on North Bengal and were brought to the lab where they were analysed for their bio-chemical properties. The result showed that all the different accessions have different and distinct characters. By going through all the results, clearly it can be concluded that the bael trees growing wild in North Bengal or in homestead shows wide variations and diversities. Abundance of flowering and fruiting was profuse in ACC-1, ACC-6, ACC-15, ACC-17, and ACC-25. Earliest fruiting was observed in ACC-11 (17th March) and ACC-20 (17th March). Fewer seeds were observed in ACC-3 (14.33), ACC-9 (13.67), ACC-14 (18.33) and ACC-15 (15.67) which is considered desirable for fresh consumption. Thinnest rind was observed in ACC-11 (2.14 mm) followed by ACC-25. Maximum TSS (in °B) was observed in ACC-25 (16.33 °B). Titratable acidity was recorded maximum in ACC-3 (0.67%) followed by ACC-11 (0.62%). Total sugar was recorded maximum in ACC-11 (11.14%) followed by ACC-25 (10.85%). Maximum reducing sugar was observed in ACC-11 (4.47%) followed by ACC-8 (4.33%), ACC-17 (4.23%) and ACC-25 (4.32%) also showed a high value of reducing sugar content as compared to other accessions. Hence, it could be concluded that ACC-11 (Alipurduar) is the most superior accessions followed by ACC-25 (Hilli).

Keywords: Accessions, bio-chemical, jalpai, distinct characters, physio-chemical.

EFFECTS OF ALOEVERTA EDIBLE COATING ON QUALITY AND POSTHARVEST PHYSIOLOGY OF BER (*ZIZYPHUS MAURITIANA* LAMK.) UNDER AMBIENT STORAGE CONDITIONS

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The study was conducted to check the efficacy of aloe vera gel as an edible coating so as to enhance shelf life of ber. The treatment combinations were T₁ = control, T₂ = corn starch (1%) and T₃ = Aloe vera gel (2%). The physio-chemical properties, hardness and decay percentage of the fruits were observed upto 15th day of storage. The study revealed that the coating of aloe vera gel was effective in retaining quality of Ber fruit over a storage period of at least 15 days. Aloe vera gel coated fruits showed minimum physiological loss in weight, minimum shrinkage percentage, maximum colour retention, lesser loss in acid content as compared to uncoated ones. It was also found that aloe vera gel subsequently helped in reducing the ripening rate of fruits which was found from the slower rate of total and reducing sugar development. Aloe vera coating was very effective in reducing ascorbic acid loss and also helped to reduce the decay percentage. Both the starch and aloe vera gel edible coating was found good enough to ensure hardness/firmness of the fruits during storage.

Keywords: shrinkage, colour retention, hardness, aloe vera



PHYSIO-CHEMICAL PROPERTIES OF JALPAI (*ELAEOCARPUS FLORIBUNDUS* BLUME.) GROWN IN NORTHERN PARTS OF WEST BENGAL**Arghya Mani**

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A study was conducted during the fruiting season of Jalpai a minor fruit of West Bengal, so as to determine the physio-chemical properties of the fruits and evaluate the best accession. The fruits were harvested from distinct locations on North Bengal and were brought to the lab where they were analysed for their bio-chemical properties. The result showed that all the different accessions have different and distinct characters. ACC-11 is having a very highest value of TSS (7.07). ACC-25 is also having a high TSS value of 6.9⁰B. ACC-24 have high fruit weight of 20.83 which is high as compared to other accessions. ACC-30 also showed a highest value of total sugar (7.50) and high reducing sugar content (2.35). ACC-20 not only has a high TSS value but also higher amount of total sugar content (6.85). Similar trend was observed in ACC-29 where a high TSS (18.7), high reducing sugar (2.17) and total sugar content (5.77) were recorded. It can be established that the ACC-11, ACC-20 and ACC-29 are plants that yields superior quality of Jalpai whereas ACC-30 produces fruit with high sugar and acid content.

Keywords: Accessions, bio-chemical, jalpai, distinct characters, physio-chemical.

PHYSIO-CHEMICAL PROPERTIES OF PUMMELO [*CITRUS GRANDIS* (L.) OSBECK] GROWN UNDER NORTHERN PARTS OF WEST BENGAL**Arghya Mani**

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A study was conducted to identify the elite pummelo genotypes among its natural population from different locations of North Bengal. The fruits from 22 different accessions were collected in ripe condition and their physio-chemical characteristics were assayed. The study showed that a wide variability exists among different fruit samples collected from distinct locations. The result shows that the fruit skin colour shows variation from greenish-yellow to orange, most of the fruits are round shaped whereas some fruits are oval as well. The placental tissues shows colour variability from whitish to pink and even reddish as well. The taste of the juice are classified as sour in some occasions to sweet in many occasions and very sweet in few occasion. Accession-17 showed the maximum average weight of fruit whereas the minimum fruit weight was observed in accession-16. The length and breadth of the fruit was found maximum in accession 17 and 20 and minimum in accession 14 and 11 respectively. The peel-pulp ratio was maximum in accession 13 and minimum in accession 3. Juice content was found maximum in accession 4 and minimum in accession 3. The TSS was found maximum in accession 15 and minimum in accession 13.

Keywords: Variability, accession, pummelo, physio-chemical

INFLUENCES OF WEED MANAGEMENT ON QUALITY PARAMETERS IN SUMMER GROUNDNUT (*ARACHIS HYPOGAEA* L.)**Mahendra Choudhary, Sheeshpal Choudhary*, Chouthu Ram Hakla** and Shiv Prasad Daroga**

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A field experiment entitled "Influences of weed management on quality parameters in summer groundnut (*Arachis hypogaea* L.)." was carried out under medium black clayey soil during summer 2015 at the Instructional Farm, Department of Agronomy, College of Agriculture JAU, Junagadh. The experiment comprising 10 treatments viz., Weedy check (T_1), Hand weeding twice at 20 and 45 DAS (T_2), Weed free (T_3), Pendimethalin @ 0.9 kg ha⁻¹ as pre-emergence (T_4), Oxyfluorfen @ 0.24 kg ha⁻¹ as pre-emergence (T_5), Imazethapyr @ 0.07 kg ha⁻¹ as post-emergence at 20 DAS (T_6), Premix Sodium Acifluorfen + Clodinofof Propriaryl @ 0.25 kg ha⁻¹ as post-emergence at 20 DAS (T_7), Premix Imazethapyr + Imazamox @ 0.100 kg ha⁻¹ as post-emergence at 20 DAS (T_8), Quizalofop-*p*-ethyl @ 0.04 kg ha⁻¹ as post-emergence at 20 DAS + 1 hand weeding at 45 DAS (T_9) and Oxyfluorfen @ 0.24 kg ha⁻¹ as pre-emergence followed by Imazethapyr @ 0.07 kg ha⁻¹ as post-emergence at 20 DAS + 1 hand weeding at 45 DAS (T_{10}) was laid out in randomized block design with three replications. The results revealed that significantly higher values of quality parameters viz., protein content, oil content and oil yield were recorded under weed free treatment. HW twice at 20 and 45 DAS (T_2), quizalofop-*p*-ethyl @ 0.04 kg ha⁻¹ as post-emergence at 20 DAS + 1 HW at 45 DAS (T_9) and oxyfluorfen @ 0.24 kg ha⁻¹ as pre-emergence fb imazethapyr @ 0.07 kg ha⁻¹ as post-emergence at 20 DAS + 1 HW at 45 DAS (T_{10}) were found equally effective in recording higher values of quality parameters than rest of the treatments.

Keywords: Weed, Herbicide, Summer groundnut, Quality and Yield,

ROLE OF DIFFERENT FACTOR IN DISTRIBUTION OF TOP BORER (*SCIRPOPHAGA NOVELLA*)**Anil Kumar**

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Prolific multiplication of top borer, *S. excerptalis* is observed to occur in Punjab at an average maximum temperature ranging 34-38.5 °C with 62 -100 per cent mean relative humidity and it also observed that the top borer incidence is directly correlated with rise in relative humidity and inversely with the increase in maximum temperature. Relative humidity above 60 percent during the period of appearance of third brood favours high incidence of the pest. In Uttar Pradesh, the climatic condition during the monsoon months, with average maximum temperature from 32.2-35 °C and mean relative humidity from 75-85 percent are conducive for its multiplication but maximum temperature coupled with low relative humidity is detrimental to its multiplication. Temperature between 32.2-35°C and 80-90 percent relative humidity have been found



favourable for the successful incubation of eggs, survival of first instar larvae and longevity of moths. Low humidity condition adversely affect the fecundity of female moths.

ESTIMATION OF HETEROSIS AND INBREEDING DEPRESSION FOR YIELD AND ITS CONTRIBUTING CHARACTERS IN WHEAT (*TRITICUM AECTIVUM* L.)

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Estimation of heterosis over economic parents and inbreeding depression by half diallel analysis was conducted at Section of Rabi Cereals, Nawabganj CSAUA&T in a set of 10 parents received from Directorate of Research by making 45 cross combinations evaluated during winter in 2011-12 and 2012-13 in Randomized Block Design with three replications. The data on thirteen characters viz. days to 75% flowering, plant height, number of reproductive tillers per plant, number of spikelets per spike, spike length, grains per spike, ear density, days to maturity, 1000-seed weight, seed hardness, duration of reproductive phase, protein content and yield per plant were utilized for the present study. On the basis heterosis over better parent for grain yield per plant ranged from -0.15 to 14.33 per cent. Significant and positive heterosis for K0402/NW2036 (14.33), K9533/NW2036, K0424/K0607 (9.99), NW2036/HD2888, K0424/K0402 (9.81) and K0402/K0607 were most considerable for thirteen characters and inbreeding depression for yield contributing characters the grain yield per plant ranged from -4.10 to 6.71 per cent. Nine combinations were not shown increase or decrease values viz., K9533/K0424, PBW343/K8027, K0402/K0607, K0402/HD2888, NW2036/K0607, NW2036/K8027, NW2036/K9423, K0607/HD2888, K0607/K8027 and HD2888/K8027. There were a little difference observed in decrease and increase values in combinations but it was not significantly observed in all combinations.

Keywords: Heterosis, Inbreeding depression, Half diallel analysis, Yield

HYDROPONICS IN FRUIT CROPS

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Hydroponics is a science of growing plants exclusive of soil, using mineral nutrient solution or in an inert medium such as perlite, gravel or mineral wool. The word “hydroponics” comes from two words, ‘*hydros*’ meaning water and ‘*ponics*’ meaning labour. The term hydroponics was given by Dr. William F. Gericke in 1937. Hydroponics is an established branch of agriculture and has certain advantage over conventional methods. No soil born pest and diseases, no weeds, healthier plants, fast growing, higher and early yield, off season production is possible, lack of herbicides and pesticides uses, less fertilizer, water etc., superior taste, quality, appearance, uniformity and extended shelf life are some of the advantages of hydroponic fruits. However, it require higher initial capital, high degree of management skills, slow early crop development, early stress after emergence and poor early vigour. Hydroponics is mainly classified into three types: liquid, solid media and aeroponics. The nutrient solutions used for media contain all important macro and micronutrients: N, P, K, S, Ca, Na, Mg, Fe (usually as chelate), Mn, Zn, B, Cu and Mo. Other hydroponic systems contain solid materials in combination with a nutrient solution. Common solid materials used in hydroponics are rock-wool, perlite, vermiculite, gravel, pumice, expanded clay pebbles, and mixtures of these. Sand and organic materials such as coconut fibre are also used in hydroponics. Major fruit crops that exploiting the hydroponic techniques are strawberry, blueberry, grapevines, papaya, banana and pineapple. Right choice of fertilizers, the timing of nutrient solution preparation and the substrate could influence nutrient availability for the plants. Hydroponics offer opportunities to provide optimal conditions for plant growth and therefore, higher yields can be obtained compared to open field conditions.

MAJOR INSECT PESTS OF STORAGE PULSES AND THEIR MANAGEMENT

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Role of pulses in Indian Agriculture need hardly any emphasis, grain legumes, particularly pulses play an important role to cater the quantitative and qualitative protein requirement of a large parts of humanity. A large number of pulses like chickpea, greengram, blackgram, pigeonpea, pea, cowpea and moth etc. belong to family Leguminosae. Different pulses are major sources of proteins, particularly in the essential amino acid, lysine, which is rather deficient in the cereals. The first advance estimates of production of pulses during 2016-17 is 8.7 million tonnes in India. In Rajasthan, the total area of pulses was 33.62 lac hectare, production was 19.52 lac M.T and productivity was 580 kg/ha. during 2014-15. According to FAO, at least 10% harvested food crops are destroyed by pests in storage. In case of serious infestation cent-percent damage can be caused by several species of pulse beetle belonging to the genus *Callosobruchus* to the stored pulses. Pulse beetle, *C. chinensis* (Bruchidae: Coleoptera) play an important role in storage losses. Damage is caused by the grubs which feed up on the entire content of the grain leaving only the shell behind. The attack of these beetles often starts in the field from where the infestation is carried over to the storage. The management approaches in stored pulses classified as preventive and curative. Curative approaches are non- chemical approaches or eco-friendly approaches and chemical approaches. The non- chemical approaches as controlled atmosphere storage, use of physical barriers, plant part powders, edible oils, non-edible oils and biological measures etc. The chemical approaches as grains treatments by chemicals and fumigants etc.



EFFECTIVE MANAGEMENT PRACTICES FOR IMPROVING SOIL ORGANIC MATTER FOR INCREASING CROP PRODUCTIVITY OF INDIA**Mamta, Manish Kumar*, Abha Kumari*, Asheesh Chaurasiya**

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Soil organic matter (SOM), affects several soil properties which are important for maintaining the productivity of soils on a sustainable basis. It has been considered as a life-line to the soil, which significantly affects water-holding capacity, cation exchange capacity (CEC), aggregate stability, buffering capacity, salinization and solidification, acidification, etc. Degrading soil health because of decrease in soil organic carbon (SOC) and resultant decline in overall soil fertility in India is the major threat to sustenance of crop and fodder productivity. In view of the importance of soil organic matter (SOM), and its close and direct relationship with soil health and crop production, its role in carbon sequestration and nutrient cycling has gained much attention in the last few years. Restoration of SOM contents in the soil to optimal levels will not only improve the soil health, but significantly contribute towards boosting crop production. Management practices for improving SOC and crop productivity: integrated nutrient management (INM), addition of organic amendments, crop and weed residues, cover crops, crop production system/cropping system, no or minimized tillage in the crop production system, incorporation of green manuring crops, mulch-cum-manuring with tree leaf, biofertilizers, tank silt application. If these practices are followed systematically, the organic matter status of the soils can be enhanced on a long-term basis and overall soil functions (soil health) can be significantly improved.

SCREENING OF SOYBEAN GENOTYPES AGAINST STEM FLY, MELANAGROMYZA SOJAE (ZEHTNER)**J. Upadhyay, A. K. Saxena AND S. B. Das**

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The soybean (*Glycine max* (L.) family Leguminaceae, sub-family Papilionaceae) is major oilseed crop of Madhya Pradesh. Soybean seed contains 18-20 per cent oil, 40 per cent protein, 30 per cent carbohydrates, 4 per cent saponins and 5 per cent fiber. For crop improvement field screening of genotypes to be evaluated it is raised in field under natural infestation. To study the screening of Nine soybean genotypes (JS-20-94, JS-20-102, JS-20-103, JS-20-108, JS-20-111, JS-20-112, JS-20-114, JS-20-116, JS-20-122, with one check variety JS 20-29) were screened for resistance to stem fly (*Melanagromyza sojae*), a trial was sown at the Experimental Field Department of Plant Breeding & Genetics J.N.K.V.V. Jabalpur (M.P.) during Kharif season 2014-15. The per cent plant infestation in different genotypes varied from 0 to 40% at 30 DAS and 60 to 100 % at maturity. It is interesting to note that JS 20-108, was superior recording less plant infestation initially at 30 days and at maturity also (0 and 60% respectively). Whereas, at 30 DAS JS-20-122 (40%) and at maturity JS-20-29 (check) (100%) was found to be inferior in this respect recording higher plant infestation. Among genotypes, JS 20-122 recorded the least per cent stem tunneling (4.67%) which was significantly superior than all other genotypes and check, but at par with JS 20-116 (8.65%), JS 20-108 (9.22%), JS 20-112 (9.37%) and JS 20-102 (9.72%). The maximum per cent tunneling (20.82%) was observed in genotype JS 20-111. On the basis of incidence of stem fly, genotype JS 20-108 was found to be less susceptible and check variety JS 20-29 was highly susceptible.

Keywords: soybean, stem fly, genotype, plant infestation, stem tunneling etc.**INTEGRATED EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON GROWTH, YIELD AND YIELD ATTRIBUTES OF RADISH CV. KALYANPUR SAFED****Umesh Kumar Verma, Rajeev Kumar, Sanjeev Kumar and Anil Kumar**

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A field experiment was conducted in the Department of Horticulture, Janta College Bakewar, Etawah (C.S.J.M. University, Kanpur) during 2013-14, to evaluate the integrated effect of various levels of **organic manures and inorganic fertilizers on growth, yield and yield attributes of Radish cv. Kalyanpur Safed**. 10 treatments were taken up along with control. Plant height, number of leaves, length and width of leaves, leaf area at various growth stages increased with increasing levels of organic manures and inorganic fertilizers as compared to control. Length of root, diameter of root, weight of root and leaf, total weight plant⁻¹, yield plot⁻¹, yield q ha⁻¹ were also increasing with increasing levels of organic manure and inorganic fertilizers.

Keywords: Radish, Organic Manures, NPK, Growth, Yield.**EFFECT OF VARIOUS LEVELS OF NITROGEN ON GROWTH, YIELD AND QUALITY OF FODDER MAIZE****Rajeev Kumar*, Sanjeev Kumar, Anil Kumar, B. B. Singh, Ravendra Singh* and Pradeep Kumar*****Janta Mahavidyalaya Ajeetmal, Auraiya (U.P.) India 206121**

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A field experiment was conducted in the Department of Agricultural Botany, Janta Mahavidyalaya Ajeetmal, Auraiya (C.S.J.M. University, Kanpur) during 2014, to evaluate the effect of various levels of nitrogen on growth, yield and quality of fodder maize. 3 treatments were taken up (viz., T₁ 75, T₂ 100 and T₃ 125 kg nitrogen ha⁻¹ along with control (T₀). Plant height, dry matter accumulations (t ha⁻¹), forage yield (t ha⁻¹) increased with



ith increasing levels of nitrogen, while stem diameters (cm), leaf area (cm²), fresh weight (g), crude protein percent decreased with increasing levels of nitrogen.

Keywords: Maize, Nitrogen, Dry matter, Crude protein

ANTIOXIDANT POTENTIAL OF *MOMORDICA CHARANTIA* FRUIT IN FOUR DIFFERENT *IN- VITRO* ASSAYS.

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Bitter gourd fruit has known to be a richer source of antioxidant compound than some common vegetables. It exhibited better radical scavenging effect and metal chelating ability than vitamin E. This study was aimed to verify the antioxidant potential of bitter gourd using different in-vitro assays. We investigated the antioxidant potential of the water extract of fruit fractions of 12 diverse bitter gourd genotypes by four different *in vitro* assay, namely DPPH radical-scavenging activity, metal chelating activity and total antioxidant capacity by ferric reducing/antioxidant power (FRAP) assay and Total antioxidant CUPRAC assay. Total antioxidant activity was found highest in green coloured genotype Green star bold by CUPRAC assay while total antioxidant activity by FRAP assay was found maximum in green genotype Green star bold what ever the solvent for extraction. Free radical scavenging activity was found maximum in L-214, while L-314 has maximum metal chelating activity. The antioxidant capacity found in bitter gourd might be due to the presence of acidic compounds, flavonoids, phenols, saponins, tannins (phenolic compounds). Genotype Green star bold was found best in antioxidant activity in both CUPRAC and FRAP assay, so Green star bold can be use as best genotype as source of antioxidant genotype. In conclusion, bitter gourd extracts possess potent antioxidant and free radical scavenging activities. The antioxidative effect of *M. charantia* evidenced that it could be a very good source of natural medicines on standard formulation. These antioxidant activities could have contributed, at least partly, to the therapeutic benefits of the certain traditional claims of bitter gourd. Since it has greatest ability in suppressing free radicals, therefore suggested that it can serve as a potent antioxidant tool in food as well as nutraceutical product development.

Keywords: Antioxidant, Bitter gourd, Ferric Reducing, Metal chelating, radical scavenging.

EFFECT OF FERTILITY LEVELS AND BORON ON GROWTH, YIELD AND QUALITY OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS* L.)

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A field experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Jaipur) during *Rabi* season 2016-17. The experiment consisting five levels of fertility (control, 100% RDF through inorganic fertilizers, 75% RDF through inorganic fertilizer + 25% through vermicompost, 50% RDF through inorganic fertilizer + 50% through vermicompost and 25% RDF through inorganic fertilizer + 75% through vermicompost) and four levels of boron (0, 1.5, 2.0 and 2.5 kg boron/ha) tested alone and in combination. The total 20 treatment combination were evaluated in RBD with three replications. The maximum plant height at 30 and 60 DAT, number of leaves per plant at 30 and 60 DAT and leaf area were recorded with application of 75% RDF through inorganic fertilizers and 25% RDF through Vermicompost while average weight of curd volume, curd yield per plant and per ha (190.89 q/ha), NPK & B content of curd, B:C ratio (3.90:1) and net returns (Rs. 380340/ha) were found highest with application of 50% RDF through inorganic fertilizers and 50% RDF through vermicompost treatment. Similarly, the boron level with 2.5 kg per ha significantly increased the plant height at 30 and 60 DAT, number of leaves at 30 and 60 DAT, leaf area at 30 and 60 DAT, average weight of curd. Curd yield per plant and per ha (185.53 q/ha), NPK & B content and curd, net return (Rs. 370879/ha) and B:C (3.97:1) as compared to control and 1.5 kg boron per ha but statistically at par with 2.0 kg boron per ha. Application of 50 per cent RDF through inorganic fertilizer and 50 per cent through vermicompost along with 2.0 kg boron as soil application per ha found superior in terms of average weight of curd (445.97 g), total yield per plot (5.35 kg/plot) and per ha (220.22 q/ha) and net return (Rs. 449866/ha) compare to other treatment.

Keyword: Cauliflower, RDF, Boron, Growth, Yield, Quality

SCREENING OF LACCASE PRODUCING LIGNOCELLULOLYTIC MICROBES FOR RICE STRAW BIODELIGNIFICATION

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Indira Gandhi Krishivishwavidyalay Raipur C.G.492012

This chapter focused on Isolation of Lignocellulolytic Bacteria from the soil samples collected from different geographical locations of Chhatisgarh and Maharashtra states of India and their screening, molecular identification and phylogenetic analysis of laccase production. Paddy straw mushroom *Volvariella volvacea* was also studied for its ability to produce Laccase as Fungi is well recognised for its ability to produce many extracellular polyphenoloxidase. There are many reports stating Phenolic part of the lignin is oxidized by Laccases. The findings of the present study showed that the Bacterial and Paddy straw mushroom isolates possesses ability to produce laccase. Highest laccase activity among bacteria was found maximum for the isolate SH2A which showed 94% identity with *Stenotrophomonas* sp. after 16s rRNA sequencing whereas For *Volvariella* isolates VV06 and VV05 showed maximum laccase activity at pH4 and 50°C respectively. The laccase enzyme was characterized for its optimal pH and Temperature. The pH optima for the highest laccase activity was found to be 4-5 for both bacterial as well as for *Volvariella* isolates. Whereas the optimal temperature was found to be 45°C -50 °C, for Bacterial isolates and for *Volvariella* isolates activity was



found maximum at 55°C. The isolates were tested for their ability to decompose rice straw. Decomposition was achieved by the 25th day under laboratory condition and at field condition it took 30-35 days.

ENGINEERING INTERVENTIONS FOR REDUCING POSTHARVEST LOSSES IN FOOD GRAINS IN BIHAR

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Food grains production during 2015-16, estimated at 253.16 million tonnes, has been higher by 1.14 million tonnes over the production of 252.02 million tonnes during 2014-15. Bihar incurs a total production of 5.38 Lakh tonnes of total pulses (including kharif and Rabi season during year 2014-15) and has total pulses area of 6.12 lakh hectare. Postharvest loss reduction activities have a major economic impact and should increasingly become a major focus in development strategies: carefully selected interventions leading to reductions in PHL are likely to be much more cost-effective than investments in additional production. Grain production has been steadily increasing due to advancement in production technology, but improper postharvest handling results in high losses in food grains. Post-harvest losses in India amount to 12 to 16 million metric tons of food grains each year, an amount that the World Bank estimates could feed one-third of India's poor or the entire population of the states of the Bihar and Haryana together for about one year (Nagpal and Kumar, 2012). The monetary value of these losses amounts to more than Rs 50,000 crores per year. During processing and storage, quantitative as well as qualitative losses occur due to improper handling. A large number of insect pests have been reported to be associated with stored grains. Almost all species have remarkably high rates of multiplication and, within one season, may destroy 10-15% of the grain and contaminate the rest with undesirable odors and flavors. In recent study of ongoing project it has been observed that major losses occurred during post harvest operations at the producer's level. For the prevention of losses due to drying, storage and milling, a STR dryer has been fabricated for cereal and pulses crops which can remove the moisture up to 2-4 % in 6 to 8 hours of operation and for storage, a super grain bag is low cost ultra hermetic bag is available for smallholder farmers. This bag is tested for farm conditions and can be relied upon to safely preserve dried agricultural commodities such as maize, wheat, rice paddy and lentil. It's made from multilayer recyclable polyethylene plastic (PE) with a proprietary barrier layer with sufficiently low permeability to prevent the exchange of air and the absorption of moisture. It is designed to be used multiple times. As per milling is concerned which also play a vital role in postharvest losses. A mini dal mill and rubber roller sheller for paddy may be intervened to achieve the target. The type and material of the rolls and grinders varies for different type of grains and depends upon various process parameters such as inherent moisture in the paddy and pulses, their size and other factors.

Keywords: hermetic, postharvest, productivity, milling, storage, drying

MANAGEMENT AND ECONOMICAL ANALYSIS OF SHOOT AND FRUIT BORER IN BRINJAL (*SOLANUM MELONGENA* LINN) FOR KOSHI REGION IN BIHAR

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Betelvine Research Centre, Islampur**

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Among the insect pests attacking to brinjal, the most serious pest is shoot and fruit borer (*Leucinodes orbonalis*) because of its high reproductive potential, rapid turnover of generations. A field experiment was carried out to manage and analysis of shoot and fruit borer damage in brinjal (*Solanum melongena* Linn.) with four treatment (Dimethoate 30 EC @2 ml/lit water, Triazophos+Deltamethrin@2 ml/lit, Emamectin benzoate 50 SG @ 0.4g/lit, spinosad 45 SC @ 0.5 ml/litre) in koshi region in Bihar during 2015-16 and 2016-17. Results revealed that among all treatments the minimum shoot damage (16.74%, 16.65%) and Fruit damage (21.01%, 21.12%), maximum healthy fruit yield (302.50, 255.75 q/h) with highest cost benefit ratio (3.0,4.05) were recorded during the crop season 2015-16 and 2016-17, respectively among treated plots with spinosad 45 SC @ 0.5 ml/litre.

Keywords: *Leucinodes orbonalis*, Spinosad, cost benefit ratio and shoot damage

EFFECT OF MICRONUTRIENTS ON GROWTH, YIELD AND QUALITY OF TOMATO (*SOLANUM ESCULENTUM* MILL.) CV. NAVODYA

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The investigation entitled "Effect of Micronutrients on Growth, Yield and Quality of Tomato (*Solanum esculentum* Mill.) cv. Navodya." was conducted during at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur. The experiment was laid out in Randomized Block Design with three replications and 10 treatments. Observations were recorded for different characteristics related to vegetative, yield and yield attributing and qualitative traits. Treatment T₁₀ B @ 50ppm+ Fe @ 100 ppm+ Zn @ 100 ppm was best in regards vegetative traits viz. plant height (cm), number of branch per plant and days taken to early flowering and fruiting. Yield and yield attributing characteristics like fruit weight (g), cluster per plant, number of fruits per cluster, fruit diameter (cm), fruit per plant, yield per plant (kg) and yield per plot (4 m²kg⁻¹) were found to be significantly influenced by effect micronutrients. The treatment T₁₀ was found to be significantly superior in respect of yield and yield attributing traits having maximum values of 1.64 and 24.71 kg for yield per plant and per plot (2x2 m), respectively. The qualitative traits like leaf and fruit nutrient analysis, TSS (5.87°brix), ascorbic acid (32.05 mg100g⁻¹), total sugar (4.10 %) and



reducing sugar (3.04%) were found to be significantly influenced by T₁₀ over control. As far as economics is concerned maximum gross return Rs. 419987.14 /ha, net return Rs. 353387 /ha and B:C ratio (5.31) were obtained in T₁₀.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE YIELD PARAMETERS OF BOTTLE GOURD [*LAGENARIA SICERARIA* (MOL.) STANDL.]

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The investigation on effect of integrated nutrient management on the yield parameters of bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] was carried out at the Horticultural Research farm, Department of Horticulture, Chaudhary Charan Singh University Campus, Meerut (U.P) during spring season of 2015. The experimental field was laid out in randomized block design (RBD) with three replications. The experiment comprised of eight treatments consisting of different organic and inorganic fertilizers i.e. T₁ Control (no fertilizers), T₂ RDF (80N:60P:50K kg/ha), T₃ (FYM @ 20 tonnes/ha), T₄ (RDF 60% + FYM @ 10 tonnes/ha), T₅ (Neem Cake 2 q/ha), T₆ (RDF 60% + Neem Cake @ 1 q/ha), T₇ (Vermicompost @ 6 tonnes/ha) and T₈ (RDF 60% + Vermicompost @ 3 tonnes/ha). All variables parameters regarding yield attributes were significantly influenced by different combinations of integrated nutrient management. Result indicated that combined application of inorganic and organic fertilizers i.e. RDF 60% + Vermicompost @ 3 tonnes/ha gave the significantly highest response. Maximum fruit diameter (10.19 cm), fruit length (40.92 cm), number of fruits per vine (16.63), average fruit weight (813.94 g), and fruit yield (246.10 q/ha) were recorded with the soil application of RDF 60% + Vermicompost @ 3 tonnes/ha followed by RDF 60% + FYM @ 10 tonnes/ha.

IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND QUALITY ATTRIBUTES OF TOMATO (*Lycopersicon esculentum* Mill.) CV. PUSA ROHINI

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Integrated nutrient management is a promising method and practice of increasing yield with quality produce and sustaining soil and environmental health. Keeping this view in the mind, a field experiment was carried out to determine the effect of NPK, vermicompost and PSB on growth, yield and quality of tomato during 2016. The judicious combinations of inorganic, organic and bio-fertilizers was significantly influenced the growth, yield and quality of tomato over control during the course of experiment. The maximum plant height (81.66 cm), number of leaves per plant (62.12), number of branches (6.47), stem diameter (1.62 cm), number of fruit per plant (18.67), fruit diameter (5.89 cm), fruit weight (51.02 g) and yield (476.27 q/ha) were recorded with the soil application of NPK 50% + Vermicompost @ 5.0 t/ha + PSB @ 5.0 kg/ha followed by NPK 75% + Vermicompost @ 2.5 t/ha + PSB @ 2.5 kg/ha. Similarly, a combination of inorganic, organic and bio-fertilizers i.e. NPK 50% + Vermicompost @ 5.0 t/ha + PSB @ 5.0 kg/ha had pronounced effect on TSS and Ascorbic acid content in tomato.

EFFECT OF ENRICHED MATERIAL (TATA GEO GREEN) & FYM ALONG WITH GRADED LEVEL OF CHEMICAL FERTILIZER ON THE QUALITY AND YIELD OF POTATO (*SOLANUM TUBEROSUM* L.)

Neeraj Kumar Tiwari, Neeraj Kumar and Atik Ahamad

Department of Soil Science N D U A T Kumargang Faizabad

The present investigation entitled on “Effect of Integrated nutrient management on nutrient, uptake, soil properties and tuber yield of potato (*Solanum tuberosum* L.)” was conducted during *rabi* season of 2012-13 Agronomy Research Farm Narendra Deva University of Agriculture & Technology (Narendra Nagar), Kumarganj Faizabad (U.P.) The experiment was conducted in Randomized Block Design with three replications and seventeen treatments. The treatments consisted of three levels of Tata Geo Green 150, 60 and 100 kg ha⁻¹ at the time of planting and same amount of TGG after three months of planting) in combination with three level of RDF (100, 75 and 50 % RDF). Data presented in table showed that maximum tuber yield (301.60q/ha) was recorded with treatment T2 receiving Tata Geo Green (Enriched) @ 3.75 t ha⁻¹ soil application + Recommended dose of chemical fertilizer which is significantly superior to over all the treatments except treatment T1, T3, T5 and T6. Various levels of TGG (Enriched) showed significant improvement in yield as well as nutrients availability as compared to 100% recommended dose of chemical fertilizers supplied through inorganic fertilizers alone. Improvements in tuber yield and nutrients status were relatively more under the treatments having TGG (Enriched) as compared to FYM. Application of various levels of TGG along with 75 and 50% RDF increased the tuber yield from 10.14% to 12.95% and 0.7% to 0.90% respectively over FYM with 25 and 50 % reduction of RDF respectively. Higher uptake of major nutrients viz., nitrogen, phosphorus and potassium was significantly higher with the application of Tata Geo Green (Enriched) @ 3.75 t ha⁻¹ as soil application + 100% recommended dose of chemical fertilizer in potato. Soil properties like, pH, EC and Zn were non significant over all the treatments while nutrients availability in soil (OC, OM, Available N, P₂O₅, K₂O, S, Fe, Exchangeable Ca, Mg, biological properties of soil such as bacteria, actinomycetes and fungi was significantly higher with the application of Tata Geo Green (Enriched) @ 5 t ha⁻¹ as soil application + 100% recommended dose of chemical fertilizer). However, the buildup was more in fertilizer + TGG followed by fertilizer + FYM. The minimum buildup was observed in RDF alone over control.



EFFECT OF BAP AND NAA ON IN VITRO PLANT REGENERATION OF BANANA (*MUSA PARADISIACA* L.) VARIETY GRAND NAINA**Shardulya Shukla, Jagraj Singh, Pushkar Dixit and Babloo Patel**

Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut(U.P), 250110

The study was conducted to assess the effect of BAP and NAA on in vitro plant regeneration of banana cultivars. Shoot tip of the variety Grand Naine was used as explants for establishment of culture. Different concentrations of BAP (2.0, 3.0, 4.0, 5.0 and 6.0 mg/L) were used in MS medium to study their effects on shoot formation. Explants of all the varieties produced both single and multiple shoots but rate of shoot regeneration varied among different cultivars and BAP concentrations. The highest shoot regeneration was found in Grand Naine at 5.0 mg/L of BAP. The banana variety Grand Naine produced the highest shoot. Shoot proliferation rate of Grand Naine was 3.50 (per explant) respectively was obtained after 30 days of culture. MS medium supplemented with different concentrations of NAA (0.5, 1.0, 2.0, 4.0 and 6.0 mg/L) were used for in vitro root formation from proliferated shoots. The cultivars Grand Naine showed the best root forming performance in all concentrations of NAA. Best results of root formation were observed on MS medium supplemented with 4.0 mg/L NAA. The plant regenerated in vitro from shoot tip explants of banana cultivars Grand Naine showed the superior performance.

ESTIMATION OF STABILITY PARAMETERS FOR SEED YIELD AND ITS COMPONENTS IN TRITICALE AND WHEAT GENOTYPES UNDER OPTIMUM AND STRESS ENVIRONMENTS**A. G. Singh and A. K. Sharma**

Department of Plant Breeding and Genetics, College of Agriculture, S.K. Rajasthan Agricultural University, Bikaner.

Thirty genotypes comprising of wheat (*T. aestivum* and *T. durum*) and hexaploid triticale was studied in Randomized Block Design with three replications, under normal, saline and stress during 2016-17 to assess the stability of these genotypes for yield and its contributing traits. Analysis of variance of stability revealed highly significant variance due to environment for all traits which indicated differential effect of different environments. The variance for genotypic effect was highly significant indicating thereby differential response of all the genotypes. The genotypes like T-4037, T-4045, T-4047, T-4049, T-4050 and six *aestivum* genotypes namely RAJ-3765, RAJ-4079, RAJ-4083, WH-1105, RAJ-3077 and RAJ – 3777 gave average response for seed yield to change in environmental conditions as indicated by their unit regression and non-significant deviations suggesting average stability and wider adaptability of these genotypes.

Keywords: wheat, triticale, environments, stability, adaptability**MANAGEMENT OF MUSTARD APHID *LIPAPHIS ERYSIMI* (KALT.) WITH NSKE AND CHEMICAL FORMULATIONS IN COMBINATION WITH THIMET 10 G IN MUSTARD.****Nazrussalam, Ekhlake Ahmad and D. N. Singh**

Zonal Research Station, Chianki, Palamau-822102, Jharkhand(Birsa Agricultural University, Ranchi, Jharkhand, India)

A field experiment was conducted during 2013-14, 2014-15 and 2015-16 on “Management of Mustard aphid *Lipaphis erysimi* (Kalt.) with NSKE and chemical formulations in combination with Thimet 10 G in mustard”. in Randomized Block Design with three replications and nine treatments. The variety was selected shivani and plot size was 4.0 x 3.0 sq. m. with a fertilizer dose of 80:40:20 Kg. NPK ha⁻¹. The data on aphid population was recorded at 1 day before and 3, 7 and 10 days after foliar spray. All the treatments were found significantly superior over control. The treatment Thimet 10G + NSKE @ 10.00 kg ha⁻¹ + 5.00 % (2 sprays) observed the best treatment with a highest CBR (1:4.73) which gave comparatively higher percent (69.26 %) reduction over control after spray and produced (6.92 q ha⁻¹) seed yield followed by Thimet 10G + NSKE @ 10.00 kg ha⁻¹ + 6.00 % (2 sprays), which gave a CBR of (1:3.99) and (67.62 %) reduction over control and seed yield (6.56 q ha⁻¹), whereas the treatment Thimet 10G + Dimethoate 30 EC @ 10.00 kg ha⁻¹ + 0.03 % gave the highest seed yield (7.16 q ha⁻¹) with a highest percent (93.30%) reduction over control but showed comparatively lower CBR (1:3.73). Although the treatment Thimet 10G @ 10.00 kg ha⁻¹ only gave the lowest CBR (1:2.51) and also showed lowest percent (49.70 %) reduction over control and produced (4.63 q ha⁻¹) seed yield. However the control plot produced the lowest seed yield (3.44 q ha⁻¹) due to highest aphid infestation. This is recommended for control of mustard aphid in Sub Zone V of Jharkhand.

INFLUENCE OF DIFFERENT ORGANIC ADDITIVES (PULSES FLOUR) ON MYCELIUM GROWTH (SPAWN) OF OYSTER MUSHROOM (*PLEUROTUS DJAMOR*)**Satpal Singh, Gopal Singh and Shoraj Singh***

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Spawn is an essential component of mushroom production. The present investigation was conducted with the aim to determine the effect of different organic additive pulses flour (Black gram, Pigeon pea and Lentil) on mycelium growth (spawn) of Oyster mushroom (*Pleurotus djamor*). In the present Study three different pulses flour viz. Black gram, Pigeon pea and Lentil were mixed as a supplement with wheat grain for spawn production. The results obtained during the present investigation, in the spawn production maximum mycelial growth (100.00 mm) was found in 2% pigeon pea flour on 20th days and the mycelium was thick then other pulse flour and minimum growth (72.33 mm) was found in Control (no organic additive) on 20th days. Based on the results obtained, for spawn production of Oyster mushroom (*Pleurotus djamor*) by organic supplementation, Pigeon pea would be recommended most effective organic supplement in Wheat grains.

Keywords: *Pleurotus djamor*, Spawn, Pulses Flour, Black gram, Pigeon pea and Lentil.

SCREENING OF BER CULTIVARS / GERMPLASM AGAINST *OIDIUM ERYSIPOIDES* F. SP. *ZIZIPHI*, CAUSING POWDERY MILDEW**Meera Choudhary, R.P. Ghasolia, Lalita Lakhran and Tejpal Bajaya**

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Powdery mildew incited by *Oidium erysipoides* f. sp. *ziziphi*, Yan and Wang is the most important disease that causes maximum reduction in yield and quality of ber (*Ziziphus mauritiana* Lamk.) fruits grown under semi-arid and arid regions of India. Developing a varietal resistance to disease provides an early, cheaper, stable and effective means of disease control. In the present investigation, 21 cultivars / germplasm were tested for resistant against *Oidium erysipoides* f. sp. *ziziphi*. Out of these, two cultivars / germplasm namely Darakhi-2, Nazuk showed 2.60 and 4.67 per cent disease intensity, respectively and categorized as resistant whereas Faliso Alwari, Jogia, Kaithali, Katha, Kishmis, Mehroon, Mundia, Safarchandi, Tabestaso and ZG-3 showed moderately susceptible reaction and Chhuhara, Chhuhara-1, Chonchal, Gola, Illaichi, Kathaphal, Seb, Thornless and Umran showed susceptible reaction.

Keywords: Ber, *Ziziphus mauritiana*, powdery mildew, *Oidium erysipoides* f. sp. *ziziphi*, cultivars/germplasm**CORRELATION AND PATH ANALYSIS FOR SEED YIELD ITS CONTRIBUTING TRAITS AND OIL CONTENT IN AJWAIN (*TRACHYSPERMUM AMMI* L.)****Monika Meena, N. S. Dodiya, Baudh Bharti, Rajani Verma, Bharat Lal Meena**

Department of Plant Breeding and Genetics, Maharana Pratap University of Agriculture and Technology, Udaipur-313001

Twenty five elite genotypes of ajwain along with three checks namely, Gujarat Ajwain-1, Pratap Ajwain-1 and Local check were evaluated under four different environments to understand the contribution of various characters to the yield. The genotypic correlation coefficients were higher than corresponding phenotypic ones for most of the character combinations. Biological yield and test weight had positive and significant association with seed yield. The biological yield showed maximum positive direct effect followed by number of primary branches, plant height, number of umbels per umbel and oil content. Biological yield and test weight were the most important characters contributing to seed yield and can be strategically used in the selection process for seed yield improvement in ajwain under late shown condition.

Keywords: Correlation, path, seed yield, oil content, ajwain.**IMPACT OF POTASSIUM HUMATE AND BIO-INOCULANTS ON COWPEA PRODUCTIVITY, SOIL MICROBES AND SOIL HEALTH****Pradip Tripura**

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Soil microorganisms are the most abundant biota in soil, responsible for a number of abilities such as nutrient cycling and organic matter decomposition, maintenance of soil fertility and restoration and plant health and sustainability in ecosystem functioning. Beneficial microbial inoculants such as actinomycetes, diazotrophic bacteria, mycorrhizal fungi, rhizobia etc. are known to promote plant growth. Many of the beneficial microbes are naturally present in soil, although in certain cases, it may be advised to increase their populations and activity either through direct inoculation or by applying agricultural management techniques. In cognizance with the above, an experiment was conducted to evaluate the effect of microbial inoculants on overall productivity of cowpea and soil health. Result revealed that the application of The three levels of potassium humate (control, 5 and 10 mg kg⁻¹) and five Bio-inoculants (no inoculation, *Rhizobium* + VAM, *Rhizobium* + PSB, VAM+PSB and *Rhizobium* + VAM + PSB) as seed treatment increased the productivity of cowpea at various stage of plant growth parameters like plant dry weight, no. of branches, pods, root length as compared to control. Total microbial population numbers (bacteria, fungi, actinomycetes), available N, P and K in soil were also increased significantly after the soil was treated with this potassium humate indicating the role of beneficial microbial in improving the plant nutrient status and soil health.

Keywords: Cowpea, Potassium humate, Bio-inoculants, plant nutrient status, microbial population**WILT DISEASE (*FUSARIUM OXYSPORUM* F. SPP. *CICER*) INFECTING CHICKPEA (*CICER ARIETINUM*)****Shahnashi Hashmi, Mehjabin Hashmi and Harpal Singh**

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Sardar Vallabhbhai Patel University of Ag. & T., Meerut

Chickpea is an ancient crop and originated from western Asia. It is one of the oldest pulses known and cultivated in Asia and Europe. Chick pea is a third most important pulse crop in the world after dry bean and dry peas. Chick pea has been grown in India sub continent for many millennia. Chick pea are the most important pulses traded in the international market. Chickpea belong to genus *cicer* family fabaceae. *Fusarium oxysporum* f. spp. *cicer* is causing vascular wilt in chickpea. The fungus is a facultative parasite and its mycelium is restricted to the vascular tissues of the host plant. Wilt is a common disease of chick pea that causes browning and blackening of xylem. Affected seedling first show drooping of the leaves then collapse. The roots look healthy but when split vertically the vascular tissues show brown to black discoloration. The fungus is seed and soil borne and can survive in the soil in the absence of host. For the disease management use resistant varieties like JG 11, JAKI 9218, JG130, KAK 2, JGK 2 and JGK 2. Deep ploughing during summer and removal of host debris from the field



can reduce the level of inoculums exclude chickpea from the crop rotation in infested fields for at least 3 years. Seed treatment with *Trichoderma viride* @ 4gram/kg seed has been found effective in reducing incidence of wilt.

STUDIES ON THE EFFECT OF CYTOKININ AND AUXIN ON CALLUS FORMATION AND SHOOT MULTIPLICATION OF STRAWBERRY (*FRAGARIA X ANANASSADUCH*) UNDER *IN VITRO* CONDITION

Sumit Tomar, Jagraj Singh, Shardulya Shukla, Govind Rajbhar, Manoj Kumar and Yogesh Prasad Rajbhar
Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut – 250110 (U.P.)

The present study was conducted in Tissue Culture Laboratory of Department of Horticulture in Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut -250 110 during 2015-16 on micro propagation for the shoot multiplication of strawberry plants. For a period of four weeks significantly maximum callus formation in mature leaf explant (81%) was noted under the treatment of BAP 2mg⁻¹ combined with IBA 1.0mg⁻¹ followed by BAP 1mg⁻¹ combined with IBA 1.0mg⁻¹, BAP 2mg⁻¹ with IBA 1.5mg⁻¹, Kinetin 1.5 mg⁻¹ with IBA 0.5mg⁻¹ and Kinetin 1.5 mg⁻¹ with IBA 1.0mg⁻¹. while the minimum (54.6%) was recorded under BAP 3mg⁻¹ with IBA 0.5mg⁻¹. Maximum callus induction in young leaf (74.0%) was noted under the treatment of BAP 2mg⁻¹ combined with IBA 1.0mg⁻¹ followed by BAP 1mg⁻¹ combined with IBA 1.0mg⁻¹, BAP 2mg⁻¹ with IBA 1.5mg⁻¹, BAP 2mg⁻¹ with IBA 0.5mg⁻¹ and Kinetin 1.5 mg⁻¹ with IBA 1.0mg⁻¹ while the minimum (48.3%) was recorded under BAP 3mg⁻¹ with IBA 0.5mg⁻¹. Maximum callus induction in internode (47.6%) was noted under the treatment of BAP 2mg⁻¹ combined with IBA 1.0mg⁻¹ followed by BAP 1mg⁻¹ combined with IBA 1.0mg⁻¹, Kinetin 1mg⁻¹ with IBA 0.5mg⁻¹, BAP 2mg⁻¹ with IBA 0.5mg⁻¹ and BAP 1.0 mg⁻¹ with IBA 1.5mg⁻¹. Maximum shoots (22.33) at six weeks after inoculation were noted under the treatment of BAP 3mg⁻¹ combined with Kinetin 2.0mg⁻¹ followed by BAP 3mg⁻¹ with Kinetin 1.5mg⁻¹, BAP 3.0mg⁻¹ combined with Kinetin 1.0mg⁻¹. The maximum root formation (94.66%) was noted under the treatment of IBA 2.0mg⁻¹; however it was statistically at par with IBA 1.5mg⁻¹ and IBA 2.5mg⁻¹ in full concentration of medium. The lowest (16.66%) was noted under control. The maximum number of roots/callus (20.00) was noted under the treatment of IBA 2.0mg⁻¹; however it was statistically at par with IBA 1.5mg⁻¹ in full concentration of medium. The minimum roots (7.33) was noted under control. The maximum average length of root (4.30cm) was noted under the treatment of IBA 2.0mg⁻¹ which was statistically superior among all in full concentration of medium. The minimum root length (1.96cm) was noted under control. It is concluded that BAP 2mg⁻¹ + IBA 1.5mg⁻¹ and Kinetin 1.5 mg⁻¹ + IBA 1.0mg⁻¹ showed better performance on accordance of callus formation in mature leaf, young leaf as well as internode. BAP 2 mg⁻¹ + Kinetin 2mg⁻¹ showed better performance on accordance of shoot induction in mature leaf, young leaf as well as internode. IBA 2mg⁻¹ was found to be the best for root initiation, number of roots/callus and length of root also.

CORRELATION AND PATH ANALYSIS IN GROUNDNUT (*ARACHIS HYPOGAEA L.*)

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Correlation and path co-efficient analysis were carried out for pod yield and its component characters in 24 genotypes of groundnut. The genotypic correlation coefficients were found to be of relatively higher magnitude than the corresponding phenotypic correlation coefficients, indicating strong inherent association between the characters. Pod yield per plant displayed significant positive association with kernel yield per plant, mature pods per plant and plant height. Path co-efficient analysis revealed high direct effects of kernel yield per plant, plant height and matured pods per plant on pod yield per plant. Hence, it would be rewarding to give due importance on the selection of these characters for rapid improvement in pod yield of groundnut.

Keywords: Groundnut, Correlation and path coefficient.

ENHANCEMENT OF YIELD COMPONENTS AND SEED QUALITY PARAMETERS BY GROWTH REGULATORS IN LENTIL (*LENS CULINARIS MEDIK.*)

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Lentil (*Lens Culinaris* Medik) is one of the most nutritious amongst cool season legumes, and belonging to family, *leguminosae* and sub-family- *papilionaceae*, genus- *Lens* and species- *culinaris* with chromosome number 2n = 14. It is of very ancient origin and its native home is regarded to be the countries in eastern Mediterranean littoral, such as Asia Minor, Greece and Egypt, from where it extended eastwards to India. The valleys in the Hindukush Mountains in India are also claimed as its native regions. It was later introduced in Europe, Africa and America. It is known by at least 30 common names in various parts of the world viz., Masoor, Mangu/ Margu, Masura, Renuka, Mangalaya etc. The present study was carried out in the Department of Genetics and Plant Breeding, N. D. University of Agriculture and Technology, Kumarganj Faizabad during *rabi* season 2015-16 and 2016-17 entitled "Enhancement of yield components and seed quality parameters by growth regulators in lentil (*Lens culinaris* Medik.)" The objective of the study was To standardize growth regulators optimization seed germination and vigour potential, with the selection of GA₃, Kinetin and NAA for exploitation of its, maximum grain yield in lentil under the agro-climatic conditions of. The 19 treatments of growth regulators and seed priming for lentil variety (NDL-1) was evaluated following 13 quantitative characters viz., Days to 50% flowering, Days to maturity, plant height on 30 and 60 days, number of branch on 30 and 60 days number of pods per plant, number of seeds per pod, 1000 seed weight biological yield/plant harvest index (%), seed yield per plant (g), seed germination, seedling length vigour index. The treatment T₃ (GA₃ 150 ppm (priming) was found best in, all the treatments. Maximum number of pods per plant (46.69) and seed yield/plant (2.68 g) was recorded with T₃ (GA₃ 150 ppm (seed priming). The experiments were conducted in factorial RBD design with three levels



of growth regulators (GA_3 (50,100,150ppm), Kinetin (50,100,150) and NAA (50,100,150ppm) and spray in lentil variety (NDL-1), result revealed that treatment T_3 (GA_3 150 ppm) significantly improved plant height at 30 and 60 days, number of branches/plant at 30 and 60 days, number of pods per plant, number of seeds per pod, biological yield, harvest index, 100- seed weight, seed yield, seed germination, seedling length, vigour index and seed yield per plant. Overall the treatment of T_3 (GA_3 150 ppm) with spray produced higher seed yield in first year and in second year.

CHARACTER ASSOCIATION OF YIELD COMPONENTS AND SEED QUALITY PARAMETERS IN CHICKPEA (*CICER ARIETINUM* L.)

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The field experiments under present investigation were conducted during *Rabi* 2014-15 and 2015-16 at Student Instructional Farm and lab experiments were carried out in Seed Testing Laboratory of Seed Technology Section, N. D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) with objective of character association of yield components and seed quality parameters in chickpea i.e. days to 50% flowering, Days to maturity, Plant height (cm) 30 and 60 DAS, No. of branches per plant 30 and 60 DAS, number of pod per plant, number of seed per pod, biological Yield (g), harvest index, 100-seed weight (g), seed yield kg/ha, germination (%), seedling length (cm), vigour index, seed yield per plant (g). The experiments were conducted in factorial RBD design with three levels of biofertilizer (*Rhizobium* 7.5g, 10g, 12.5g, *Trichoderma* 5g, 7.5g, 10g and PSB 7.5g, 10g, 12.5g) and seed priming (13, 16, 18 hrs) in chickpea variety (Pant G-186), Association studies revealed that During 2014-15 seed yield per plant showed highly significant and positive correlation with number of branches per plant on 30 days (0.801), number of branches per plant on 60 days (0.645) number of pods per plant (0.508) while significant and positive correlation with the number of seeds/pod (0.479), seed yield kg/ha (0.416), plant height on 30 days (0.402). Where positive correlation coefficient of this characters with rest attributes were noted non significant. During 2015-16 seed yield per plant showed highly significant and positive correlation with harvest index (0.866), biological yield (g) (0.717), plant height on 30 days (0.652), number of branches per plant on 60 days (0.641), vigour index (0.629), seedling length (0.595) plant height on 60 days (0.552) while significant positive correlation with seed yield kg/ha (0.587).

EFFECT OF FOLIAR SPRAY OF BIOREGULATORS ON THE VEGETATIVE GROWTH OF BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA*)

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Broccoli is an important crop of Europe and North America. In India, it was not much popular during the last decades but presently it's become a part of healthy diet menu. Broccoli in local parlance is known as the '*hari gobi*' belongs to family Brassicaceae. A field experiment was carried out during 2016 at Horticulture Research Farm, Department of Horticulture, Chaudhary Charan Singh University Campus, Meerut, to find out the impact of foliar application of bioregulators and micronutrients on the performance of broccoli cv. Pusa KTS-1. All variable parameters regarding vegetative growth was significantly influenced by different concentrations of bioregulators (GA_3 and NAA). Results revealed that the foliar application of GA_3 @ 120 ppm registered significantly higher plant height (33.49 cm), plant spread (73.88 cm), number of leaves per plant (21.11), leaf length (36.70 cm), leaf width (18.38 cm) and stem diameter (3.14 cm) over NAA treatments. It is also revealed from the statistical analysis of data that the higher concentration of bioregulators i.e. GA_3 @ 120 ppm and NAA @ 120 ppm, increased vegetative growth but this increment in growth was not statistically significant higher over lower concentration of i.e. GA_3 @ 60 ppm and NAA @ 60 ppm in case of broccoli.

EFFECT OF SALINITY STRESS ON CHLOROPHYLL CONTENT IN OKRA GERMPLASM

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The photosynthesis is an important physiological process which is significantly reduced under salt stress. Reduced photosynthesis under salinity is not only attributed to stomatal closure leading to a reduction of intercellular CO_2 assimilation, but also to non-stomatal factors like reduction in green pigments and leaf area. In the case of ladyfinger, chlorophyll a concentration was decrease due to the salt stress and the photosynthetic rate decrease. Chlorophyll b was not much effect but the carotenoids value was decreases, which ultimately reduce the photosynthetic rate in lady finger. An experiment was carried out during 2012 and 2013 at Biotechnology laboratory, Department of Biotechnology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut to find out the response of different concentration of salt stress on chlorophyll content in fifteen genotypes of okra. Among the physiological characters the chlorophyll a, chlorophyll b and total chlorophyll was measured. The 15 genotypes viz. Parbhani Kranti, K.S-442, K.S-770, K.S-305, VRO-3, F.B-10, EC-169367, EC-1081012I, SKY-107, K.S-404, K.S-167, K.S-326, K.S-311, EC-67103, K.S-446 were ranked on the basis of their values for the studied parameters under each salinity level. Over all the Parbhani Kranti shows the maximum chlorophyll content even after three treatments (25 mM, 50 mM and 100 mM) of salt. The physiological parameters (chlorophyll a, chlorophyll b and total chlorophyll) were found significantly decreased by the increasing salt stress. The results show an inverse relationship between salt concentration and chlorophyll a content. Maximum chlorophyll content (1.355mg/gfw) was noted at control (non



saline) while other salinity levels, 25, 50 and 75 mM showed 1.345, 1.334 and 1.324 mg/gfw, respectively. So it is clear that high salt stress (75 mM) exhibited the maximum drastic effects in terms of reduction in photosynthesis rate.

INCREASED IMPORTANCE OF INTEGRATED PEST MANAGEMENT

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Currently, there is renewed attention to Integrated Pest Management (IPM) in response to steadily increasing pesticide use that results in pest control crises due to development of resistant pests and outbreaks of secondary pests. Another important factor that contributed to the development of IPM was increasing evidence and awareness of the cost to human health and the environment of intensive use of pesticides. It should immediately be noted that the introduction of IPM does not necessarily involve sophisticated information gathering and decision-making on any level of the stakeholder hierarchy. As a problem-solving approach to pest control, IPM can be introduced at any level of agricultural development. For example, improvement of basic crop management practices, such as planting time and crop spacing, can often be effective in reducing pest attack. A useful beginning can be made with relatively limited specialized information or management input. Later, additional information, technologies, and mechanisms can be developed to enhance its effectiveness. IPM is a dynamic process that makes use of an ecological systems approach and encourages the user or producer to consider and use the full range of best pest control options available given economic, environment and social considerations.

BIOLOGY AND POPULATION DYNAMICS OF SORGHUM SHOOT FLY, *Atherigona soccata* RONDANI

Keerthi, M. C. and Somasekhar

Investigations on the seasonal incidence and population dynamics of sorghum shoot fly, *Atherigona soccata* Rondani was under taken at the MARS, UAS, Raichur during 2015-16. Studies on the seasonal incidence of shoot fly in terms of egg load and dead heart formation on sorghum revealed that, oviposition by shoot fly on 27th standard week was 0.25 eggs per plant, which reached a peak on 33rd and 35th standard week of 2015 (2.90 and 3.1 eggs/ plant, respectively). Similar trend was observed with respect to dead hearts. During 27th standard week it was 2.05 per cent and reached peak of 96.12 and 94.32 per cent on crops sown during 33rd and 35th standard week of 2015, respectively. Attempts to determine the relationship between egg load and dead heart with weather parameters of 1, 2, 3 and 4 weeks lead time (prior) of the observations revealed is both morning relative humidity and afternoon relative humidity exerted positive relationship with egg load and dead hearts in all correlated week. A total of 12,485 flies were caught with a mean of 240 flies per week. The peak shoot fly catch (1,025 flies per trap) was recorded during second standard week of August (33rd standard week) at Location 3, where sorghum was the major crop. The egg load on plants revealed highly significant positive relationship with the trap catches on one week before and same week of observation. Effect of weather parameters on trap catches revealed that, afternoon relative humidity had highly significant positive relationship with trap catches on all correlated weeks. The average rainfall had highly significant positive correlation with trap catches during one week after trap catches and four weeks before trap catches. The rainy days had significant positive association with trap catches during same week of trap catch.

EFFECT OF SULPHUR, ZINC & FYM ON GROWTH OF FRENCH BEAN

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The present studies on effect of Sulphur, Zinc & FYM of French bean was conducted during rabi season of 2013-14. Which was laid out in split plot design with 3 replication. Result revealed that the application of sulphur up to 30 Kg/ha was significantly higher in respect to plant height, leaves/plant at 60 days after sowing, branches/plant at 60 days of the sowing, fresh and dry weight at 30, 60 and 90 DAS, pods/plant, pod length/pod, seeds/pod, grain weight/plant. Use of Zinc up to 10 Kg/ha was statistically significantly improved plant height, leaves/plant at 60 days, branches/plant at 60 days of the sowing, Fresh weight at 90 days of the sowing, pods/plant, pod length/pod, seeds/pod, grain weight/plant. Branches/plant, leaf area at 60 days of the sowing, seeds/pod, and grain weight/plant, 100 seed weight protein yield, Nitrogen and potassium uptake in grain, potassium uptake in straw, gross income and net income were found due to application of 10 t/FYM.

STUDIES ON CORRELATION AND PATH ANALYSIS IN CHRYSANTHEMUM (*DENDRANTHEMA GRANDIFLORA* TZVELEV

Atul Prakash

Correlation and path analysis were carried out in 20 genotypes of chrysanthemum for different yield attributing traits. The results based on correlation coefficients, number of flowers per plant showed positive and significant association with number of primary branches per plant. The path coefficient analysis at genotypic level and phenotypic level revealed that primary branches per plant, plant height after full bloom and days to flower bud initiation had highest direct positive effect on number of flowers per plant. Hence direct selection for number of primary branches per plant, plant height after full bloom and days to flower bud initiation is suggested for getting yield improvement.



IMPROVEMENT OF SUGAR CANE SEED –AN APPROACH**Ved Prakash, N.K. Pruthi*, S.K.Singh*, Viresh Singh and Joginder Singh**

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Sugarcane is a prime source of commercial sugar accounting for about 70 percent of the world sugar production. Besides being a source of other products like animal feed, antibiotics, particle board, bio fertilizer and raw material for generating electricity, sugarcane has emerged as an important base material for bio ethanol production. Sugarcane, being propagated vegetatively, has a low 1:6 to 1:8 seed multiplication rate due to which seed production of newly released varieties is invariably slow. Further, the seed accumulates diseases and pests during several cycles of field production. Hence, no availability of disease free, true to type planting material is a major constraint in improving sugarcane productivity. Advances in biotechnology have offered new opportunities for crop improvement and propagation through plant tissue culture technologies. Of late, development of tissue culture technology for rapid multiplication of disease free planting material has been an important step towards quality seed production in sugarcane. The transgenic approach wherein the spatial, temporal and stringent regulated expression of soluble acid invertase may dramatically influence the level of reducing sugar at the time of sowing of seed and that eventually lead to better germination and quality

STATUS OF PHOSPHINE RESISTANCE AND BIOCHEMICAL CHARACTERIZATION IN KHAPRA BEETLE, *TROGODERMA GRANARIUM* (EVERTS) STRAINS COLLECTED FROM FIVE STATES**Sunil Kumar Yadav and Chitra Srivastava**

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A total of sixteen strains of *T. granarium* were collected from five states viz., Rajasthan, Haryana, Delhi, Uttar Pradesh and West Bengal from merchant's stores, flour mill, farmer's house or godown and bioassay tests were conducted on 4th instar larvae in laboratory at 35°C ±1 and 65±5 % relative humidity in the BOD incubator with different concentrations of phosphine. The data on probit estimates revealed that Delhi-2 strain was highly susceptible to phosphine showed the least LC₅₀ value (0.013 mg/l) which was considered as reference to calculate resistance ratio (RR) at a given response level (LC₅₀) to test the folds of resistance. Among the strains collected from Rajasthan, Nagaur strain was highly resistant showed higher LC₅₀ value (0.677 mg/l) with x52.07 folds resistance. The Bhahadurgarh-2 strain from Haryana was highly resistance showed the highest LC₅₀ value (1.012 mg/l) among the strains collected with x77.84 fold resistance. Likewise, Hapur (U.P.) and Kolkata (W.B.) strains showed LC₅₀ values of 0.657 and 0.270 mg/l with x50.53 and 22.30 folds resistance, respectively. The strain maintaining in laboratory was less resistance showed lower LC₅₀ value (0.037 mg/l) with only x2.84 folds resistance. Thus, from present survey, it was noted that *T. granarium* strain has developed x77.84 folds resistance to phosphine as compared to the susceptible one. The biochemical studies showed that specific activity of peroxidase ($\mu\text{mol min}^{-1} \text{mg}^{-1}$) was found to be increased significantly with increasing in resistance ($P = 0.05$). In highly susceptible strain of Delhi-2, it was 24.984 $\mu\text{mol min}^{-1} \text{mg}^{-1}$ while in highly resistance strain of Bhahadurgarh-2, it was 139.028 $\mu\text{mol min}^{-1} \text{mg}^{-1}$. The specific activity of catalase ($\mu\text{mol H}_2\text{O}_2$ reduced $\text{min}^{-1} \text{mg}^{-1}$) was found significant among the strains ($P = 0.05$) but not related with the resistance level.

CUMULATIVE EFFECT OF *FUSARIUM MANGIFERAE* INFECTION AND ETHYLENE CONTENT IN MANGO FLOWER BUD IN RELATION TO MALFORMATION UNDER LOW TEMPERATURE STRESS CONDITION**Mohammad Wahid Ansari, Zahid Hameed*, Zahid Khorshid Abbas**, Amit Verma***, Anil Kumar, Ratnum K Wattal, Gurdeep Bains* and Ramesh Chandra Pant***

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Malformation is widespread and destructive disease of mango (*Mangifera indica* L.) in nature. Diverse claims have been made to find out its actual causal agent. Till date, the etiology of the disease has not been absolutely defined. Several species of *Fusarium* are found to be associated with the disease. Here, we quantified infection level of *Fusarium mangiferae* in ethrel-treated and -untreated flower bud of mango cultivars viz., Amrapali, Bombay green, Chausa, Dushehri and Mallika under very low temperature during December. Immunodiagnostic assay revealed a higher % cross reactivity in ethrel treated mango flower bud than untreated one in all the tested cultivars. Gas liquid chromatography study showed relatively higher ethylene content in mango flower bud individually treated with ethrel and *Fusarium mangiferae* than untreated condition. Further, the field trial study showed that the incidence of malformation is positively correlated with cumulative treatment of ethylene and *F. mangiferae*, and not with *F. mangiferae* application alone. Therefore, we suggest that the change in endogenous ethylene and other metabolites level in response to environmental stress most likely causes the malformation, and *Fusarium* may act as malformation inducing principle rather than toxic effect. Furthermore, the metabolic regulation in response to environmental stress at the time of flower bud formation, which needs to be investigated to control the disease.

Keywords: Ethylene, *Fusarium mangiferae*, gas liquid chromatography, Immunodiagnostic assay, mango malformation.

ROLE OF AGRO-FORESTRY IN AGRICULTURE AND LIVESTOCK MANAGEMENT

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Agro-forestry has an important role of play in alleviating poverty. In many developing countries, they play a vital role as safety nets, helping rural people avoid poverty, or helping those who are poor to mitigate it. In addition, forests have great potential to increase rural incomes and thus life people out of poverty. Forests, both natural and planted, make an important contributing to natural and local economics and forest, based enterprises provide at least a third of all rural non-farm employment and generate income through the sale of wood products, enriching private companies, government and rural communities. A livelihood involves income-generating activities determined by natural, social, human, financial and physical assets and access to these. Trees, shrubs, herbs, game and a natural assets that are harvested in significant quantities by a large number of house-holds across virtually, all Agro-forest type. Such assets therefore make up on important contribution to livelihoods, same as that, fuel wood is an important source of house-holds energy for heating and cooking in many countries. Non-wood forest products, such as bust meat are important to help meet dietary deficits and a vital source of protein medicinal plants from the forest, used either in self-medication or in traditional medicinal system are in many regions the sole or main source of medicinal remedies for maintaining or improving health, small scale forest product processing, such as wood carvings or cane furniture, may be an important source of non-farm employment.

Many sectors that are vulnerable to climate change, including Agriculture, forestry, energy, housing, transport etc. benefit from diverse ecosystem services provided by forests. This is because the vulnerability of these sectors depends directly or indirectly on the vulnerability of ecosystems surrounding term. The major challenge is to reduce the vulnerability of these climate sensitive sectors in all future development activities. This will require developing and implementing best practice guideline for developing appropriate strategies. In practice, this requires a major paradigm shift in the formulation of national development policies, main streaming and inter grating climate concerns in to national development planting and sect oral policies, and directing investments in ways that increase adaptive capacity and reduce the vulnerability of society to climate change for instance, investments in reforestation, a forestation, and forest management should consider better the role of forests in watersheds and in providing clear water for human consumption and agriculture mainstreaming forest in to national adaptation policies and programs is a challenge that needs attention. Agro-forestry provides a range of ecosystem service fundamental to the planets well being and environmental sustainability. They play an important role in stables soils and protecting land from erosion by wind and water, and they help to maintain a steady supply of clean freshwater. Trees and forest soils also lock up atmospheric carbon and forests thus have an important role to play in reducing the concentrations of one of the main green house gasses which cause global warming. Agro-forestry also supports much of the world's biodiversity. Agro-forestry is important a provider of ecosystem assessment defines services and scales from local to regional and global. The millennium ecosystem assessment defines ecosystem services as the benefits that people obtain from ecosystem. However in national development programs, the links between the agro-forest ecosystem services and the alleviation of poverty should be better emphasized and articulated.

Agro-forestry provides a range of ecosystem service fundamental to the planets well being and environmental sustainability. They play an important role in stables soils and protecting land from erosion by wind and water, and they help to maintain a steady supply of clean freshwater. Trees and forest soils also lock up atmospheric carbon and forests thus have an important role to play in reducing the concentrations of one of the main green house gasses which cause global warming. Agro-forestry also supports much of the world's biodiversity. Agro-forestry is important a provider of ecosystem assessment defines services and scales from local to regional and global. The millennium ecosystem assessment defines ecosystem services as the benefits that people obtain from ecosystem. However in national development programs, the links between the agro-forest ecosystem services and the alleviation of poverty should be better emphasized and articulated. Overview, climate change will most likely exacerbate the pressures on forests and their ecosystem services in the future climate change will have a wide range of impacts an species and ecosystem, thus may result in a drastic decline in the capacity of forests to produce ecosystem services and the loss of ecosystem services will reduce human well being at all levels and on all scales.

Key words : Agro-forestry, climate, ecosystem, energy, livelihood, forest, energy, fuel energy.

INSECTICIDAL ACTIVITY OF SOME PLANT EXTRACTS AGAINST CABBAGE APHID, *BREVICORYNE BRASSICAE* (L.)

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To study the insecticidal activity of crude extract of some plants against cabbage aphid, *Brevicoryne brassicae* (L.) experiments were conducted during Rabi 2016-17 in the laboratory of Department of Entomology, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar. In the era of environment awareness, more emphasis is being given to the natural products for the management of insect-pests, as they are biodegradable and less harmful to environment. Considering the agro-ecosystems with an increase in population and reduction of land resource, there is worldwide demand for natural insecticides to increase the agriculture production. The test on evaluation of plant extracts from *Ageratum conyzoides* (L.), *Parthenium hysterophorus* (L.), *Lantana camera* (L.), *Solanum nigrum* (L.), *Cannabis sativa* (L.), *Calotropis gigantean* (L.), *Livistona chinensis* (Jacq.), *Cassia angustifolia* (Mill.) were tested for their insecticidal against *Brevicoryne brassicae* (L.). Leaves of mustard were treated with different concentrations (1%, 3%, 5%, 7% and 10%) by spraying with potter's tower and aphids were allowed to feed for 72 hours. The results revealed that percent mortality was directly related to concentration of plant extract and exposure period. The treatments of *C. angustifolia* seeds and *C. angustifolia* leaves were the most effective causing maximum mortality in *B. brassicae* (up to 100% mortality at 10% and 7% concentrations, respectively, after 72 hours of exposure period). The laboratory study proves that



extracts from these plants show insecticidal activity against *B. brassicae* and can be used as safer alternative to the synthetic insecticides in aphid management

EFFICACY OF FUNGICIDES AND BIOCONTROL AGENTS FOR THE MANAGEMENT OF CHICKPEA WILT (*FUSARIUM OXYSPORUM* F.SP. *CICERI*)

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Chickpea (*Cicer arietinum* L.) is an important pulse crop and it is used as a big source of protein in the human diet. This crop has a significant role in farming systems as a substitute for fallow in cereal rotations. Fusarium wilt, caused by the soil-borne fungus *Fusarium oxysporum* f.sp. *ciceri*, has become a major factor limiting chickpea production worldwide. The pathogen long survival in soil and high pathogenic variability. The study was conducted under In vitro condition to examine effectiveness of four fungicides (viz. Thiram @0.3%, Carbendazim @0.1%, Captan @0.3%, fosetyl AL @0.2%) alone and in combination of these fungicides and three Biocontrol agents (viz. *Trichoderma harzianum*, *T. viride* and *Pseudomonas fluorescens*) against *Fusarium oxysporum* f. sp. *ciceri*. Among these fungicides Carbendazim @0.1%, Fosetyl AL @0.2%, Thiram+Carbendazim @0.3% and Fosetyl AL+Carbendazim @0.3% was found the most effective with absolute (100%) inhibition of mycelial growth of *Fusarium oxysporum* f.sp. *ciceri*. Whereas, Captan @0.3% was less effective with 80.82% and 82.59% inhibition of mycelial growth respectively at 5 DAI and 7 DAI. Among three biocontrol agents, *Trichoderma harzianum* show highest per cent inhibition of mycelial growth (66.67% and 72.96%) respectively at 5 DAI and 7 DAI.

Keywords: *Fusarium oxysporum* f.sp. *ciceri*; Fungicides; Biocontrol agents; In vitro efficacy

IMPACT OF FOLIAR SPRAY OF BIOREGULATORS ON THE YIELD OF BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA*)

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Broccoli (*Brassica oleracea* var. *italica*) belonging to the family Brassicaceae is an important cole crop after cabbage and cauliflower. It is one of the most nutritious cole crops and contains vitamin A, thiamin, riboflavin, niacin, vitamin C and minerals like Ca, P, K and Fe. An investigation was carried out to find out the impact of foliar spray of bioregulators and the yield of broccoli cv. Pusa KTS-1 at Horticulture Research Farm, Department of Horticulture, Chaudhary Charan Singh University Campus, Meerut, in 2016. Results revealed that the foliar application of GA₃ @ 120 ppm treated plants had maximum head diameter (17.21 cm), head weight per plant (426.66 g), head yield (12.88 t/ha) and minimum days taken to head initiation (41.00) over NAA treatments. It is also revealed from the statistical analysis of data that the higher concentration of bioregulators i.e. GA₃ @ 120 ppm and NAA @ 120 ppm, increased yield growth but this increment in growth was not found significantly higher over lower concentration of bioregulators i.e. GA₃ @ 60 ppm and NAA @ 60 ppm.

IMPACT OF SYNERGIST PIPERONYL BUTOXIDE (PBO) WITH CHLOROPYRIPHOS IN *CNAPHALOCROCIS MEDINALIS* (GUENEE)

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The effect of piperonyl butoxide (PBO) was studied in combination with insecticide chlorpyrifos in the resistant populations of *Cnaphalocrocis medinalis* by using seedling dip bioassay method. The chlorpyrifos, 46 ppm was used along with piperonyl butoxide (PBO) of 50 ppm was fixed based on baseline toxicity data to test the resistance percentage for different field collected populations of Tamil Nadu. The resistance percentage to chlorpyrifos varies slightly among the four field populations. Among the field collected populations, the population from Bhavanisagar was found to be the most resistant to chlorpyrifos followed by Aduthurai then Coimbatore and Trichy population. Suppression of resistance (SR) was calculated for different resistant populations like Bhavanisagar, Aduthurai, Coimbatore and Trichy in Tamil Nadu to access the impact of PBO with chlorpyrifos. There is slight reduction of resistance percentage by mixing with synergist (PBO) in case of Bhavanisagar, Aduthurai, Coimbatore and Trichy population from 73.33 to 68.66, 63.33 to 61.34, 53.33 to 48.67, and 51.34 to 46.00 respectively. Synthetic synergist PBO exhibited very low level of synergism with chlorpyrifos. In case of Bhavanisagar, Aduthurai, Coimbatore and Trichy population SR (%) were 5.833, 3.777, 7.771 and 9.919 respectively.

APPRAISAL'S GENOTYPES ON WATER ABSORPTION, TRANSPIRATION LOSS AT SENESCENCE STAGE AND GENETIC CORRELATION OF *CHRYSANTHEMUM MORIFOLIUM*

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A field experiment entitled “Appraisal's genotypes on water absorption, transpiration loss at senescence stage and genetic correlation of *Chrysanthemum morifolium*” was conducted at Experimental Orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar (Haryana) during the 2016-17 in winter season to identify the suitable variety for successful cultivation as well as vase life of *Chrysanthemum* flower. Fifteen Genotypes namely, Aparajita, Anastasia, Braca Splendid, Charlia, Celtic, Cologne, Fortune, HF-164, Paladov Sunny,



Paiwer-W, Paladov Dark, Papaya, Tocovar- 6, Vanilla Sorbet and White Double were selected for the evaluation. The significant responses in water absorption, transpiration loss at senescence stage and flower vase life were observed in White Double, Cologne, Charlia and Celtic. The maximum water absorption and transpiration loss were recorded in genotype White Double (116.83g and 72.20 ml. respectively) whereas maximum fresh weight was recorded with the genotype Cologne (120.00 g) while genotype White Double had longest vase life (20.66 days). The maximum per cent of opened flowers were noticed in the genotype Charlia (92.45 %) while maximum unopened flowers were noticed in genotype Celtic (21.86%) and the significant genetic correlation between different parameters and vase life of flowers were noted during experimentation.

Keywords: Chrysanthemum, appraisal, flowers vase life

PLANT PARASITIC NEMATODES AND THEIR INTERACTIONS WITH HOST

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Root-knot nematodes are distributed worldwide and these are obligate plant parasites. The genus consists of 98 species and they parasitize almost every species of plant. Their vernacular name comes from the galls (root-knots) induced by *Meloidogyne* on the roots of their host. There are 4 most common species of this genus which exist on this planet which are of more economical value causing significant revenue losses worldwide. During the infection the mature females of *Meloidogyne* lay eggs in a protective gelatinous matrix which forms an egg mass. Egg masses are found on the root surface and can contain up to 1000 eggs. After embryogenesis, the first-stage juvenile (J1) moults within the egg to the infective second-stage juvenile (J2), which hatches from the egg. Many *Meloidogyne* species have a broad host range and, in general, hatching is dependent solely on suitable temperature and moisture conditions, with no stimulus from host plants being required. J2s usually penetrate the roots directly behind the root cap, but can penetrate at any site. To facilitate penetration, J2s use a combination of physical damage through thrusting of the stylet and breakdown of the cell wall by cellulolytic and pectolytic enzymes. However, in contrast with cyst nematodes, the J2s migrate intercellularly within the root. J2s migrate to the root tip and make a U-turn when they reach the apical meristematic region. They then move upwards in the vascular cylinder towards the zone of differentiation. The J2 initiates the formation of a permanent feeding site, which consists of several giant cells. These cells function as specialized sinks, supplying nutrients to the now sedentary J2. The head of the J2 is embedded in the periphery of the vascular tissue. After feeding, the J2 swells and moults a further three times to reach the reproductive adult stage. J3 and J4 stages lack a functional stylet and do not feed. Males are vermiform and leave the root. The adult females continue to feed and enlarge to become pear-shaped. Root-knot nematodes have unbalanced sex ratios. They show an exceptional variety of reproductive strategies, ranging from amphimixis to obligatory mitotic parthenogenesis. Most species are parthenogenetic and males are only formed under adverse conditions.

EFFECT OF ORGANIC, INORGANIC & BIOFERTILIZERS ON ECONOMY OF CABBAGE (*Brassica oleracea* var. *capitata*).

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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 combinations 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). The maximum net profit/ha was recorded under treatment T₁₀ (Rs. 185967.68) while minimum net profit/ha was obtained in treatment T₄ (Rs. 91028.40). The significantly maximum gross profit/ha was recorded in treatment T₁₀ (Rs. 233690.00) whereas, minimum gross profit/ha was recorded in treatment T₄ (Rs. 146785.00). Thus, the maximum income (both gross and net) was obtained with T₁₀. The significantly maximum B:C ratio 4.59 was recorded under the application of 125% RDF (T₆). And the minimum B:C ratio 1.63 was recorded under the application of 100 % from organic FYM+VC+AZ+PSB (T₁₁).

Keywords: Organic, Inorganic, Biofertilizer, and Cabbage.

EFFECT OF DIFFERENT RECIPES OF LIME BLENDED BAEL SYRUP ON STORAGE

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An investigation on “Effect of different recipes of lime blended bael syrup on storage” was conducted at the Post-Harvest Technology Laboratory, Section of Horticulture, College of Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2014-2015, with the object to assess the chemical changes of lime blended bael syrup under ambient storage condition and to find out the suitable recipe for preparation of lime blended bael syrup. The experiment was laid out in Completely Randomized Design with three replications and ten treatments. The lime blended bael syrup was filled in 200 ml pre-sterilized glass bottles and stored at ambient storage conditions. The results observed that, there was gradual increase in TSS, acidity, reducing sugars, total sugars and pH content of the bael syrup prepared with



different recipes irrespective of storage period. However, non reducing sugars content of syrup decreased with the advancement of storage period of syrup prepared with different recipes. Minimum changes in TSS, acidity, reducing sugars, non reducing sugars and total sugars in bael syrup was observed when prepared with using 30 per cent bael pulp blended with 10 per cent lime juice. The bael syrup prepared with using 30 per cent bael pulp blended with 10 per cent lime juice when stored at ambient storage condition remain better without spoilage upto 120 days.

Keywords: Bael syrup, Lime juice, Bael pulp, ambient storage.

NEPHROPROTECTIVE ACTION OF TAURINE AND GARLIC EXTRACT AGAINST COPPER SULPHATE INDUCED RENAL TOXICITY IN *CLARIAS GARIEPINUS*

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The present study was performed to investigate whether sulphur containing antioxidants such as taurine and garlic extract could ameliorate copper sulphate induced histopathological alterations in kidney of *Clarias gariepinus*. Fishes were divided into seven groups (I to VII) containing 20 in each group. The histopathological investigation of kidney of fishes exposed to copper sulphate at 4 ppm and 8 ppm concentrations and sampled at 15th, 30th, 60th and 90th day revealed severe alterations in dose and time dependent manner. The major histopathological changes include fragmentation of glomerulus, desquamation of luminal epithelium, degeneration and disorganization of haematopoietic tissue, haemorrhage and cytoplasmic vacuolation with necrosis of renal tubules. Moreover, addition of 5 ppm each of taurine or garlic extract was found partly to minimize the histopathological changes in kidney. In conclusion, it appears that taurine and garlic extract have beneficial effect in protecting against copper sulphate induced nephrotoxicity to some extent by minimizing histopathological changes. The amelioration of copper induced toxicity on histopathological parameter was highest in taurine treated groups followed by garlic extract treatment. The results reflected that taurine and garlic extracts have a promising role and these are worth to be considered as natural antidotes for copper intoxication.

Keywords: Taurine, Garlic extract, Copper sulphate, Kidney, Histopathology, *Clarias gariepinus*

ANALYSIS OF PLANT GROWTH PROMOTING ACTIVITY, BIO-CONTROL AND ABIOTIC STRESS TOLERANCE OF FLUORESCENT *PSEUDOMONAS* STRAINS, ISOLATED FROM RHIZOSPHERE OF VEGETABLE CROPS

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Abiotic stress is major global problem. It reduces the growth and development of agricultural productivity. Fluorescent *Pseudomonas* is agronomically important due to its plant growth promoting activity such as synthesis of phytohormone, alkaline phosphate activity and antibiotic compounds (2,4-diacetylphloroglucinol). These microbes also synthesized ethylene, which plays important role in abiotic stress tolerance. The occurrence and distribution of these microbes is ubiquitous and rhizospheric region of plants. Fluorescent *Pseudomonas* strains isolated from different vegetable crops such as Okhara, Brinjal and Tomato of the rhizospheric region. Seven strain of *Pseudomonas* spp. were characterized using standard microbiological methods. These strains showed multiple abiotic stress tolerance such as salinity, temperature and heavy metal. Phytohormone including auxins, cytokines and ethylene are synthesized in stressed and unstressed condition. Three isolates showed efficient phosphate solubilization and siderophore production. These isolates were further tested antagonistic activity against pea pathogen *Sclerotinia sclerotiorum*, which cause rot of pea plant. Antagonistic activity was measured by zone of inhibition against pea pathogen. Such strains can be used bio-control the pathogen and enhance abiotic stress tolerance of plants. *Pseudomonas* spp. inoculants are reliable, ecofriendly and sustainable approach and open alternate option to reduce demands of chemical based fungicides.

Keywords: Abiotic stress, Fluorescent *Pseudomonas*, Plant growth promoting activity

POSTHARVEST MANAGEMENT OF OKRA

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Okra [*Abelmoschus esculents* L. (Moench)] is also known as lady's finger and locally known as bhindi is one of the most important vegetable of tropical and sub-tropical regions of India. Most varieties of okra are takes 50-60 days to first picking after seed sowing. Immature pods of okra should be cut with a sharp and clean knife. 6-8 cm long pods of okra are desirable for fetch high market prize as well as export point of view. Okra has a high respiration rate at warm temperatures and should be promptly cooled to reduce field heat and subsequent deterioration. Post harvest losses in okra mainly occur due to discoloration, blackening, shrivelling and injury to pods (bruises) by a means of improper storage, handling and transportation. Okra pods lose quality within two days under room temperature condition leading to heavy post-harvest losses. For local market, after pre cooling it should be packed in jute bags or baskets and subjected to a little water sprinkling over it. Okra can be stored satisfactorily for 14 days at 8.9°C and 90% relative humidity. Chilling injury, surface discoloration, pitting, and decay occur if stored below 7°C (45°F) temperature. Experimental results reported that shelf life of okra can be improved by treating with citric acid 500 ppm + sodium benzoate 100ppm. In case of distance market for retains freshness, firmness and quality, it should be packed in corrugated fiber board (CFB) boxes at 8 ± 1 °C with 90–95% RH, which helps in retain its freshness upto 13 days without the use of postharvest chemical treatments. Use of polyethylene film for packaging is to be good, since it is transparent, moisture proof and facilitates easy sealing. Okra fruits packed in Low-density polyethylene (LDPE) bags of 50 micron thickness with 5% vents and stored at 12°C temperature with 95% RH increase the shelf life up to 16 days without remarkable loss in quality of pods. Air-tight containers and high ethylene level caused paleness during transport. This can be accomplished by good ventilation in the storage environment and not keeping okra in the same location as other ripening fruit.



ISOLATION AND CHARACTERIZATION OF THE HALOTOLERANT CYANOBACTERIUM ANABAENA GA1 FROM RANN OF KUTCH FOR MYCOSPORINE LIKE AMINO ACID PRODUCTION

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Extremophilic cyanobacteria are important from the biotechnological perspective owing to their ability to produce an array of industrially important biomolecules. Mycosporin like amino acids produced by cyanobacteria from stressful environment are important sunscreen compounds. In the present study an attempt was made to isolate, identify and characterize cyanobacteria from the extreme environment of Rann of Kutch, experiencing high levels of salinity. Based on microscopic, morphological and cultural characteristics a halotolerant strain of *Anabaena* was identified and characterized. The identity of the strain was further confirmed on the basis of 16S rDNA sequence homology. The identified cyanobacterium *Anabaena* GA1 was screened for their ability to produce mycosporine like amino acids. Results showed that the organism is able to produce significant quantity of mycosporine like amino acids and therefore it could be exploited further the production of mycosporine like amino acids.

Keywords: Cyanobacteria, Extreme environment, 16 S r DNA, Mycosporine like amino acids

STUDY OF THE FARM STRUCTURE, CROPPING PATTERN AND CROPPING INTENSITY ON PULSE GROWING SAMPLE FARMS IN AZAMGARH DISTRICT OF UTTAR PRADESH INDIA

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Pulses are important with the view of their food and nutritional security and also income and employment generation ability possibility to raise the cropping intensity due to its nature of best fit with food grain production system. Keeping in view the importance of the pulses a study on production and marketing of pulses was conducted in Thekma block of Azamgarh district. A sample of 100 farmers belonging to marginal, small and medium holding size were drawn through purposive cum proportionate random sampling technique, from five selected villages of Thekma block, personal interview method with the help of prestructured schedule was applied to collect the primary and secondary data were collected from block and district offices. Tabular and functional analysis was done to analyse the data and presentation of the result. Population and education status of the respondents were inversely and directly related with farm size. More than 50% of the sample farmers were owner of marginal holding very less number of medium size farmers were found. Overall average holding size was found to 0.67 hectare. Paddy, wheat and onion were the major crops of kharif, rabi and zaid season respectively. Pulses under study were also allotted considerable acreage in cropping pattern, cropping intensity was inversely related with farm size. Investment per farm and per hectare on building and livestock were inversely related with farm size where as it were having direct association in case of farm machinery and implement.

EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS ON YIELD, QUALITY AND NUTRIENTS UPTAKE BY MUSTARD (*BRASSICA JUNCEA* L.)

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In India, it is the third most important edible oilseed crop after that soyabean, 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 contribute 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 world mustard industry. Singh and Pal., (2011) also found that the plant height, total dry matter accumulation, leaf area index and seed and stover yields were significantly higher when RDF 120:17.6:16.6:40,N:P:K:S kg/ha was applied along with FYM 10t/ha. Singh *et al.*, (2015) revealed that higher values of growth parameters, viz. number of branches, plant height, yield attributes, seed and stover yields were recorded in plots receiving 75% RDF + 5 t/ha, + Zn 10 kg/ha, + S 25 kg/ha, + Azotobacter, which was followed by 75% RDF + 5 t/ha, + Zn 10 kg/ha, + S 25 kg/ha respectively. Kumawat and Rathore., (2013) reported that the plant height, dry matter accumulation, primary and secondary branches/plant, chlorophyll content in fresh leaves, seeds/siliqua, 1000-seed weight and seed and stover yields were significantly higher under incorporation of FYM 20t/ha over FYM 10t/ha.

Keywords: Mustard, Organic, Inorganic, Nutrient

A REVIEW: EFFECT OF MALTING & FERMENTATION ON THE FUNCTIONAL & RHEOLOGICAL PROPERTIES OF SORGHUM FLOUR

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Sorghum is widely grown in India. Maharashtra is the leading state in the production of sorghum. Sorghum is popular for poor man's food. Sorghum based product composed of high nutritional value and acceptability. Although, Sorghum has number of benefits viz., it provides high amount of carbohydrates, rather than it contains phenolic compounds and antioxidants which helps in managing diabetes, heart health,



improve digestive health, beneficial in maintaining healthy bones and reduces risk of cancer. Malting and fermentation are the two term which get impact on the rheological and functional behaviour of the sorghum flour. Malting and fermentation placed a good impact on the sorghum flour. Effect of this malting and fermentation varies with the various varieties of sorghum as they composed of different characteristics.

Keywords: Malting, fermentation, benefits, sorghum, rheology etc.

STUDY THE MORPHOLOGICAL CHARACTERS OF OKRA GERMPLASM FOR SALINITY TOLERANCE

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Okra (*Abelmoschous esculentus* (L.) Moench), also called as Lady's finger belongs to a family Malvaceae, is one of the important vegetable crops grown in tropical, subtropical and warm sections of the temperate zones of the world. The experiment was conducted at HRC, SVPUAT, Meerut during *Kharif* season of year 2012 and 2013. The morphological characters studied were days to flowering, plant height, number of nodes per plant, number of fruits per plant, diameter of fruit, length of fruit and pod yield per plant. Among all the 15 genotypes of okra, six genotypes namely Parbhani Kranti, K.S-442, K.S-770, K.S-305, VRO-3 and F.B-10 were found to be less sensitive for salt stress, while nine genotypes namely EC-169367, EC-1081012I, SKY-107, K.S-404, K.S-167, K.S-326, K.S-311, EC-67103, K.S-446 were found to be sensitive for salt stress. In general, all of these morphological characters were decreased with increasing salinity levels of applied treatments. It was observed that salt stress has significantly affected the growth and development of okra plant.

IMPACT OF SULPHUR ALONE AND COMBINATION WITH FYM ON YIELD AND METHIONINE CONTENT IN MUSTARD CROP

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The field experiment was conducted on Research Farm of the Department of Soil Science and Agricultural Chemistry, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP) during Rabi season 2014-15. In the present investigation, the impact of sulphur alone and combination with FYM was studied on yield and methionine content in mustard crop in a Vertisol which laid in Factorial randomized block design with ten treatments including T_1 = Control, T_2 = 15 Kg S ha^{-1} , T_3 = 30 Kg S ha^{-1} , T_4 = 45 Kg S ha^{-1} , T_5 = 60 Kg S ha^{-1} , T_6 = FYM 5 tha^{-1} , T_7 = 15 Kg S ha^{-1} + FYM 5 tha^{-1} , T_8 = 30 Kg S ha^{-1} + FYM 5 tha^{-1} , T_9 = 45 Kg S + FYM 5 tha^{-1} , T_{10} = 60 Kg S ha^{-1} + FYM 5 tha^{-1} . The findings of experiment on yield of seed and straw as well as increased significantly with enhancing sulphur up to highest level of 60 kg S ha^{-1} + 5 tha^{-1} . Highest seed (1799.17 kg ha^{-1}) and Stover (4486.75 kg ha^{-1}) yields was recorded with the application of Sulphur 60 kg ha^{-1} + FYM 5 t ha^{-1} over rest of the treatments. The highest methionine content (3.09 mg g^{-1}) was observed 45 kg S ha^{-1} + FYM 5 tha^{-1} . There was no significant effect found through the interaction between sulphur and FYM levels on yield and methionine content in mustard. In this current study it was observed that the Sulphur and FYM is not only beneficial for mustard crop but also their interaction in soil and plant is also effect the yield and quality of mustard.

Keywords: Mustard, Sulphur, FYM, yield, Methionine

VEGETABLES AS PROTECTIVE FOOD FOR HUMAN HEALTH – A REVIEW

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This article reviews the vital role of protective food 'vegetables' for balanced diet to human health. As per the estimated report of World Health Organization (WHO), up to 2.7 million peoples could potentially be saved each year if vegetable and fruit consumption is significantly increased. Experts have recommended a daily intake of fruits and vegetables at least 400g. According to Indian Council of Medical Research (ICMR), adult person should consume 300g vegetables per day (125g leafy vegetables + 100g root vegetables + 75g other vegetables). But, amount of vegetable consumption depends on the age, sex, income, education, regions and level of physical activity. The minimum requirement of calories and nutrients for adult man and woman are, calories (2800 and 2200 kcal), protein (55 and 45g), calcium (450 and 550 mg), iron (20 and 30mg), carotene (3000 and 3000 μ g), riboflavin (1.5 and 1.2 mg), ascorbic acid (50 and 50 mg), folic acid (100 and 100 μ g) and vitamin B₁₂ (1.0 and 1.0 μ g), respectively. The balanced diet should contain adequate energy sources (calories) and nutrients. Vegetables are contain plenty amount of vitamins, minerals, dietary fibers, carbohydrates, proteins and amino acids. Beside this, vegetables are rich in micronutrients and bioactive compounds to meet the nutritional requirements for good health. Potatoes and tubers include sweet potato, yam, taro and cassava contain high amount of starch, from 12-50%. Leafy vegetables include amaranths, bathua leaves, coriander, spinach etc. are the excellent source of minerals like calcium, iron and phosphorus and oxalic acid. On an average 30grams of leaves will be sufficient to meet the daily requirement of vitamin A and C. Legumes vegetables include lima bean, pea, cowpea etc. not only the good source of protein and fiber but also contain good amount of manganese, molybdenum and zinc. Chillies have good amount of vitamins B complex and magnesium while, tapioca is excellent source of carbohydrates. Garlic and cauliflower are considered as rich source of phosphorus and sulphur. Vegetables also contain some compound (phytochemicals) having therapeutic (healing and curing) effect against some ailments. Phytochemicals prevents the risk of stroke, cancer, heart diseases, type-2 diabetes etc. Onion and garlic have several sulphur containing compounds that help in lowering blood cholesterol. Cabbage has anticancer property due to presence of Indole-3-carbinol. White brinjal is good for diabetic patient. Charantin extracted from bitter gourd and diphenylamine found in onion, are effective against diabetes. Leafy vegetables rich in folic acids used to reduce the risk of colon cancer, cardiovascular disease and fetus development.



WHEAT IMPROVEMENT IN INDIA: CURRENT STATUS AND FUTURE STRATEGIES**Rohit Kumar Saini, RamrajSen and S.A. Kerkhi**

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Wheat (*Triticumaestivum* L.; $2n=42$) has been described as the 'King of cereals'. India is one of the major producers of wheat and occupies second position after China. The genus *Triticum* of the tribe *Triticeae* constitutes of all wheat whether wild or cultivated. Its geographical centre of origin- South-western Asia. Wheat has three genetically related genomes A, B and D. It is grown in temperate, sub-tropical and tropical regions. Much of the emphasis on wheat breeding has been placed on increasing productivity of the crop. In India, the wheat research started in an organized manner after the joining of Sir Howards as the Imperial Botanist at Pusa (Bihar) in 1905. Important milestone in this process was created with the Establishment of the AICWIP & DWR in 1965, 1978 respectively by the ICAR. Pure line selection practiced by earlier wheat workers in local land races which resulted in to development of NP4, NP6, NP12, Pb8, Pb11 etc. Dr. K. C. Mehta & Dr. B. P. Pal developed disease resistant varieties NP 700 & NP 800 series. Dwarf wheat cultivars were made by introducing Sonora 63, Sonora 64, Mayo 64 & Lerma Rojo 64 from CIMMYT, Mexico. Varieties PV18, Kalyan Sona, Sonalika, Chhoti Lerma & Safed Lerma there by shering Green revolution in India. Different selection and hybridization techniques are utilizing for development of new wheat cultivars. Most of the wheat varieties are developed by Pedigree and bulk methods. Backcross method is suitable for transfer of disease resistance traits. Recently, biotechnological method have been applied to incorporate the resistance gene. Wild relatives are a useful source of genetic variation for increasing grain protein percentage. Till now near about more than 400 wheat varieties have been released in India under AICWIP. Future strategies in wheat improvement programme- (1) Breeding for enhancing productivity like., breaking yield barriers, Breeding for biotic & abiotic stress tolerance (2) Quality improvement. Use of advance tools for genetic improvement in wheat- (1) New Plant Type (NPT) Approach (2) Use of Transgenics and gene exchange for wheat improvement (3) Hybrid Wheat.

INFLUENCE OF INSECTICIDES ON YIELD OF TOMATO IN MANAGEMENT OF *TUTA ABSOLUTA* UNDER PROTECTED CULTIVATION**Ramesh K. B., P. R. Zanwar*, Tukaram A. Nikam*, H Sunil Naik*, Niranjana G. N.**

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The investigation was carried out during *kharif* under naturally ventilated polyhouse condition at Department of Horticulture, V.N.M.K.V, Parbhani during 2015-16 to evaluate the influence of some selected insecticides on yield of tomato in *Tuta absoluta* management under protected cultivation. The experiment was laid out in a randomized block design (RBD) with eight treatments each replicated thrice. The treatments comprised of Chlorantraniliprole 18.5 SC @ 30 g a.i/ha, Emamectin benzoate 5 SG @ 10 g a.i/ha, Garlic extract @ 5ml/litre of water, Spinosad 45 SC @ 83 g.a.i/ha, Indoxacarb 14.5 SC @ 60 g.a.i/ha, Azadirachtin 5% @ 200ml/ha, *Beauveria bassiana* 2.25 % WP 2 kg/ha and untreated control. Tomato fruits from each treatment plots were picked and weighed separately where three pickings were carried throughout cropping season and the total yield from each plot was calculated and computed on hectare basis. The results revealed that all the insecticidal treatment were significantly superior over untreated control in increasing yield. The highest yield of tomato was recorded in plots treated with Garlic extract found to yields 80.27 q/ha which was followed by Emamectin benzoate 75.00 q/ha where Chlorantraniliprole yields 61.66 q/ha and Spinosad yields 60.00 q/ha, Indoxacarb 60.00 q/ha, Azadirachtin 51.11q/ha and *Beauveria bassiana* yields 39.72 q/ha). The lowest yield was obtained from untreated plot which was 32.77 q/ha. Garlic extract and Emamectin benzoate found effective in management of *Tuta absoluta* as well as influence better yield in tomato cultivation.

EFFECT OF NITROGEN AND POTASSIUM ON AVAILABLE NUTRIENTS STATUS OF SWEET POTATO (*IPOMOEA BATATAS*. L.) IN VERTISOLS OF MAHARASHTRA**Pushpalatha*, M., Vaidya **, P. H. Sunil B. H. and Adsul, P. B.**

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The effect of nitrogen and potassium on available nutrients status of sweet potato (*Ipomoea batatas*. L.) was studied under Vertisols of Maharashtra. This experimental site is located in Horticulture farm, College of Agriculture, Latur district of Maharashtra. The treatment consists of four levels of nitrogen and three levels of potassium (N_3 -125, N_2 -100, N_1 -75 and N_0 - 0 kg ha⁻¹ and K_2 -100, K_1 -75 and K_0 - 0 kg ha⁻¹). The experiment was carried out in factorial randomized block design with three replications and twelve treatments. A higher application of N along with K in the soil was significantly higher available nutrient status, as well as organic carbon as compared to initial nutrient status of sweet potato grown soil but lower status was recorded in 0 kg ha⁻¹ application of fertilizers. From the different graded levels of nitrogen application of 125 kg ha⁻¹ (N_3) observed significantly higher content of available nutrients viz., N (276.56 kg ha⁻¹), P (23.28 kg ha⁻¹), K (544.78 kg ha⁻¹) and organic carbon content 5.9 g /kg than the rest of the treatments followed by the nitrogen level 100 kg ha⁻¹ (N_2) and different graded levels of K_2 fertilizer (100 kg ha⁻¹) recorded significantly higher values for available N (231.83 kg ha⁻¹), P (21.86 kg ha⁻¹), and K (471.17 kg ha⁻¹) and organic carbon content 4.6 g /kg followed by the treatment K_1 (75 kg ha⁻¹). The initial nutrients viz., N (275.98 kg ha⁻¹), P (15.75 kg ha⁻¹), K (559.58 kg ha⁻¹) and organic carbon content 3.80 g /kg. The application of 100 kg ha⁻¹ N along with 75 kg ha⁻¹ K can maintain better nutrient status in black soils.



SURVEY CITRUS INSECT PESTS AND THEIR MANAGEMENT IN SUB ZOBAKEREN AND HAMELMALO, KEREN, ERITREA**Huma Naz, Adugna Haile, Zineb Idris, Habtiti Kifleariam, Mical Tesfay**

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Citrus (orange and lime) is major crop in sub zoba Keren and Hamelmalo cultivated along the banks of river Anseba from dug wells. Study on citrus pests and their management was conducted in the two sub zoba with the objectives to assess the main citrus pests and their management practices. The study was conducted using unstructured questionnaires and farmers group discussions (FGD). In each sub zoba citrus growing villages were selected at random and in each village citrus producer farmers were selected at random for interview and questionnaire filling. In addition 5-7 citrus producers with different age, sex and wealth were selected for FGD. Besides this, pest assessments were done in each farmer's field, samples were collected from leaves, stem and fruit at an interval of two weeks for pest infestation counts. The result of the study showed that about 12 insect species and one Acarina were recorded as pest of citrus out of which *Parlatoria zizyphus*, *Aonidiella aurantii*, *Aluerothrix floccosus*, *Phyllocnistis citrella* and *Tetranychus cinnabarinus* were the dominant pests that threaten the citrus production in the two sub zoba. Highest pest incidences of whitefly and spider mites were recorded in Hamelmalo and Gonfola area with 63 and 55.7% respectively. Although pests are present throughout the year they are more prevalent during the dry season. Farmers practice both cultural (pruning affected plant parts and leaves washing) and chemical control using dimethox and malathox. Farmers use knapsack sprayers without using protective clothes during spraying. Citrus is a perennial crop affected by different pest throughout the year, integrated pest management should be encouraged for safe and better management of the pests.

Keywords: white fly, leaf miner, red spider mite, black scale, red scale, insect infestations, interviews, management practices, Eritrea

PHOTOSELECTIVE SHADE NETTING IN VEGETABLE CROPS**A. P. Pawar, Y. R. Parulekar*, B. J. Patle and S. V. Bhavar**

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The photosensitive netting is an emerging approach, which introduces additional benefits, on top of the various protective functions of nettings. These nets are unique; they spectrally modify, as well as scatter the transmitted light. The photosensitive net products are based on the incorporation of various chromatic additives, light dispersive and reflective elements into the netting materials. The photosensitive nets include "coloured-Colour Nets" (e.g. Red, Yellow, Green, Blue net products) as well as "neutral-Colour Nets" (e.g. Pearl, White and Grey) absorbing spectral bands shorter or longer than the visible range. The spectral manipulation is aimed at specifically promoting photomorphogenetic physiological responses, while light scattering improves light penetration into the inner canopy. Radiation use efficiency increases when the diffuse component of the incident radiation is enhanced under shade. Covering greenhouses with films or screens containing UV absorbing additives is known to provide better protection against most pests, relative to standard cladding materials.

INTEGRATED NUTRIENT MANAGEMENT STUDIES IN BOTTLE GOURD**B. J. Patle, A. P. Wagh*, N. R. Kadge, P. L. Deshmukh**

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The present investigation entitled on "Integrated nutrient management studies in Bottle gourd (*Lagenaria siceraria* L.)" during *kharip* season of 2012-13 at the field of Main Garden, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment conducted in Randomized Block Design with three replications using cv. Samrat, with thirteen treatments, two kinds of organic manures (FYM and vermicompost) alone and in combination with two kinds of bio-fertilizers (*Azotobacter* and PSB) and reduced doses of chemical fertilizers were tested in comparison with control i.e. without any nutrient application. On the basis of results, the application of 50 % RDCF (50:25:25 NPK kg ha⁻¹) + 2.5 t ha⁻¹ FYM + 1.65 t ha⁻¹ vermicompost and *Azotobacter*, PSB each 5 kg ha⁻¹ to the crop found to be sound integrated practice, where it recorded maximum vine length (551.56 cm), length of internode (15.88 cm), number of female flower (17.44), fruit set percent (75.11 %), yield per vine (7.61 kg), yield per hectare (380.61q), maximum uptake of major nutrient (133.21, 20.93, 116.08 kg ha⁻¹ N, P, K respectively) and maximum final available nutrient status after harvest (225.68, 25.13, 381.81 kg ha⁻¹ N, P, K respectively). According to B: C ratio, the treatment T₁₂ was found to be profitable and remunerative. Minimum vine length, number of branches, internodal length, number of female flowers, number of fruit per vine, weight of fruit, diameter of fruit was observed in the treatment T₁₃ i.e. Control. In all there was increasing in soil fertility level by the use of biofertilizers, FYM, Vermicompost along with inorganic fertilizer as compared to inorganic fertilizers alone.

ESTIMATION OF THE EFFECT OF DROUGHT ON YIELD AND YIELD CONTRIBUTING TRAITS IN CORIANDER GENOTYPES (CORIANDER SATIVUM L.)**Mamta Bajja*, B.L. Kakralya, Kamlesh Jangid, Anita Burdak and Kamal Singh Chouhan**

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Eight Coriander varieties viz. Rcr-20, Rcr-41, Rcr-435, Rcr-436, Rcr-446, Rcr-475, Rcr-684 and Rcr-728 were conducted at the research farm of S.K.N. College of Agriculture, Jobner (Rajasthan) during *Rabi*, 2016 in randomized block design with three replications on loamy sand



soil. Under control condition plot were irrigated at regular interval while in drought condition plots were maintained under rainfed condition. Yield and yield contributing parameters were recorded at maturity stages and after harvesting. The Coriander varieties Rcr-20 and Rcr-446 behaved as drought tolerance varieties maintained higher seed yield along with number of umbels per plant, seeds per umbel, test weight, seed yield, biological yield, harvest index under drought conditions. The coriander varieties Rcr-435 and Rcr-728 maintained under higher seed yield along with number of umbels per plant, seeds per umbel, test weight, seed yield, biological yield, harvest index under control conditions.

EFFECT OF MULTINUTRIENT BRIQUETTES ON SEED COTTON YIELD AND FIBRE QUALITY IN BT COTTON

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The present study was conducted to know the requirement of multinutrient briquettes on effect of Bt cotton yield and fibre quality parameter. Treatments like T₁: Absolute Control, 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) is applied through a six split dose, T₄: 120: 60: 60 kg NPK ha⁻¹ through briquettes with drip irrigation, T₅: Application of NPK + micronutrient briquettes (120:60: 60 NPK kg ha⁻¹ + 20 kg ha⁻¹ ZnSO₄). The experiment conducted at experimental farm, Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (2015-16) under *kharif* season. In this study, the results indicated that the application of 80:40:40 kg NPK kg ha⁻¹ through soluble fertilizers by fertigation in six splits have produced more seed cotton yield (15.59 q ha⁻¹) which was at par with application of 120: 60: 60 N, P₂O₅ and K₂O through briquettes. The addition of 20 kg ZnSO₄ in NPK briquette (14.11 q ha⁻¹) proved its superiority over all treatment except fertigation and lowest one is absolute control (10.74 q ha⁻¹). In general, Bt cotton with 120:60: 60 NPK kg ha⁻¹ + 20 kg ha⁻¹ ZnSO₄ (29.1 SL mm) at par with the 80:40:40 kg NPK kg ha⁻¹ through soluble fertilizers (29.0 SL mm), produced with greater fibre length, uniformity percentage, maturity ratio and fibre strength parameters as compared to other treatments. Hence the present recommendation was application of RDF through fertigation (80:40:40 NPK kg ha⁻¹) followed by the Application of NPK + micronutrient briquettes (120: 60: 60 NPK kg ha⁻¹ + 20 kg ha⁻¹ ZnSO₄) with present recommended schedule of application to increase yield and fibre quality under Marathwada region.

GROWTH AND YIELD OF SESAME AS INFLUNCED BY INTEGRATED NUTRIENT MANAGEMENT

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2013 on loamy sand soil. The treatments comprised of 8 fertility levels viz., Control, FYM @ 10 t/ha, FYM @ 5 t/ha + 50% RDF, Poultry manure @ 4 t/ha, Poultry manure @ 2 t/ha + 50% RDF, Vermicompost @ 3 t/ha, Vermicompost @ 1.5 t/ha+ 50% RDF and RDF of N and P₂O₅ (40:20) and two biofertilizer levels (*Azotobacter*, seed inoculation and control), thereby making 16 treatments combinations was laid out in a Randomized Block Design and replicated three times. Results showed that different fertility treatments had significant effect on all the growth parameters (Plant height, dry matter accumulation/metre row length, number of branches per plant, chlorophyll content, CGR, LAI and RGR, yield attributes (number of capsules per plant and seeds per capsule) seed, stalk and biological yields of sesame. By and large, the significantly higher values of these parameters were recorded in the treatment, vermicompost @ 1.5 t/ha + 50% RDF and in most of the cases was at par with poultry manure @ 2 t/ha + 50% RDF, FYM @ 5 t/ha + 50 % RDF, vermicompost @ 3 t/ha and poultry manure @ 4 t/ha and significantly superior to rest of the treatments. Results further showed that with regard to growth parameters, yield attributes, yields (seed, stalk and biological), increased significantly seed inoculation with *Azotobacter* proved and superior to absolute control. The combined application of fertility levels and biofertilizer gave significantly effect on seed yield. The application of vermicompost @ 1.5 t/ha+ 50% RDF with biofertilizer was at par with vermicompost 1.5 t/ha+ 50% RDF with biofertilizer and significantly superior over the rest of treatment.

SUGARCANE PRODUCTION: AN APPROACH FOR ENHANCING INCOME IN WESTERN UTTAR PRADESH

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Sugarcane is an important commercial crop of the country occupying around 3.8 million hectares of land with an annual cane production of around 360 million tonnes occupies about 5.14 percent of the cultivated land area. About 35 million farmers grow and depend on sugarcane for their livelihood and an equal number of agricultural labourers earn their living by working in sugarcane farms. Uttar Pradesh is the leading producer of sugarcane in India, with a production of 1,385 Lakh Tonnes (39%) of total sugarcane production in the country. Uttar Pradesh has the largest area under sugarcane cultivation about 2.23 million hectare (43.32 %) in 2014-15 of the total cultivated area. Some of the major sugarcane producing districts in Uttar Pradesh are Bareilly, Muzaffarnagar, Bulandshahr, Meerut and Saharanpur. Under the changing climatic conditions, input prices, and cropping pattern, sugarcane cultivation is one of the sustainable and employment generating crop enterprise. Keeping in view, the economics of sugarcane production was worked out in Meerut district of UP during 2017. The information on the various expenditure items (from land preparation to sugarcane mills gate) was collected on the pretested structured schedule by the personal interview method from the randomly selected respondents separately for sugarcane plant and ratoon. The study reveals that the total cost of



cultivation of sugarcane plant and ratoon was Rs. 213530 and 152257. Expenditure on labour, machine power, manure, irrigation and fertilizer was accounted 29, 5.95, 5.58, 5.97, 4.70 percent respectively in sugarcane planted. In ratoon crop 35, 6.50, 6.23 percent expenditure on labour, machine power, irrigation respectively. Expenditure on leased in land accounted to be 29 and 35 percent to the total cost of cultivation, value of sugarcane top was only Rs. 8300 and 8700 in both the crops. The per quintal cost of production was estimated to be Rs 350.00 and 220.00 for sugarcane planted and ratoon. As per State Advisory Price, the overall net benefit per quintal of sugarcane is Rs. 30. On the basis of the information more attention is required towards the varietal improvement along with efficient marketing of input as well as output for enhancing the efficiency of the enterprise.

EFFECT OF FERTILITY LEVELS AND BIO-ORGANICS ON GROWTH AND YIELD OF MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

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The experiment was conducted during *kharif*, 2016 in plot No. 1 at Agronomy farm, School of Agriculture, OPJS University, Churu (Rajasthan) during *kharif*, 2016 on loamy sand soil, which consisted four each of fertility levels (Control, 50, 75 and 100% RDF) and bio-organics (Control, PSB, vermicompost and PSB+vermicompost) thereby making sixteen treatment combinations were tested in a Randomized Block Design with three replications. Results indicated that application of 75% RDF being at par with that of 100%, significantly increased the plant height, number of branches per plant, dry matter accumulation per metre row length, chlorophyll content, pods per plant, seeds per pod, test weight and yield (seed, straw and biological) over preceding levels. However, in respect of number and weight of root nodules and harvest index, the treatments 50 to 100% RDF remained almost same. Results further indicated that among bio-organics, application of vermicompost being at par with PSB + vermicompost, significantly increased plant height, number of branches per plant, dry matter accumulation per metre row length, chlorophyll content, number and dry weight of root nodules per plant, seeds per pod, test weight and yield (seed, straw and biological) over control and PSB. However, with regard to fresh weight of root nodules, all the three bio-organics remaining at par proved superior to control. Combined application of 75% RDF and vermicompost (F_2B_2) proved to be the best treatment in terms of pods/ plant, seed yield and nutrient uptake by crop.

YIELD AND NUTRIENT STATUS IN COWPEA AS A INFLUENCED BY NITROGEN AND PHOSPHORUS

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A field experiment entitled “Effect of nitrogen and phosphorus on growth and yield of summer cowpea [*Vigna unguiculata* L. Walp]” under South Saurashtra region” was carried out on medium black soil at the Instructional Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh (Gujarat) during the summer season of 2010. The experiment comprising of 16 treatment combinations with four level of nitrogen viz., 00, 20, 30 and 40 kg N ha⁻¹ and four level of phosphorus viz., 00, 40, 60 and 80 kg P₂O₅ ha⁻¹ was laid out in Factorial Randomized Block Design with three replications. From the experimental results, it was ascertained that application of nitrogen @ 20, 30 and 40 kg ha⁻¹ significantly increased the yield attributes viz., number of pods plant⁻¹, number of seeds plant⁻¹ and 1000 seeds weight over without application of nitrogen. The fertilization of nitrogen to cowpea @ 20 kg ha⁻¹ significantly augmented higher seed, stover and biological yield of 1107, 2385 and 3492 kg ha⁻¹, respectively which were 20.4, 17.6 and 18.4 per cent higher as compared to without application of nitrogen. Significantly protein content was recorded with the application of 20, 30 and 40 kg N ha⁻¹ as compared to control. Application of @ 20, 30 and 40 kg N ha⁻¹ extracted appreciably higher nitrogen, phosphorus and potassium content as well as uptake by seed and stover as compared to without application of nitrogen. Phosphorus application to cowpea @ 40, 60 and 80 kg ha⁻¹ significantly showed better effect on yield attributes viz., number of pods plant⁻¹, number of seeds plant⁻¹ and 1000 seeds weight over without application of nitrogen. The fertilization of phosphorus to cowpea @ 20 kg ha⁻¹ significantly augmented higher seed, stover and biological yield of 1099, 2352 and 3451 kg ha⁻¹, respectively which were 20.1, 18.4 and 18.9 per cent higher as compared to without application of phosphorus. Remarkably higher protein content and nitrogen content as well as uptake by seed and stover and phosphorus content by stover and uptake by seed were obtained higher with application of phosphorus @ 60 and 80 kg ha⁻¹. Though, phosphorus content by seed and uptake by stover and potassium content as well as uptake by seed and stover were turn out better performance over without application of phosphorus.

PRODUCTIVITY AND PROFITABILITY OF WHEAT (*TRITICUM AESTIVUM* L.) AS INFLUENCED BY IRRIGATION SCHEDULING AND ORGANIC MANURES UNDER SEMI-ARID EASTERN PLAIN ZONE OF RAJASTHAN

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A field experiment was conducted under loamy sand soil during two consecutive *rabi* seasons of 2014-15 and 2015-16 at S.K.N. College of Agriculture, Jobner, Rajasthan study to the effect of irrigation scheduling and organic manures on growth and yield of wheat. The treatments consisted of five irrigation scheduling i.e. I₁ (irrigation at critical stages), I₂ (0.9 IW/CPE ratio), I₃ (0.6 IW/CPE ratio at vegetative phase + 0.8 IW/CPE ratio at reproductive phase), I₄ (0.6 IW/CPE ratio at vegetative phase + 1.0 IW/CPE ratio at reproductive phase) and I₅ (0.8 IW/CPE ratio at vegetative phase + 1.0 IW/CPE ratio at reproductive phase) in main plots and four organic manures (control, FYM @ 15 t/ha, VC @ 6 t/ha and FYM @ 7.5 t + VC @ 3 t/ha) in sub plots were replicated four times in split plot design. The pooled mean results showed that irrigation applied at 0.9 IW/CPE ratio (I₂) recorded the maximum values of growth parameters (dry matter accumulation and functional leaves) and yield (grain, straw, biological and HI) proved significantly superior over I₁, I₄ and I₃. However, the treatment I₅ with maximum plant height also remained equally effective with regard to above parameters. With regard to relative water content and total number of tillers the above



treatment being at par with I_1 proved superior over rest of the treatments. Results further indicated that application of FYM at 7.5 t + VC at 3 t/ha (M_3) recorded significantly higher growth parameters (plant height, dry matter accumulation and total number of tillers), yield (grain, straw, biological and HI) and being at par with M_2 proved superior over rest of the treatments. However, the above treatment (M_3) recorded significantly higher functional leaves and RWC over M_0 and M_2 . Scheduling of irrigation to wheat either at 0.9 IW/CPE ratio throughout the growth or 0.8 IW/CPE ratio at vegetative phase + 1.0 IW/CPE ratio at reproductive phase brought about significantly higher yield (grain, straw and biological). So far as saving of irrigation water is concerned, irrigating the crop with 0.8 IW/CPE ratio at vegetative phase + 1.0 IW/CPE ratio at reproductive phase was most effective as the above schedule besides producing almost equal yields also curtailed one irrigation with highest water use efficiency. The treatment combination, I_2M_3 recorded the significantly higher grain yield over rest of the treatment combinations except I_2M_2 , I_5M_2 and I_5M_3 .

EFFECT OF SALICYLIC ACID TO MITIGATE THE HIGH TEMPERATURE STRESS IN WHEAT GENOTYPES

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A field experiment entitled Effect of Salicylic Acid to Mitigate the High Temperature Stress in Wheat Genotypes was conducted at Department of Plant Physiology, S.K.N. College of Agriculture, Jobner during November to April, 2015. Two wheat genotypes namely Raj-4079 & Raj-4120 were sown on 20th November & 20th December under standard package of practices. Salicylic acid was sprayed at two stages i.e. at first 50 DAS stage and at second 80 DAS. The doses of salicylic acid used were control, 50, 100 and 150 ppm. Physiological parameters were recorded in three replications in all the treatment of the both genotypes under normal and late sown at 60 DAS and 90 DAS. Yield was recorded at harvest. Delayed sowing of wheat due to high temperature stress significantly reduced relative water content, chlorophyll stability index, cell membrane stability index and heat stability index. Seed and biological yield were significantly decreased by delayed sown in wheat. But delayed sowing of wheat due to high temperature stress significantly increased the proline content. By application spray of SA, maximum increase being at 150 ppm of SA followed by 50, 100 ppm under normal (20 November) and late (20 December) sown conditions. There was not much change in harvest index to SA spray. But data revealed that relative water content, chlorophyll stability index, cell membrane stability index, heat stability index. However, increased with delay in sowing but significantly decreased proline content with SA treatment. Seed and biological yield increased with delay in sowing but significantly increased all these parameters with SA treatment. The study thus reveals that adverse effect of temperature on physiological parameters and yield of wheat genotypes may be improved by treatment with SA (150 ppm) under normal as well as and late sown conditions. Salicylic acid (SA) at 150 ppm concentration of spray treatment mitigate the effect of high temperature on physiological parameter and yield traits in wheat genotypes with better result in yield. On the basis of the above findings Raj-4079 observed superior over Raj-4120 with respect to maximum parameters increase studied under field conditions.

GROWTH AND YIELD OF SESAME AS INFLUNCED BY INTEGRATED NUTRIENT MANAGEMENT

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A pot experiment was conducted at Agricultural Research Station (Sri Karan Narendra Agriculture University, Jobner), Durgapura-Jaipur using ten with an objective identical drought tolerant varieties of chickpea during the *Rabi* season of 2011-12. Chickpea varieties viz., RSG-888, RSG-973, RSG-807, RSG-991, RSG-963, CSJD-884, RSG-974, RSG-931, RSG-143-1 and RSG-945. The chickpea varieties RSG-143-1 and RSG-973 proved them drought tolerant because these varieties maintained comparatively higher cell sap density, relative water content, chlorophyll and lower specific leaf area under moisture stressed condition.

WEED CONTROL THROUGH HERBICIDE AND PHOSPHORUS MANAGEMENT AS INFLUENCED YIELD AND QUALITY PARAMETER OF CLUSTERBEAN

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A field experiment was conducted under loamy sand soil during *khairf*, 2013 at Agronomy farm, S.K.N. College of Agriculture, Jobner. The treatments comprising six weed control treatments (weedy check, one HW at 20 DAS, two HW at 20 and 40 DAS, pendimethalin @ 0.75 kg/ha, imazethapyr @ 100 g/ha and fenoxoprop-p-ethyl @ 70 g/ha) and four levels of phosphorus (0, 20, 40 and 60 kg/ha) assigned to main and sub plots of split plot design, respectively were replicated thrice. Clusterbean variety 'RGC-1003' was used as a test crop. Results showed that the highest grain, stover and biological yields (1649, 3792 and 5441 kg/ha) were obtained with two hand weeding treatment. Pre emergence application of imazethapyr @ 100 g/ha was the best herbicidal treatment in reducing density and bio mass of weeds and nutrient depletion by weeds and enhancing yield and quality parameters. It also provided grain and stover yields of 1478 and 3347 kg/ha, respectively with the minimum weed competition index (10.39%). It was further noted that two HW at 20 and 40 DAS, imazethapyr @ 100 g/ha and one HW at 20 DAS were found statistically similar and significantly better treatments in enhancing nutrient concentration in grain and stover, protein content in grain but in increasing nutrient uptake by crop, twice HW was found significantly better than rest of the treatments. Results also showed that application of 60 kg P/ha in clusterbean recorded the highest N, P and K concentration in weeds and their depletion by weeds at harvest stage. Every increase in level of phosphorus upto 40 kg/ha significantly improved the yield and quality characters over preceding levels. Being at par with 60 kg/ha, it also provided 94.0, 85.4 and 87.9 per cent more grain, stover and biological yields of clusterbean than control. The highest concentration of N, P and K in grain and stover and their uptake by crop and protein content in grain were also obtained at 60 kg



P/ha. Application of phosphorus at 40 kg/ha combined with two HW at 20 and 40 DAS was found the most superior treatment combination for obtaining higher grain yield in clusterbean. Whereas, application of Imazethapyr @ 100 g/ha (PE) along with 40 kg P/ha was the observed as the best herbicidal combination for getting higher yield.

PRODUCTIVITY AND PROFITABILITY OF FENNEL AS A INFLUENCED BY MICRO- IRRIGATION AT EASTERN PLAIN ZONE OF RAJASTHAN

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The field experiment entitled "Micro-irrigation management in fennel (*Foeniculum vulgare* Mill.)" was conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner during *rabi* season 2012-2013. The experiment consisted of nine treatments of irrigation levels and planting pattern viz. Surface irrigation at 1.0 IW/CPE ratio with normal row planting, drip irrigation at 1.0, 0.8, 0.6 and 0.4 IW/CPE ratios with normal row planting as well as paired row planting. The experiment was laid out in Randomized Block Design with three replications. The objective of the study was to select appropriate irrigation schedule to maximize productivity and profitability of fennel. The results showed that drip irrigation at different IW/CPE ratios significantly increased yield attributes, yields, quality parameters, nutrient content and uptake, water use efficiency and economics, except consumptive use of water over surface irrigation at IW/CPE ratio (control). The results further revealed that the drip irrigation at an IW/CPE ratio 0.8 with paired row planting, being at par with 0.8 IW/CPE ratio in normal row planting and drip irrigation at 1.0 IW/CPE ratio in normal and paired row planting, recorded significantly, umbels/plant (34.80), umbellets/umbel (22.49), seeds/umbel (442.16), seed (33.50 q/ha), straw (79.16 q/ha), biological yields (110.67 q/ha), total N and P uptake, essential oil yields, net returns (218438) and B:C ratio (6.66) over 0.4 and 0.6 IW/CPE ratios with normal and paired row planting. Similarly, drip irrigation at an IW/CPE ratio 0.6 with paired row planting, being at par with 0.6 IW/CPE ratio in normal row planting, also significantly increased the above parameters over 0.4 IW/CPE ratio with normal as well as paired row planting. The further examination of data indicated that the drip irrigation at an IW/CPE ratio 0.6 with paired row planting recorded significantly higher N content in seed and straw, P content in seed, essential oil and protein content in seed over 0.4 IW/CPE ratio in normal and paired row planting and surface irrigation at IW/CPE ratio 1.0, however, it was at par with 0.6 IW/CPE ratio in normal row planting and 0.8 and 1.0 IW/CPE ratio in normal and paired row planting. Results further revealed that the consumptive use was found significantly higher with drip irrigation at IW/CPE ratio 1.0 over surface irrigation at IW/CPE ratio 1.0 as well as drip irrigation at IW/CPE ratio 0.4, 0.6 and 0.8 whereas, drip irrigation with 0.4 IW/CPE ratio in paired row planting recorded statistically higher water use efficiency compared to all other treatment. Application of drip irrigation at 0.8 IW/CPE ratio with paired row planting proved to be the best treatment in terms of growth, yield and economics, however, maximum water use efficiency can be obtained with drip irrigation at 0.4 IW/CPE ratio with paired row planting from fennel.

PROFITABILITY AND PRODUCTIVITY OF FENNEL AS A INFLUENCED BY IRRIGATION AND MOISTURE CONSERVATION PRACTICES

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *rabi*, 2009-10 on loamy sand soil, to study the effect of irrigations and moisture conservation practices on productivity of fennel. The experiment consisting four treatments of irrigation levels (4, 5, 6 and 7 irrigations) in main plots and four treatments of moisture conservation practices (control, dust, plastic and straw mulch) in sub plots thereby, making sixteen treatment combinations were tested in split plot design with three replications. Results indicated that application of 6 irrigations significantly increased the number of branches per plant, dry matter accumulation per metre row length, number of umbels per plant, umbellets per umbel, seeds per umbellet, yields (seed, stover and biological), essential oil content, protein content in seed, nitrogen content in both seed and stover, total N uptake, consumptive use of water and net returns over 4 and 5 irrigations, but remained at par with 7 irrigations. However, water use efficiency was found maximum with 4 irrigations. Results further revealed that application of straw mulch significantly increased number of branches per plant, dry matter accumulation per metre row length, number of umbellets per umbel, yields (seed, stover and biological), protein content in seed, nitrogen content in both seed and stover, total N uptake, water use efficiency and net returns over control, dust and plastic mulch. Whereas, number of umbels per plant, and total N uptake increased and water use decreased significantly with straw mulch as compared to control and dust mulch, but remained at par with plastic mulch. However, in respect of number of seeds per umbellet, the treatment straw, plastic and dust mulch were remained almost same. Application of 5 irrigations with straw mulch proved to be the best treatment combination in terms of number of umbels per plant, seed yield and net returns. Whereas, 4 irrigations along with straw mulch proved the best treatment in terms of water use efficiency.

EFFECT OF SULPHUR AND MOLYBDENUM ON PRODUCTIVITY OF FENUGREEK IN SEMI EASTERN PLAIN ZONE OF RAJASTHAN

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A field experiment was conducted during *rabi* season of 2011-12 at agronomy farm, S. K. N. college of agriculture, Jobner (rajasthan). the treatments comprising four levels of sulphur (0, 20, 40 and 60 kg s/ha) and four levels of molybdenum (0, 0.5, 1.0 and 1.5 kg mo/ha) making total 16 treatment combinations were replicated three times in a randomized block design. The results showed that sulphur application upto 40 kg/ha significantly increased pods per plant, seeds per pod, seed (15.36 q/ha), straw (37.42 q/ha) and biological yields (52.78 q/ha), n concentration in seed and straw, s concentration in seed, N and Mo uptake in seed and straw, S uptake in straw, total uptake of N, S and Mo, protein content in seed and net returns (rs 39244/ha). the sulphur uptake in seed increased significantly with increasing levels of sulphur upto 60 kg/ha. the sulphur application at 40 kg/ha increased the seed yield by 36.5 and 8.8 percent and net returns by 64.5 and 13.0 per cent over control and 20 kg s/ha. Sulphur application could not bring significant improvement in test weight, harvest index and mo concentration in straw.



Application of 1.0 kg Mo/ha significantly increased pods per plant, seeds per pod, seed (15.22 q/ha), straw (37.17 q/ha) and biological yields (52.39 q/ha), N, S and Mo concentration in seed, N concentration in straw, N and S uptake in seed and straw, Mo uptake in seed, total uptake of N, S and Mo, protein content in seed and net returns (Rs 38504/ha) over preceding levels of sulphur. The per cent increase with 1.0 kg Mo/ha was 29.9 and 7.7 per cent in seed yield and 46.7 and 10.0 per cent in net returns over control and 0.5 kg Mo/ha. The increasing dose of molybdenum to fenugreek failed to bring significant increase in test weight, harvest index, S and Mo concentration in straw. Hence, it is concluded that application of 40 kg S/ha and 1.0 kg Mo/ha to fenugreek is most beneficial to increase yield and net returns.

DEVELOPMENT OF BAKERY PRODUCTS BY USING *SPIRULINA PLATENSIS* POWDER THEIR EFFECT OF STORAGE ON FAT ACIDITY

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Baking is stated to be one of the oldest methods of cooking. The cooking process is carried out by dry heat in some kind of oven. Bakery products are prepared from one or more of the flours which are derivative of some cereal grain. Bread, buns, biscuits is a common staple right from prehistoric times but still they are deficient in nutrients. So, the present study was undertaken to develop nutritionally enriched bakery products like biscuits, breads and buns by blending with wheat flour (WH-1105) and *Spirulina platensis* powder at ratio of 98:2, 96:4 and 94:6. Breads and buns were packed in plastic zip lock pouches while biscuits were packed in PET jars and stored at room temperature, (20-25°C). The stored biscuits were evaluated for an interval of 15 days for three months while breads and buns were evaluated at 2 days interval for 7 days at both room and refrigeration temperature. It was found that fat acidity increased with increase in storage period in both control and supplemented biscuits up to 75 days and were found within the acceptable limit as per BIS (30-50 mg KOH/100g). While in breads and buns fat acidity were found acceptable up to 4 days at room temperature and up to 7 days at refrigeration temperature.

Keywords: Bakery products, Supplementation, *Spirulina platensis* powder, Fat acidity

POPULATION DYNAMICS OF ORIENTAL FRUIT FLY, *BACTROCERA DORSALIS* HENDEL (TEPHRITIDAE: DIPTERA) ON CUSTARD APPLE, *ANNONA SQUAMOSA* L.

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Bactrocera dorsalis became the major threats in the field of horticulture and causing considerable yield loss by damaging the fruits. Monitoring of the pest population is essential as one of the procedures in the IPM concept. The study aimed to investigate the seasonal fluctuation of adult males of *B. dorsalis* on custard apple in relation to abiotic factors. A field study on seasonal monitoring and population dynamics of fruit fly, *B. dorsalis* infesting custard apple was conducted in the Division of Horticulture, Zonal Agricultural Research Station (ZARS), Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bengaluru, Karnataka during April 2015 to March 2016 by using methyl eugenol lure trap. To examine the incidence of *B. dorsalis* on custard apple the fruit fly traps were installed in the custard apple orchard and flies collected from the each trap were recorded separately at weekly intervals throughout the study period. The study revealed that the fruit fly population coincides with the maturity and harvesting period, however, during the offseason fruit flies activity was recorded on the mango and sapota orchard. The trap catches of *B. dorsalis* in Fligh-TTM trap was observed with varying intensities ranging from 3.50 to 337 flies/trap, with a mean of 83.57 flies/trap. However, its maximum activity (337 flies/trap) was found during October, whereas population was found to be lower during April (3.5 flies/trap). The trap catches were correlated with the daily prevailing weather data and correlation studies revealed that the *B. dorsalis* population had the significant positive correlation with morning relative humidity (0.43**), evening RH (0.39**) and rainfall (0.32*). Whereas, it has the positive non-significant correlation with minimum temperature (0.14). The data also indicated that the fruit fly population had a negative correlation with the maximum temperature (-0.24) and sunshine hours (-0.32).

MANAGEMENT OF COWPEA WEB BLIGHT WITH COMBINED TREATMENT OF BIOCONTROL AGENT

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Cowpea [*Vigna unguiculata* (L.) Walp.] is an important pulses crop in Indian sub-continent. It is cultivated in *Kharif* season, especially for grain. In Rajasthan total area of cowpea cultivation i.e. 66.3 thousand ha with a production nearly 30.6 thousand tonnes and the productivity is 463 kg per ha. Cowpea web blight has become a serious problem in cowpea growing areas. The anamorph of pathogen causing web blight in cowpea is *Rhizoctonia solani*. *R. solani* is a widespread and an ecologically diverse soil-borne fungus attacking a wide range of hosts. It causes web blight, root rot, stem rot, fruit and seed decay, damping-off, foliar blight, stem canker and crown rot in various crops, but cowpea is especially susceptible to this seedling disease when planted in moist soils coupled with high temperature and humid conditions. The disease is characterized by oval or spindle shaped brown black lesions having length ranging from 0.2-8 cm at soil level near collar region and girdling the basal portion of the stem. Due to several adverse effects associated with chemical control of diseases and management of *R. solani* is also very difficult with fungicides and cultural methods, hence biological method of its management is being promoted. It operates via several mechanism viz., amensalism, competition and parasitism. Antibiotic molecules include antibiotics, bacteriocins, HCN, and several other extracellular metabolites, they pose inhibitory or cidal effects individually or in combination against pathogen. Microorganism isolated during the course of studies were tested for antagonism to *R. solani* and on the basis of mode of antagonism against *R. solani* under *in vitro* conditions, best bioagents



were used as sole application and combination of bioagents as seed treatment, soil application and both seed treatment and soil application. The combined treatment of bioagent (ST+SA) gave maximum protection against the web blight disease. The combined treatments of bioagents were relatively more effective with less mortality per cent, more cowpea plant survival and increased root, shoot length, fresh and dry weight and more grain yield as compared to individual treatment.

Keywords: Cowpea, web blight, *R. solani*, bioagents

EFFECT OF ZINC AND THIOUREA APPLICATION ON GROWTH AND YIELD OF GREENGRAM [VIGNA RADIATA (L.) WILCZEK]

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2016 on loamy sand soil. The experiment comprising of four levels of zinc (0, 2.0, 4.0 and 6.0 kg/ha) and five treatments of thiourea application (control, seed soaking with 500 ppm, foliar spray at branching (500 ppm), foliar spray at flowering initiation (500 ppm) and foliar spray at branching and flowering initiation with 500 ppm) thereby making 20 treatment combinations was laid out in randomized block design and replicated thrice. Results showed that progressive increase in level of zinc upto 4.0 kg/ha significantly increased the growth and yield attributing characters of greengram viz., plant height, branches/plant, dry matter accumulation at most of stages, chlorophyll content, LAI, number and weight of nodules/plant, number of pods/plant, number of grains/pod and test weight over preceding levels. However, it was found at par with 6.0 kg/ha, wherein the maximum values of growth and yield attributes were obtained. Being at par with 6.0 kg/ha, zinc fertilization at 4.0 kg/ha also fetched 12.3 and 60.5 per cent more net returns with highest B:C ratio 3.27, over 2.0 kg/ha and control, respectively. The maximum zinc use efficiency was recorded when its level was raised from 0 to 2.0 kg/ha. Foliar spray at branching and flowering initiation (500 ppm) was found significantly superior among all the treatments with respect to growth and yield determining characters of greengram. It also improved the grain, straw and biological yield to the extent of 40.3, 35.3 and 37.2 per cent over control. It also represented the maximum net returns of ₹ 53155/ha with the highest B: C ratio (3.33) among all the thiourea treatments.

NUTRIENT CONTENT AND UPTAKE AS A INFLUENCED BY FOLIAR APPLICATION OF IRON ON CLUSTERBEAN VARIETIES

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2014 on loamy sand soil. The twenty treatment combinations consisting of five clusterbean varieties (RGC-986, RGC-1003, RGC-1033 RGC-1055 and RGC-1066) and foliar spray treatment of 0.5 % FeSO₄ (control, branching, flowering and branching +flowering) were tested in randomized block design with three replications. Results revealed that variety RGC-1033 proved significantly superior to RGC- 986, RGC-1003, RGC-1033 and RGC-1066 in respect of N, P, K and Fe concentration and their uptake by grain and stover and protein content in seed. Similarly, the seed yield (1816 kg/ha), stover yield (3787 kg/ha) and biological yield (5602 kg/ha) were also significantly higher with variety RGC-1033. Result showed that foliar spray 0.5% FeSO₄ at branching, at flowering and at branching + flowering stage resulted in significantly higher seed, stover and biological yield, N,P, concentration in seed and stover and their uptake and protein content in seed. Foliar application of 0.5% FeSO₄ at branching which was at par with application of 0.5% FeSO₄ branching + flowering stage (D42288/ha) with B:C (1.77).

THE EFFECT OF ZINC ON GROWTH AND YIELD OF OKRA [ABELMOSCHUSESCULENTUS (L.) MOENCH]

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The experiment consisted of 20 treatment combinations with five organic manures (control, 6.0 t VC/ha, 7.5 t VC/ha, 20.0 t FYM/ha, 25.0 t FYM/ha) and four zinc levels (control, 2.5 kg/ha 5.0 kg/ha and 7.5 kg/ha) in Randomized Block Design with three replications. Results further indicated that application of 7.5 kg per ha. zinc significantly enhanced the plant height, number of branches per plant, leaf area, chlorophyll content in leaves, fruit length and diameter, number of fruit per plant, fruit yield per plant, fruit yield per plot, fruit yield per hectare. Lower levels and also proved at par with 5.0 kg zinc per ha. The results reported in preceding chapter revealed that Zinc levels significantly increased the plant height (45 DAS and at harvest), number of branches per plant, leaf area and chlorophyll content. Application of 7.5 kg Zinc per ha exhibited maximum plant height at 45 DAS (95.46 cm) and at harvest (118.23 cm), number of branches per plant (2.58), leaf area (116.80cm²) and chlorophyll content (1.60 mg/g) followed by application of 5.0 kg Zinc per ha. Their findings clearly indicated that Zinc played a significantly role on enhancing the growth of okra. The beneficial effect of Zinc on plant growth might be attributed to the fact that the zinc might be due to supply of micro nutrients, availability and uptake nutrients from soil due to favorable conditions. The physiological parameters pertaining to photosynthesis, stomatal conductance and transpiration also exhibited significant increment with zinc supplied through zinc sulphate in soil. It also influenced cell division, meristematic activity of tissues and expansion of cell and formation of cell wall. Application of 7.5 kg Zinc per ha significantly increased the fruit length (11.70 cm), fruit diameter (2.14cm), number of fruit per plant (22.33), fruit yield per plant (233.67g), per plot (5.61 kg) and per ha (129.81q). Followed by 5.0 kg Zinc per ha. The beneficial effect of zinc on yield attributes and yield might be due to enhanced supply of micro nutrients during entire growing season. Significant increase in yield under the reference of zinc was largely a function of improved growth and the consequent increase in different yield attributes and yield. Further, zinc might have increased the efficiency of added



chemicals fertilizer in soil and increase the rate of humification of zinc enhances the availability of both native and added nutrients in soil and thus yield of okra increased.

SURVIVAL OF *APHELENCHOIDES BESSEYI* IN PROSOMILLET (*PANICUM MILIACEUM*)

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The TNAUs germplasm Prosomillet of 2009, 2010, 2011 and 2012 harboured *Aphelenchoides besseyi*, the survival of the nematodes for a long duration suggested their survival more than survival of rice white tip nematode. The nematodes remain viable in stored seeds. Foliar nematode, *Aphelenchoides besseyi* is of great concern for profitable cultivation of proso millet (*Panicum miliaceum*). Attempts were made for the studies on population dynamics of *Aphelenchoides besseyi* in different germplasm of proso millet seems to be the first study of its own kind, but need further confirmation. The Present investigation included nine containinated germplasm of prosomillet (*Panicum miliaceum*) namely -TNAU-137, TNAU-145, TNAU-149, TNAU-151, TNAU-155, TNAU- 164, TNAU-183, TNAU-191 and TNAU- 194. The germplasm needs of four years 2009 to 2012were collected for studies to fulfil the requeriment of study, the investigationswere carried out of in filed and laboratery during 2014-15. To determinethe survival of *Aphelenchoides besseyi* obesrvation were recorded on seed weight and nematode popolation out of 250 seeds, germination percentage out of 100 seeds, and nematode population per seed. The germplasm of Prosomillet should be exposed even for longer period to find out the *Aphelenchoides besseyi* survival.

RESPONSE OF CLUSTERBEAN VARIETIES TO FERTILITY LEVELS AND AGRO-CHEMICALS ON YIELD AND QUALITY PARAMETERS

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2013 on loamy sand soil. The eighteen treatment combinations consisting of two clusterbean varieties (RGC-1038 and RGC-1066) and three each of fertility levels (Control, 50 and 100% RDF) and agro-chemicals (Control, 500 ppm Thiourea , 100 ppm TGA spray at vegetative and pre flowering stages) were tested in randomized block design with three replications. Results revealed that variety RGC-1066 proved significantly superior to RGC-1038 in respect of seed yield (1300 kg/ha), stover yield (3297 kg/ha) and biological yield (4597 kg/ha) were also significantly higher with RGC-1066. The significantly higher values of nitrogen and phosphorus concentration in seed and stover and protein content in seed, total uptake of nitrogen, phosphorus and potassium, net returns (Rs 34395/ha) and B:C ratio (1.41) were also recorded with variety RGC-1066. Results further indicated that application of 100% RDF significantly increased the seed, stover and biological yield, protein content in seed and total uptake of nitrogen, phosphorus and potassium, net returns (Rs 39937/ha) and B:C ratio (1.58) over preceding levels. Whereas, test weight, nitrogen and phosphorus concentration in seed and stover increased significantly upto 50 % RDF which remained at par with 100% RDF. Results also showed that among the agro-chemicals, application of thiourea @ 500 ppm as foliar spray being at par with TGA @ 100 ppm, significantly increased the seed, stover and biological yield, N and P concentration in seed and stover and protein content in seed and total potassium uptake, net returns (Rs 35617/ha) and B:C ratio (1.45) over control.

RESPONSE OF URDBEAN[*VIGNA MUNGO* (L.) HEPPER] TO PHOSPHORUS FERTILIZATION AND THIOUREA

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner in Jaipur district of Rajasthan during kharif season of 2015 on loamy sand soil. The experiment consisted of four levels of phosphorus (0, 20, 40 and 60 kg/ha) and five thiourea treatments (control, thiourea 500 ppm at branching, thiourea 500 ppm at branching and flowering, thiourea 1000 ppm at branching and thiourea 1000 ppm at branching and flowering). The total 20 treatment combinations were tested in randomized block design with three replications. Urdbean variety T- 9 was sown on 4th July, 2015 in the rows spaced 30 cm apart. Results revealed that progressive increase in level of phosphorus upto 40 kg/ha significantly increased the growth and yield determining characters of urdbean viz., plant height, number of branches/plant and crop dry matter accumulation/m row length at most of the stages, number and weight of root nodules/plant, number of pods/plant, seeds/pod and test weight over lower levels. It also recorded significantly higher seed (1164 kg/ha), straw (2272 kg/ha) and biological yield (3437 kg/ha) of urdbean over 20 kg/ha and control. The above treatments remained at par with 60 kg P₂O₅/ha. Results further indicated that application of thiourea 500 ppm at branching and flowering significantly enhanced the plant height, number of branches/plant, dry matter accumulation, total and effective nodules/plant, fresh and dry weight of nodules,number of pods/plant, seeds/pod and test weight over thiourea (500 and 1000 ppm) at branching and control. Consequent upon the higher values of yield attributes the significantly higher seed, straw and biological yields of urdbean (1167, 2270 and 3437 kg/ha) was also obtain under the above treatment.

GROWTH RESPONSE OF MAIZE TO *PARTHENIUM* WEED MANURES

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A field experiment was conducted to assess the influence of *Parthenium* weed manures on the nutrient contents and yield of maize. The experiment was laid down in a randomized block design (RBD) with six treatments and four replications. The treatments viz. green manure (GM), compost (CM), vermicompost (VM) and dry leaf manure (DM) were applied in comparison with fertilized (FE) and unfertilized



checks (CO). The inorganic fertilizers were applied at a rate of 120, 80 and 40 kg N, P and K ha⁻¹ respectively. The maize (cv. African Tall) was planted at the rate of 100 kg ha⁻¹. Plots consisted of nine rows spaced 30 cm apart and with the size 3 x 3 m². The morph-physiological traits of the crop were noted at 70 and 100 days after sowing (DAS). On the basis of the results obtained, it can be concluded that the application of green manure (GM) was more effective in increasing the growth, nutrient uptake and productivity without any detrimental effect on maize crop.

EFFECT OF DIFFERENT FUNGICIDES AGAINST *PYRICULARIA GRISEA* AT BOOTING STAGE IN BASMATI RICE

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Rice is an important staple food grain crop in India. Basmati rice is an important export commodity among the food grains. Basmati rice is having the characteristics of extra-long slender grains having soft and fluffy texture upon cooking, delicious taste, superior aroma and distinct flavour. The total area of Basmati rice in India is about 2.10 million hectares and production is 8.70 million tonnes. The area of Basmati rice in Uttar Pradesh is 354.39 thousand hectare with a production of 1260.69 thousand tons. The average productivity of Pusa Basmati-1121 is 35.0 Q/ha this variety is very much in demand. There are several biotic and abiotic factors behind the low productivity of Basmati rice. But Blast disease caused by *Pyricularia grisea* is also a serious disease as compared to other diseases of Basmati rice. This disease generally causes yield loss of 10-20% but in severe cases yield loss may reach up to 80%. In India, Bhatt 1988 reported more than 65% yield loss in Basmati rice. Used various fungicides such as tricyclazole, hexaconazole, carbendazim, propiconazole and isoprothilane against blast in basmati rice. The percentage leaf blast average of two years was tune 13.96% incidence followed by isoprothiolane 15.433% with control 37.77%. Proportionately different fungicides the per cent disease was significantly less tricyclazole sprayed plots followed by isoprothiolane others. The average of two years lowest leaf blast incidence in tricyclazole and highest per cent disease control average of two years by tricyclazole compression to others fungicide was recorded.

ROLE OF CYANOBACTERIA IN NITROGEN FIXATION

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Cyanobacteria Blue green algae (BGA) are one of the major components of the nitrogen fixing microbes. Cyanobacteria have a unique potential to contribute to enhance to productivity in a variety of paddy. Cyanobacteria are group of photosynthetic, nitrogen-fixing bacteria that live in a wide variety of moist soils and water either freely or in a symbiotic relationship with plants or lichen-forming fungi (as in the lichen genus *Peltigera*). They range from unicellular to filamentous and include colonial species. Clones may form filaments, sheets, or even hollow spheres. Some filamentous species can differentiate into several different cell types, vegetative cells-normal, photosynthetic cells that may form when environmental conditions, akinetes-climate resistant spores that may form when environmental condition become harsh, thick-walled heterocyst's-which contain the enzyme nitrogenase, vital for nitrogen fixation. Cyanobacteria can fix atmospheric nitrogen in anaerobic conditions by means of specialised cells called heterocyst may also form under the appropriate environmental conditions (anoxic) when fixed nitrogen scarce. Heterocyst-forming species are specialized for nitrogen fixation and are able to fix nitrogen gas into ammonia (NH₃), nitrites (NO₂) Or nitrates (NO₃), which can be absorbed by plants and converted to protein and nucleic acids (atmospheric nitrogen is not bioavailable to plants, except for those have endosymbiosis nitrogen-fixing bacteria, especially the Fabaceae family, among others). Free-living Cyanobacteria are present in the water of rice paddies, and cyanobacteria can be found growing as epiphytes on the surfaces of the green alga, Chara, where they may fix nitrogen. Cyanobacteria such as *Anabaena* (a symbiotic of the aquatic fern *Azolla*), can provide rice plantations with bio fertilizer. Importance Cyanobacteria play an important role in maintenance and build-up of the soil fertility. Blue green algae (BGA) are photosynthetic nitrogen fixer and are free living. Cyanobacteria are capable of obtaining various kind pollutants and have advantage as potential of biodegrading organism. It also increases soil phosphate by excretion of organic acids.

Keywords: Cyanobacteria, Nitrogen fixation, Nitrate, Nitrite

BREAKDOWN OF THE BT GENE RESISTANCE AGAINST LEPIDOPTERAN INSECTS IN COTTON

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One of the best modern plant protection measure against plant-eating insects is adoption of transgenic approaches. Transgenic means individual having gene from unrelated source. Many economically important crops such as cotton has been transformed with genes encoding insecticidal proteins from *Bacillus thuringiensis* (*Bt*) to confer them protection against the most important insect pests like lepidopteran. Plants have been genetically engineered to produce their own *Bt* crystal protein (CP), which is toxic to the pest species of concern insects. Most *Bt* cotton plants commercially contains *cry1Ac* or a combination of gene of *cry1Ac* and *cry1Ab*. *cry1Ac* is highly active against the lepidopterans that feed on the cotton bolls. In China, the cowpea trypsin inhibitor gene (*CpTi*) was combined with a *cry1Ac* gene to produce a pyramided gene product. Cotton has also been transformed with *vip3A* gene (a *Bt* gene producing a secreted insecticidal protein). But now insects have evolved resistance against *Bt* gene and plant defense mechanisms. Hence to maintain this resistance there are several strategies such as high dose of the insecticidal protein along with an adjacent refuge plot of non-*Bt* plants has been chosen as the most effective. Second approach is the gene pyramiding and pyramided *Bt* crops hold great promise and, in combination with the high dose/refuge strategy, may likely confer maximum protection to the *Bt* crop technology against insect resistance. Constitutive expression of transgenes pose an energy expenditure load on the plants and a



strong selection pressure on the insect populations that feed on them. Hence the other approach to overcome this problem is Tissue-Specific Expression of gene.

MANAGEMENT OF NEWLY EMERGED BLAST (*Pyricularia grisea*) DISEASE IN WHEAT

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A newly emerged disease, the Wheat blast disease caused by *Pyricularia grisea* (teleomorph *Magnaporthe grisea*) has become a serious restriction on increasing the area and production of the crop, especially in the tropical parts of the Southern Cone Region of South America. First identified in 1985 in the State of Paraná in Brazil, it has become an endemic disease in the low lying Santa Cruz region of Bolivia, south and south-eastern Paraguay, and central and southern Brazil in recent years. Severe infections have also been observed in the summer planted wheat crop in north-eastern Argentina. So far, only sporadic infections have been seen in Uruguay, especially during the wet and warm years. Spike infection (often confused with *Fusarium* head blight infection) is the most notable symptom of the disease and capable of causing over 40% production losses. The recent appearance of wheat blast in Bangladesh demonstrates the threat of global spread, which could occur via the movement of infected seed or grain. Wheat blast is mainly a spike disease but can also produce lesions on all the above ground parts of the plant under certain conditions. Depending upon the point of the infection on the rachis, the disease can kill the spike partially or fully. The infected portion of the spike dries out without producing any grain which can be visibly distinguished from the healthy portion. The effect of potassium phosphite and synthetic fungicides like as K_2HPO_3 (1ml l^{-1}), epoxinazole + pyraclostrobin (700 ml ha^{-1}), tebuconazole (600 ml ha^{-1}), tebuconazole + trifloxystrobin (750 ml ha^{-1}) and non-treated control. Synthetic fungicides demonstrated an average blast control of 55% by severity values. Combined results carried out under environmental conditions highly conducive to disease management.

ROOT-MEDIATED ALLELOPATHIC INTERFERENCE OF *NICOTIANA PLUMBAGINIFOLIA* VIV. ON *SETARIA VIRIDIS*.

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An assessment was conducted to evaluate the potential and nature of root-mediated allelopathic interference of *Nicotiana plumbaginifolia* on *Setaria viridis*. Early growth of *S. viridis* reduced significantly in agar medium containing root exudates of *N. plumbaginifolia* seedlings as well as in its rhizosphere soil. The metabolites released by roots of donor plant in the growth media showed inhibitory effect on *S. viridis*. Even the soil integration of root residues also reduced the growth of recipient plant in terms of seedling length and seedling dry biomass. Only a partial enrichment in growth inhibition occurred upon activated charcoal supplementation or nitrogen fertilization in these amended soils. Root residues did not alter the bioavailability of nutrients in the soil, which was rather nutrient rich. These results indicated the definite role of allelopathy of *N. plumbaginifolia* roots in retarding *S. viridis* growth. Root amended soils contained a significantly higher amount of phytotoxic phenolics as the putative allelochemicals, which were ferulic acid, vanillic acid, p-coumaric acid and benzoic acid. The study concluded that the donor weed, *N. plumbaginifolia* roots and their exudates exerted allelopathic effects on *S. viridis* by releasing water-soluble phenolics as putative allelochemicals in the soil.

Keywords: activated charcoal, amended soils, phenolics, root residues.

MILLETS AS CLIMATE RESILIENT CROPS

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Millets are staple crops of the poorest people in the semi-arid tropics of Asia and Africa. India is the largest producer and consumer of millets. Millets are grown in dry lands and important in hill and tribal agriculture -food security of disadvantaged regions. Require less water, mature early and cultivated in scarcity conditions - Grown under low rainfall (200- 600 mm) areas. Highly resilient in adapting to different ecological conditions, ideal crops for climate change and contingency plantings. Being C_4 plants these are more environment friendly with high water use efficiency and low input requirement, but equally responsive to high input management. Unique nutritional properties – high fiber, quality protein & mineral composition, being called as “Nutri-cereals”. Millets are climate resilient and highly adaptable to wide range of environmental conditions. Efficient biomass producers, Armoured with C_4 photo respiratory physiology - thrive better under moisture stress, Photosensitivity also related to soil moisture. Millets have multiple uses in food (including health foods), feed, fodder (dry & green), and industrial raw materials (including bioethanol from sweet stalk sorghum) Therefore, millets are “Resource Smart & Climate Smart”.

ON THE TRAIL OF INDIGENOUS MEDICINES AND ITS ROLE IN DEVELOPMENT OF MODERN MEDICINE

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Attempts by various communities worldwide to search out medicinal virtues are warranted by the age-old records of indigenous remedies. Medicinal plants have not lost their significance even during the age of great development and progress in chemistry. Nay, modern science researches have widened and made more precise our knowledge of the chemical effect and composition of the active constituents which help decipher medicinal virtues of plants. The present authors studied some such taxa from ethnobiological point of view with particular emphasis on medicinal values. This is an effort to prove the strength of indigenous medicines in the development of modern medicines. The roots of



the latter find way in the former. The folk medicinal claims / indigenous medicines gave rise to modern medicines. This is supported by the present author by citing many examples. Both are compared chemically and utility point of view highlighting the standpoint that indigenous knowledge culminated into modern medicine.

Keywords: Indigenous Medicine, Modern Medicine.

SOIL FERTILITY MANAGEMENT TO SUSTAIN PRODUCTION AND COMPARISON OF THREE METHODS FOR SOIL FERTILITY QUALITY SPATIAL SIMULATION WITH UNCERTAINTY ASSESSMENT

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Soil fertility refers as the inherent capacity of soil to provide the nutrients to the plants in proper balance for better plant growth. It is a result of the physical, chemical and biological processes that act together to provide nutrients, water, aeration and stability to the plant, as well as freedom from any substances that may inhibit growth. Within this definition, it is useful to distinguish between those components of fertility which change relatively slowly, perhaps over the course of a rotation, or in some cases, decades, and the more immediate contribution from materials such as fertilizers and manures. The term 'inherent fertility' is used to describe these more stable characteristics, while recognising that they are, to a large extent, products of soil management. Spatial information of soil fertility quality is crucial for sustainable agriculture management. This study compared three methods based on sequential Gaussian simulation for spatial simulation of soil fertility. These methods are different in data utilization and simulation procedure: Method 1 first calculates simulation of soil fertility quality index (SFQI) sample data from the sample data of soil fertility indicators and then simulates the spatial distribution of SFQI with incorporation of land use information; Method 2 is similar to Method 1 except that land use information is not used; and Method 3 first simulates soil quality indicators using their sample data and then derives each SFQI realization from randomly grouped realizations of different soil quality indicators. Balanced soil fertility management through integrated nutrient management involving judicious combinations of manures, fertilisers and biofertilisers must be done to ensure normal growth and high productivity of the crops. The only possible scope to maximize crop production with the available varieties is to enhance and sustain the productivity through integrated and balanced soil fertility management practices.

Keywords: soil fertility, inherent capacity, fertiliser, biofertiliser, SFIQ, INM, sustainable agriculture

CHARACTERIZATION AND FIELD PERFORMANCE OF STRAWBERRY (*FRAGARIA X ANNANASA* DUTCH) GERMPLASM FOR GROWTH, YIELD AND QUALITY ATTRIBUTES

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Thirty varieties of strawberry collected from different sources were evaluated for two years under temperate conditions of Kashmir valley. The experiment was carried out in the experimental farm of Division of Fruit Science, SKUAST-Kashmir, Shalimar campus, Srinagar in a randomized block design with three replications. The data was recorded on various growth, yield and biochemical characteristics of fruit. The studied germplasm showed variation for majority of the traits. Plant height during peak harvest ranged from 14.67 to 36.52 cm and Sweet Charlie (36.52 cm) exhibited the tallest plants closely followed by Camarosa, Henna and Ofra. Maximum number of leaves per plant was produced by Chandler (46.67). Sweet Charlie, Florida and Festival produced flowers for maximum number of days i.e. for 72 days whereas Larson flowered for 38 days. Maximum number of runners per plant was obtained in Katrain Sweet (18.6) followed by Camarosa (18.0) and Sweet Charlie (17.2), however maximum number of berries per plant was produced by Henna (18.1) closely followed by Camarosa (17.6). Maximum weight of berries was recorded in Camarosa (17.50 g) closely followed by Chandler (17.22 g), Sweet Charlie (16.88 g) and Festival (16.80 g). Camarosa also produced maximum yield per plant (454 g) followed by Florida (432 g), Ofra (422 g) and Camarosa (416 g). Highest total soluble solids (TSS) were found in Sweet Charlie (13.1 %) with minimum titrable acidity (0.67 %) followed by Festival, Camarosa and Chandler. It is clear from the present study that Camarosa along with Sweet Charlie, Festival are the major varieties which can easily replace the Chandler variety which is the only commercial cultivar performing better in the Kashmir valley.

IPM AN EFFECTIVE SOLUTION FOR LESS USE OF PESTICIDES AND THEIR DRASTIC THREAT TO ENVIRONMENT

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Human population continues to increase along with expectations for higher quality food and more resource-intensive production including animal agriculture. The higher quality food in turn needs good protection from diseases and pests for this purpose synthetic pesticides and fungicides are being used but these cause great threat to environment like pollution of ground and surface water, air pollution; declines in the health of critical pollinators and other beneficial organisms; loss of soil and carbon sequestered in soil; increases in greenhouse gases; and declines in biodiversity. Continued use of pesticides also causes insect resurgence so there is an urgent need for developing and improving alternative pest control methods in horticulture. Integrated Pest Management (IPM) aims to reduce and control the damage caused by pests by making use of ecological interactions between the pest, their antagonists and the environment. IPM usually involves combined use of pesticides, pest antagonists, mass trapping, and environmental manipulation. IPM programmes are very site specific. It is based on the identification of pests, accurate measurement of pest population, assessment of damage levels, and knowledge of available pest management strategies or tactics that enable the specialist to make intelligent decisions about control. IPM offers the possibility of improving the effectiveness of pest control programmes while



reducing some of the negative effects. Many successful IPM programmes have reduced pesticide use and increased protection of the environment. Hence there is a need to convey the farmers to adapt IPM over use of synthetic pesticides so as to have the quality food without effecting the environment.

EFFICACY OF GROWTH RETARDANTS (PROHEXADIONE CALCIUM AND PACLOBUTRAZOL) ON STORAGE LIFE OF PEAR CV. "CLAPP'S FAVOURITE"

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Present investigation was carried out to study the efficacy of growth retardants viz., prohexadione calcium and paclobutrazol on storage life of pear cv. 'Clapp's Favourite' during the year 2015-2016. The experiment was laid out with thirteen treatments replicated thrice on 12 year-old-pear tree with uniform vigour and health under uniform cultural practices. The treatment comprises of single and double spray of growth retardants i.e., Prohexadione calcium (100 ppm, 200 ppm and 300 ppm) and paclobutrazol (100 ppm, 200 ppm and 300 ppm). The orchard soil was moderately deep with good fertility status. Data was recorded on storage life of the pear at (7, 14, 21 and 28 day's interval) and results revealed that both the growth retardants prohexadione calcium and paclobutrazol had showed a significant influenced on total sugars, TSS, acidity and physiological loss in weight. Highest value 0.20 per cent for total sugars was recorded with prohexadione calcium @ 200 ppm sprayed twice at 28 day's interval of storage whereas minimum value for total sugars was recorded in control. Application of prohexadione calcium and paclobutrazol had also showed a significant influenced on TSS and fruit acidity content of the fruit. Maximum TSS and acidity (15.31 and 0.20 %) was recorded with an application of prohexadione calcium @ 200 ppm sprayed twice. Results also revealed that minimum physiological loss in weight (14.17 %) was recorded with an application of prohexadione calcium @ 200 ppm sprayed twice.

UNDERUTILIZED FRUIT VARSITY OF NORTHERN HIMALAYAN REGION OF INDIA

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India is the second largest producer of the fruit crops in the world. Biodiversity is considered essential for food security and nutrition for the entire world. The traditional knowledge of dietary food practices has long history in relation to human nutrition. Biodiversity conservation and sustainable development are two inter-related branches focusing on social progress, economic growth and environmental protection on one side, and ecosystem conservation on the other. Wild edible plants have been the mainstay of human diet for centuries. North-Himalayan region, being rich in plant diversity, has a very large number of Non-traditional or underutilized fruit crops. Fruits are rich source of nutritional value like vitamins, minerals, Fat, proteins and medicinal value. The North Himalayan region of India comprising eight states namely Jammu and Kashmir, Uttarakhand, Himachal Pradesh and parts of Punjab, Haryana, Rajasthan, Delhi and Uttar Pradesh has vast physiographical variations, which have been represented in five agro climatic zones. Fig, mulberry, quince, loquat, strawberry, pistachionut, chestnut, hazelnut and other temperate fruit crops are present in North-Himalayan region of India. North Himalayan region is one of the richest reservoir of genetic variability and diversity of different fruit crops that is various kinds of fruits. The diversity for fruit crops of this region has mainly been managed by local farmers, often women.

NEW MODIFIED RATIO ESTIMATOR FOR POPULATION MEANS USING TWO AUXILIARY VARIABLES IN STRATIFIED SAMPLING

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In survey sampling, it is always advantageous to use the information available on the auxiliary variable which is correlated with the variable of interest. As the use of auxiliary information increases the precision of estimators for estimating the population parameters. The use of such auxiliary information is made through different methods of estimation such as ratio, regression, product, difference type, exponential type estimators. The present study is taken into consideration to discuss the problem of estimation of population mean through ratio method of estimation in stratified sampling using the information of two auxiliary variables. The expressions for the mean square error of the proposed estimator have been derived upto the first order approximation and are compared with the existing estimators. Also an empirical study has been carried out in order to show that the proposed estimators turn out to be more efficient than the existing estimators and for this we have considered the real data sets of Agriculture.

RECENT ADVANCES IN MOLECULAR BREEDING IN POMEGRANATE

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Pomegranate is known as super apple or apple with many seeds due to its high nutritive property, medicinal property, therapeutic property and antioxidant capacity. It is commercially grown in arid and semiarid regions, throughout the year. For increasing in identification and



collection of new germplasm, recently molecular markers are used. Morphological markers include traits such as plant height, disease response, photoperiod, sensitivity, shape or colour of flowers, fruits or seeds etc. But in pomegranate mainly DNA based markers are like RFLP, RAPD, AFLP, SSR and ISSR markers are used. Recently, Markers are used to test clonal fidelity of pomegranate plants raised through tissue culture. RAPD, AFLP and SSR markers are used mostly to identify the genetic diversity in pomegranate and also used to survey the phylogenetic relationships in this crop. It is referred that pay the more attention in future for the application of molecular markers to pomegranate research for important aspects such as assessment of genetic diversity, identification of QTLs, gene cloning, diseases diagnosis, molecular linkage map, marker-assisted selection breeding, germplasm valuation and identification, etc. which help a basis for the conservation of pomegranate germplasm resources, identification of genetic relationship and selective breeding of elite cultivars.

CHARACTERIZATION OF *RHIZOBIUM* STRAINS FROM *VIGNAMUNGO* (L.) HEPPER, *CICERARIETINUM* AND *VIGNARADIATA*(L) IN MUZAFFARNAGAR REGION OF UTTAR PRADESH

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In present investigation Urd (*Vignamungo* (L.) Hepper, chickpea (*Cicerarietinum* L.) and moong (*Vignaradiata* L.) were studied for isolation, identification, biochemical and antibiotic activities characterization of *Rhizobium* strains. A total of 37 samples were screened out of which 27 samples of *Cicerarietinum*, 5 samples of *Vignamungo* and 5 samples of *Vignaradiata* were collected from different fields of surrounding area of Muzaffarnagar, Uttar Pradesh. On the basis of white mucoid growth on YEMA medium only 3 samples from *Vignamungo*, 18 (*Cicerarietinum*) and none of sample *Vignaradiata* from were found positive for the presence of *Rhizobium*. In Gram staining reaction all the 21 (18 from chickpea and 3 from urd) isolates were found Gram-negative and rod shaped. Biochemical characterization of *Rhizobium* strains showed that all the 21 isolates have negative reaction with Citrate utilization test, Starch utilization test was positive with all isolates except for U1, C3, C13 and C24, Glucose peptone agar test was positive with all isolates except for C 18, negative results were found with Gelatin test for all isolates and Catalase test was found positive for all isolates. All the isolates were found sensitive to Ciprofloxacin (Cf) except C12 which was partially resistant, Ofloxacin (Of) except C2 which was partially resistant. Norfloxacin (Nx) was susceptible to 11 isolates, resistant to 7 isolates and partial resistant to 3 isolates. Levofloxacin (Le) and Gatifloxacin (Gf) were susceptible to all isolate but Levofloxacin (Le) was partial resistant to C3, C8 and C14. All the isolates, on the other hand, showed resistance to antibiotics Aztreonam (Ao) and Co-trimoxazole (Co) were showed resistant while Nitrofurantoin (Nf) showed partial resistance to isolates with few exception.

EFFECT OF DIFFERENT BIO-CONTROL AGENTS ON ROSE POWDERY MILDEW UNDER GREENHOUSE CONDITIONS

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Seven bio-control agents viz. *Ampelomyces quisqualis*, *Pseudomonas fluorescence*, *Trichoderma viride*, *Saccharomyces cerevisiae*, *Bacillus subtilis*, *Verticillium lecanii* were evaluated under *in vitro* & greenhouse conditions. The least conidial germination (14.26 %) & maximum conidial germination inhibition (77.19 %) in respect of *Bacillus subtilis* followed by *Ampelomyces quisqualis* with 15.01 per cent & 74.24 per cent of conidial germination & its inhibition respectively. Maximum (34.89 %) conidial germination & lowest (44.18 %) conidial germination inhibition was recorded in *Pseudomonas fluorescence*, which was closely followed by the yeast with 33.73 per cent of conidial germination & 46.03 per cent of inhibition. The most effective treatment in inhibition of germ tube elongation was *Bacillus subtilis* (22.00 µm) followed by *Ampelomyces quisqualis* (24.22 µm) while least effective was yeast (56.83 µm) but superior to control (114.67 µm) with regard to germ tube length. The best disease control under greenhouse conditions were obtained with *Ampelomyces quisqualis* (78.51 %), *Bacillus subtilis* (74.12 %), *Verticillium lecanii* (70.55 %) and *Trichoderma harzianum* (67.33 %) which possessed minimum level of disease with range of 16.53 to 25.17 per cent in managing the powdery mildew compared to *Pseudomonas fluorescence*, yeast and *Trichoderma viride* where the control fall between 53.91 to 62.53 per cent.

INCREASING IMPORTANCE OF BIOLOGICAL CONTROL OF PLANT DISEASE

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Biological control has become an attractive alternative strategy for the control of plant diseases to reduce the excessive use of agrochemicals and its health hazards. Due to excessive use of agrochemicals causing environmental pollution and harmful to beneficial microorganism. There are various naturally occurring soil microbes that aggressively attack on plant pathogens and plants are benefited by disease suppression and hence referred to as biocontrol agents. There are many biocontrol agent like *Trichoderma* sp., *Bacillus* sp., *Pseudomonas* sp., *Verticillium* sp., which manage the plant disease. Besides this, biocontrol agents also help in controlling insect pests and weeds. Biocontrol agents comprise of multiple beneficial characters such as rhizosphere competence, antagonistic potential, and ability to produce antibiotics, lytic enzymes and toxins. These biological control activities are exerted either directly through antagonism of soil-borne pathogens or indirectly by eliciting a plant-



mediated resistance response. The mechanisms of biocontrol involve antibiosis, parasitism, competition for nutrients and space, cell wall degradation by lytic enzymes and induced disease resistance.

UNFRUITFULNESS IN ARID AND SEMI-ARID ZONE FRUIT CROPS: CAUSES AND REMEDIES

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Fruit crops are indispensable part of agriculture in arid and semi-arid region of India; they are potential source of income and dietary nutrients in these areas. The unfruitfulness is one of the serious problems of many orchards and its causes need to be understood properly for obtaining economically acceptable production level. Unfruitfulness is a state in which a plant is unable to bloom, set fruit or carry them to maturity. The causes of unfruitfulness can be either internal or external factors. External factors include various abiotic-climatic factors *i.e.* temperature, rainfall, cloudy weather, wind, frost, rootstock, disturbed soil and water relation, nutrient supply, pruning, insects-pests and diseases. Internal factors are evolutionary tendencies *viz.* monoecy, dioecy and pseudo-hermaphroditism; structural diversity (floral structure); heterostyly, self-incompatibility, dichogamy, abortion of ovules, pollen impotence, genetic sterility and C/N ratio of the plant. For getting optimum production and higher return in crops like ber and aonla, planting of self-fruitful varieties or inclusion of compatible varieties to ensure cross pollination can be done. Also, mechanical and hand pollination can be practiced in date palm. Spraying with GA₃, NAA and boron increases the fruit set and reduces the physiological fruit drop in these crops.

FRUIT CROPS BASED DIVERSIFIED CROPPING SYSTEMS FOR ARID AND SEMI-ARID REGIONS OF INDIA

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Agriculture is the chief means of subsistence for the rural people across the arid and semi-arid regions. Sustainable productivity is difficult to achieve by monoculture of either seasonal or forage crops in these regions. Under such situation hardy fruit crops such as ber, phalsa, aonla, bael, lasoda, ker, karonda can survive very well, their cultivation along with value addition through processing provide a source of income to the farmers. These perennial species also provide fodder for animal during scarcity periods where livestock is integral part of agriculture. Farmers who face repeated crop failure would consider a technology to be one that produces some yield in the worst year than the one that produces some yield in best. For sustainable production, food and nutritional security, economized productivity and ecological restoration, suitable hardy fruits based cropping system integrating perennial fruit trees with seasonal crops should be followed in arid and semi-region. Based on the diversity of fruits, grasses and other crops grown in these region, the major cropping system *viz.*, Horti-Agri system, Horti-Pastoral system, Horti-Agri-Pastoral system have been developed for the arid region.

EFFICACY OF FUNGICIDES AGAINST STEM GALL DISEASE OF CORIANDER CAUSED BY *PROTOMYCESMACROSPORUS*

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Stem gall of coriander (*Coriandrum sativum* L.) caused by *Protomycesmacrosporus* Unger is a common disease of coriander which is an important spice crop of India and other countries. Stem gall is causes much damage to the crop. *Protomycesmacrosporus* Unger, the incident of stem gall of coriander (*Coriandrum sativum* L.) occur abundantly in northern part of India. To manage the disease through fungicide, experiment was conducted at Vegetable Research farm, NDUAT, Faizabad (U. P.), India during the rabi seasons of (2015-2016) with eleven treatments of chemicals and organic treatments, for seed treatment and soil treatment with three replications. All treatments resulted in lower disease intensity and higher seed yield compared to the control. The seed treatments Thiram 2 g/kg seed treatment with Propiconazole@ 0.1 % seed + soil treatment gave the lowest disease severity of 14.00 % with maximum grain yield 12.26 g/plant and highest per cent disease (51.70%) over control treatment. For the first time, it has been possible to obtain at least a partial field control of this disease, through seed treatment + soil treatment with Propiconazole at the dose of 0.1%. There are indications that better control is possible by combining seed and soil treatments with Propiconazole.

EFFECT OF IRRIGATION SCHEDULING ON TOMATO YIELD (*LYCOPERSICON ESCULENTUM*) AND WATER USE EFFICIENCY UNDER DRIP IRRIGATION

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Water is a most limiting factor and main source of crop production in irrigation sector. Efficient management of available water resources is very essential to meet the increasing competition of water between agricultural and non-agricultural sectors both. In present study, it has been



analyzed that total production of 2841.05 quintal/hectare has been obtained under various treatments considered in the study and it has observed that maximum production of 634.52 quintal/hectare has been obtained under the treatment T3 (3 hr water applied in time interval of three day) whereas minimum achieved under treatment T5 (control) as 507.32 quintal/hectare out of three treatments such as T1 (1 hr water applied in one day time interval), T2 (2 hr water applied in two day time interval) and T4 (4 hr water applied in four day interval) whereas highest fruit weight also recorded in T3 treatment as 10.50 kg/plant and lowest 5.40 kg/ plant was obtained under T5 treatment. Highest water use efficiency (WUE) and benefit-cost ratio (BCR) also achieved under the T3 as 3.25 q/ha-cm and 3.01 respectively. Indian agriculture today faces the challenge of meeting demand for safe and quality food. Care has to be taken in protecting the natural resources and the environment in the race for food security. Water is a major input in agriculture. The water use efficiency of the crops has to be increased in order to reduce the water loss from the field.

SCREENING OF POTATO GENOTYPES FOR FOLIAR AND TUBER RESISTANCE AGAINST *PHYTOPHTHORA INFESTANS* CAUSING LATE BLIGHT OF POTATO UNDER SUBTROPICAL PLAINS OF INDIA

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The late blight disease caused by *Phytophthora infestans* (Mont.) de Bary, is a serious threat to potato cultivation worldwide. The chemical management is best option for quick control, however due to high cost of chemicals, toxic effect and development of resistant to *P. infestans*. Use of chemicals should be reduced. However, the varietal resistant is cheapest and environment friendly for management of this disease. Therefore, a total of twenty two (two sets) advanced potato hybrids along with four control varieties namely Kufri Bahar (HS), K. Garima (MR), K. Girdhari (HR) and K. Shailja (MR) were evaluated during crop seasons (2012-14; 2013-15) for foliar and tuber resistance against late blight at CPRI, Regional Station, Meerut. The standard methodologies were followed for disease observation and calculation of both the resistance. In first set, based on field evaluation result revealed that advanced hybrid MS/9-723 showed highly resistant AUDPC (45), another hybrid MP/04-578 showed AUDPC (82) was resistant and 8 hybrids showed AUDPC (150-375) were moderately resistant and remaining one was susceptible (>375) against HS cv. K Bahar (AUDPC-794) during 2012-14. In second set, two advanced hybrids viz, MS/10-885 (75) and MP/07-214 (13) were highly resistant, MS/10-966 (87) was resistant and remaining 9 were moderately resistant during 2013-15 against HS cv. K. Bahar (AUDPC-749). In detached leaf test, five hybrids were moderately resistant (MS/8-88, MS/8-861, MS/9-723, MS/9-2185 & MP/04-816) and remaining were susceptible during 2012-14 whereas MS/10-940 was resistant, eight were moderately resistant and two were susceptible during 2013-15. For tuber resistant three hybrids viz, MS/8-861, MS/9-912 & MP/04-816 were moderately resistant and remaining were susceptible whereas MP/06-39 & HT/10-2505 were resistant and remaining hybrids were susceptible during 2013-2015. The hybrids namely MS/9-723, MS/10-885, MS/10-966, MP/04-578 and MP/07-214 possessed high level of foliar resistance to late blight and two hybrids MP/06-39 & HT/10-2505 possessed high level of resistance to tuber. These hybrids further can be used for varietal development for resistance to late blight of potato.

TAXONOMIC STUDY OF SOME SPECIES OF OEDIPODINAE (ORTHOPTERA: ACRIDIDAE) OF ROHILKHAND REGION, UTTAR PRADESH, INDIA

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Grasshoppers eat extensive amount of foliage both as grown-ups and as nymphs and can cause serious damage to parched land and prairies. Paddy, pulses, vegetables and different yields can be influenced as they are the major pest in agricultural land. The Acrididae are best known as all locusts (swarming grasshoppers) belong to this family. They are characterized by short and stout antennae, tympana on first abdominal segment and three segmented tarsi. The main aim of this study was to explore the grasshopper species belonging to the subfamily Oedipodinae (Family: Acrididae; Order: Orthoptera). Oedipodinae is represented by 136 genera with 602 species worldwide and it includes band-winged grasshoppers. A comparative study of differences in various morphological characters of 5 species belonging to 5 genera of subfamily Oedipodinae was carried out. Taxonomic importance of various morphological characters is shown. Body size, length and width of eyes, shape of fastigium of vertex, shape of antennae, no. of antennal segment, shape of pronotum, presence or absence of median and lateral sulci on pronotum, presence and absence of prosternal process, shape of mesosternal and metasternal interspaces and lobes, difference in tegmina, structure of hind femur with reference to no. of inner and outer spines on hind tibia, shape and size of arolium are the characters that play an important role in separating various genera and species. *Aiolopus simulatrix simulatrix*, *Gastrimargus africanus africanus*, *Locusta migratoria migratoria*, *Oedaleus abruptus* and *Trilophidia annulata* were identified and studied. Insect sampling site was Rohilkhand region of Uttar Pradesh.

EVALUATION OF MYCOACARICIDES AGAINST TWO SPOTTED SPIDER MITE, *TETRANYCHUSURTICAE* KOCH ON JASMINE (*JASMINUMSAMBACAIT.*)

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An investigation was carried out in field condition at two different locations i.e., Vadipatti and Allanganallur blocks of Madurai district of Tamil Nadu to evaluate the bio-efficacy of certain commercially available mycoacaricides against two spotted spider mites *Tetranychusurticae* Koch on Jasmine (*JasminumsambacAit.*). From the cumulative mean data of this study it was found that among the mycoacaricides



evaluated, *Beauveria bassiana* (Bals-Criv.) Vuill. @ 1×10^8 CFU/g and *Lecanicillium lecanii* (Zimm.) Zare & W. Gams @ 1×10^8 CFU/g recorded the highest per cent reduction of eggs (59.99 and 58.61 per cent at Vadipatti block and 57.20 and 55.78 per cent at Allanganallur block) and mites (63.39 and 61.98 per cent at Vadipatti block and 59.44 and 58.51 per cent at Allanganallur block) respectively, which were statistically on par in their bio-efficacy against *T. urticae* on *J. sambac*. Regarding the flower yield; amongst the test mycoacaricides, the highest per cent increase in flower yield was recorded in case of *B. bassiana* @ 1×10^8 CFU/g (56.20 per cent at Vadipatti block and 55.33 per cent at Allanganallur block) and *L. lecanii* @ 1×10^8 CFU/g (54.89 per cent at Vadipatti block and 55.01 per cent at Allanganallur block) along with the highest cost benefit ratio of 1:1.83 and 1:1.59 at Vadipatti block and Allanganallur block respectively and 1:1.61 and 1:1.50 at Vadipatti block and Allanganallur block respectively, which were statistically at par. Thus from the present investigation it can be concluded that *B. bassiana* @ 1×10^8 CFU/g and/or *L. lecanii* @ 1×10^8 CFU/g can be recommended for the bio-intensive management of *T. urticae* infesting Jasmine as a substitute to synthetic chemical acaricides due to their host specificity, safety to natural enemies with no toxic residues.

NATURAL RESOURCES CONSERVATION

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Natural resource conservation is the ethical use and protection of valuable resources such as trees, minerals, wildlife, water, sunlight, atmosphere, land along with all vegetation and crops. Some natural resources such as sunlight and air can be found everywhere are known as ubiquitous resources. There are very few resources that are considered inexhaustible these are solar radiation, geothermal energy and air. In 1982 the UN developed the World Charter for Natural resources conservation, which recognized the need to protect nature from further depletion due to human activity.

Natural resource conservation is a discipline in 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. Hence sustainable development can be followed where there is a judicious use of resources which compromises the needs of the present generations as well as the future generations. A successful management of natural resources should engage the community because of the nature of the shared resources the individuals who are affected by the rules can participate in setting or changing them. The right to resources includes land, water, fisheries and pastoral rights. The users or parties accountable to the users have to actively monitor and ensure the utilization of the resource compliance with the rules and to impose penalty.

Key Words- Natural resource conservation, sustainable development, right to resources

CHEMICAL WEED CONTROL IN URDBEAN (PHASEOLUS MUNGO L.)

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The present investigation entitled "Chemical weed control in urdbean (*Phaseolus mungo* L.)" was carried out during kharif season 2013, college of Agriculture science and technology Dehradun (Uttarakhand). The soil of experimental field was clayey in texture with low in nitrogen, medium in phosphorus and high in potassium contents. The treatment comprised of eleven weed management practices (viz., T₁: weedy check, T₂: hand weeding twice at 20 and 40 DAS, T₃: pendimethalin @ 1000 g ha⁻¹ PE, T₄: Quizalofop-p-ethyl @ 37.5 g ha⁻¹ PoE (20 DAS), T₅: Fenoxaprop-p-ethyl @ 50 g ha⁻¹ PoE (20 DAS), T₆: Pendimethalin 30EC + imazethapyr 2EC (Vallor 32) @ 750 g ha⁻¹ PE (2 DAS), T₇: Pendimethalin 30EC + imazethapyr 2 EC (Vallor 32) @ 1000 g ha⁻¹ PE (2 DAS), T₈: Imazethapyr @ 25 g ha⁻¹ PoE (20 DAS), T₉: Imazethapyr @ 40 g ha⁻¹ PoE (20 DAS), T₁₀: Imazethapyr @ 55 g ha⁻¹ PoE (20 DAS), T₁₁: Weed free plot). Significantly greater plant height, more number of leaves, maximum leaf area index higher number of branches, dry matter accumulation, number of nodules, dry weight of nodules, crop growth rate, relative growth rate, yield attributes, seed yield, Stover yield and harvest index were obtained under weed free treatments, followed by hand weeding twice at 20 and 40 DAS and imazethapyr @ 40 g ha⁻¹ PoE (T₉) and minimum was obtained under weedy check. In the experimental field, *Parthenium hysterophorus*, *Digera arvensis*, *Celosia argentea*, *Cynotis axillaris*, *Alternanthera sessilis* and *Echinochloa colonum* were the dominant weeds and found throughout the crop growth period. The lowest density and dry matter production of weeds, weed index and highest weed control efficiency were recorded under hand weeding twice at 20 and 40 DAS, followed by imazethapyr @ 40 g ha⁻¹ PoE (T₉).

STATUS OF INSECTICIDE RESISTANCE AND LEVEL OF CARBOXYLESTERASE IN COTTON LEAFHOPPER *AMRASCABIGUTTULABIGUTTULA* (ISHIDA)

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The status of insecticide resistance in some field population of *Amrasca biguttulabiguttula* (Ishida) collected from the different five talukas (viz., Akola Patur, Murtizapur, Balapur, Akot) of Akola district (MH) was determined during the cropping seasons of 2015-2016. The cotton leafhopper *Amrasca biguttulabiguttula* (Ishida) is considered to be an alarming insect pest causing both quantitative and qualitative loss in cotton. *In situ* bioassay studies were done and the role of detoxifying enzymes in conferring resistance to neonicotinoid and organophosphates groups of insecticides usage areas of Akola were determined. Bioassay studies showed that imidacloprid, dimethoate, acephate, and flonicamid registered varying levels of resistance for different talukas of Akola district were studied. The resistance ratio was high in acephate (4.5, 3.8, 4.4, 4.0, 4.1 fold) and the lowest in flonicamid (3.1, 3.4, 3.2, 3.0 and 2.9 fold) for respective location. Furthermore, the enzyme activity ratio (carboxylesterase) was relatively greater, and corresponded to the higher LC₅₀ values of neonicotinoids and organophosphates. The study revealed that the higher activity of the detoxifying enzyme in the resistance population of cotton leafhopper apparently has a significant role in endowing resistance to neonicotinoid and organophosphate groups of insecticides. However, this study recommends using neonicotinoids in cotton growing areas with caution.

THE POTENTIAL PRODUCER OF NOVEL ENDOPHYTIC ACTINOMYCETES ARE MEDICINAL PLANTS OF WEST BENGAL, INDIA

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Indigenous cultures used herbs as “herbal medicine” for development of health care in their daily life from prehistoric period. Treatment with medicinal plants is very safe and high efficiency. They are rich source of biologically active natural ingredients which can be used in drug development. Endophytes are hidden group of microorganisms that reside asymptotically within the internal tissues of their healthy host for their whole life cycle. Actinomycetes are prokaryotic, Gram positive, filamentous group of bacteria with high G+C content in their DNA. The purpose of this study shows that endophytic actinomycetes were isolated from medicinal plants on their morphological approaches. Selected healthy medicinal plants were collected from different location of West Bengal. Plant parts (stems, leaves, roots) were washed out with running tap water to remove soil particles and adhering epiphytes. Different plant parts were cut into small pieces with a sharp sterile blade. Small plant parts were surface sterilized with 70% ethyl alcohol and NaOCl. Sterilized parts were placed on water agar (2%). Inoculated plates were incubated at 28±2°C. Growth of actinomycetes were immediately transferred on selective media (ISP-5). Slants were prepared to maintain the pure culture of isolates and preserved at -20°C. All isolated strains were confirmed on basis of microscopic and macroscopic character. A total 40 actinomycetes (stem-20, leaf-12, and root-8) were isolated from different parts of medicinal plants. Stem shows highest isolation rate of endophytic actinomycetes than leaf and root. The evaluation of all isolates depends upon their different potential aspects for medicinal or agricultural applications.

EFFECT OF SEED SIZE ON YIELD AND SEED QUALITY TRAITS IN SOYBEAN (*GLYCINE MAX L. MERRILL*)

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The present investigation entitled “Effect of seed size on yield and seed quality traits in soybean (*Glycine max* L. Merrill)”. To identify the proper size of seed the six genotypes viz., NRC 37, JS 97-52, JS 335, JS 93-05, TAMS 98-21 and TAMS 38 were grown in Randomized Block Design (RBD) with four replications and different characters were studied. The medium seed size variety JS 335 performed better than all small and bold seed variety in respect of yield and yield contributing characters. The medium seed size variety recorded the significantly higher germination percentage and maximum vigour index in JS 335 than the other seed sizes. The medium seed size variety JS 93-05 recorded lowest value for 50% flowering and matures earlier as compared to other seed grades and late maturity observed in small seed size variety JS 97-52. The correlation study revealed observed that the seed yield was highly significantly and positively associated with vigour index and germination. The seedling dry weight significantly and positively associated with vigour index. The vigour index significantly and positively associated with germination. The observed that seed yield was significantly and positively associated with number of pods per plant, days to 50% flowering, plant height, days to maturity and number of branches per plant. From the study, it was advisable to use medium (10 to 12 gm per 100 seed weight) seed size cultivars followed by bold (more than 12 gm per 100 seed weight) seed size cultivars for better seed quality characters and more productivity of soybean.

PRADHAN MANTRI JAN DHAN YOJNA (PMJDY) – A NEW WAY FOR MAINSTREAMING THE FINANCIALLY EXCLUDED

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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.

PARABIOLOGICAL CONTROL IS A BIORATIONAL APPROACH FOR THE CONSERVATION OF EGG PARASITOID, *TRICHOGRAMMA CHILONIS* AND CONTROL OF A LEPIDOPTERAN PEST, *SPODOPTERA LITURA* (FAB.)

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The potential of using F₁ sterility vis-à-vis use of biocontrol agent, *Trichogramma chilonis* as a component of area-wide management of lepidopteran pest *Spodoptera litura* has been advocated.

Hypothesis: Parabiological control is an ecofriendly and economically viable approach to control the noxious pest, *S. litura* (Fab.) which has developed resistance against many modern insecticides. There are many control measures like physical control, chemical control, biological control to control their population. Among these measures parabiological control is a biorational approach to conserve the natural enemies like parasitoids as well as to suppress the insect pest below economic injury level.

Methods: Many biological control agents (exotic or indigenous) are responsible for controlling the other species is called biological control. When laboratory mass reared certain species e.g. Lepidopteran insect control their own population is called parabiological control. Two sub-sterilizing doses, 100 Gy & 130 Gy have been administered to the *S. litura* males to study the effect of radiation to the host eggs for the bioefficacy of egg parasitoids *T. chilonis*.

Results: The feasibility of using F₁ sterility as a genetic control method has been studied for several species of Lepidoptera (Knippling 1970). However, the full potential of F₁ sterility strategy could be achieved for lepidopteran pest, *S. litura* by the integration of egg parasitoids, *Trichogramma chilonis* Ishii.

Implication: F₁ sterility technique vis-à-vis inoculative releases of egg parasitoids have the synergistic effect for the suppression of insect pest and also to conserve the egg parasitoids in an agroecosystem.

ALLELE MINING: A NEW TRENDS IN CROPS IMPROVEMENT

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Allele mining is a promising approach to dissect naturally occurring allelic variation at candidate genes controlling key agronomic traits which has potential applications in crop improvement programs. It helps in tracing the evolution of alleles, identification of new haplotypes and development of allele-specific markers for use in marker-assisted selection. Realizing the immense potential of allele mining, concerted allele mining efforts are underway in many international crop research institutes. This review examines the concepts, approaches and applications of allele mining along with the challenges associated while emphasizing the need for more refined 'mining' strategies for accelerating the process of allele discovery and its utilization in molecular breeding. Enormous progress has been made in the last 15 years in depositing an exponential amount of sequence information into GenBank (Chan, 2005; Mardis, 2008). With rapid accumulation of sequence and expression data in various genomic databases, accelerated discovery and annotation of new genes can be expected which would enable the development of allele-specific markers (Spooner et al., 2005). Based on gene and genome sequences, polymerase chain reaction (PCR) strategies are devised to isolate useful alleles of genes from a wide range of species (Latha et al., 2004). This capability enables direct access to key alleles conferring resistance to biotic and abiotic stresses, greater nutrient use efficiency, enhanced yield and improved quality. Using novel genomic tools, similar alleles responsible for a given trait and their variants in other genotypes can be identified. This is often referred to as 'dissection of naturally occurring variation at candidate genes/loci' or simply 'allele mining'. Identification of allelic variants from germplasm collections not only provides new germplasm for delivering novel alleles to targeted trait improvement but also categorizes the germplasm entries for their conservation. Realizing the importance of allele mining in genomics-driven plant breeding era, we discuss the concept of allele mining and its strategies along with the prospects and challenges.

ELICITATION OF RESISTANCE RESPONSES IN GRAPEFRUIT AND LEMON FRUITS TREATED WITH A POMEGRANATE PEEL EXTRACT

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The defence responses of grapefruit and lemon to treatment with pomegranate extract (PGE) were investigated. PGE, an alcoholic extract from pomegranate peel, was recently proposed as a means of effective alternative control against postharvest rots. In *in vivo* experiments, a significant reduction of rots caused by *Penicillium digitatum* and *P. italicum* was achieved on artificially inoculated fruits without direct contact between PGE and pathogens. On lemons both pathogens were completely inhibited by PGE at 12 g dry matter L⁻¹ applied 12 and 24 h before the pathogen but a significant reduction of rots was also achieved by inoculating the pathogen immediately after PGE (0 h), indicating a very quick activation of defence responses. Lower, but significant, reductions were also obtained on grapefruits. An increase in reactive oxygen species (ROS) activity, reaching its peak after 24 h, was observed, in agreement with *in vivo* efficacy trials. Similarly, the expression of five



genes involved in activation of defence responses in plants (*CHI*, *CHS*, *MAPK*, *MAPKK* and *PAL*) increased following PGE application. Based on the results of the present study, the high efficacy demonstrated for PGE in previous studies can be partially attributed to the induction of resistance in host tissues.

POTASSIUM FORMS AND THEIR RELATIONSHIP WITH PHYSICO-CHEMICAL PROPERTIES OF VERTISOL IN THE MALWA REGION OF MADHYA PRADESH

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Potassium (K) is known as quality element and also an essential macro nutrient required for the proper growth and development of plants. Different forms of K are in dynamic equilibrium and any depletion in a given form is likely to shift in the direction to replenish it. These different forms of potassium and their relationship with various soil properties were studied in total ninety representative surface (0-15 cm) and sub-surface (15-30 cm) soil samples from the 45 fields of Agriculture college farm, Indore (MP) were collected in the year of 2014-15. The study area of Agriculture College farm, Indore belongs to Malwa Plateau agro-climatic zone and having medium to deep black soils. The mean values of pH were 7.57 and 7.54 for surface and sub-surface soil samples, respectively. More than 90% soil samples were in the safe limit of EC. About 66.67% surface soil samples and 68.89% sub-surface soil samples belonged to low status ($< 0.5\%$) of OC. The nitrogen (N) status was also low in surface and sub-surface soil samples ($150-250 \text{ kg ha}^{-1}$). Available phosphorous (P) content was low to medium status in both depths of soil. The mean values of water soluble, exchangeable, available, non-exchangeable, lattice and total K in 14.77, 256.10, 271.86, 305.08, 12285.10 and 12855.24 mg kg⁻¹ in surface and 15.94, 250.89, 266.82, 305.19, 12142.70 and 12714.73 mg kg⁻¹ in sub-surface soils respectively. Electrical conductivity in surface and sub-surface soil showed highly significant positive correlation with exchangeable, available, lattice and total K. Water soluble K showed significant and negative correlation ($r = -0.294^*$) with calcium carbonate content in surface soil. Clay content in sub-surface soil showed significant and negative correlation with exchangeable K ($r = -0.347^*$), available K ($r = -0.379^*$), lattice K ($r = -0.381^{**}$) and total K ($r = -0.383^{**}$). On the other hand, pH showed significant and negative correlation with available K ($r = -0.330^*$), non-exchangeable K ($r = -0.293^{**}$) exchangeable K ($r = -0.398^{**}$), lattice K ($r = -0.405^{**}$) and total K ($r = -0.405^{**}$) in surface soil.

ROLE OF ABIOTIC FACTORS ON THE INCIDENCE OF FRUIT FLY, *BACTROCERA ZONATA* IN GUAVA

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The fruit fly *Bactrocera zonata* population was evaluated by putting methyl eugenol traps in guava orchards. Six traps were mounted at three different places in orchards. The observations were started from 2nd fortnight of October during 2009 and 2010. During first year i.e., 2009 *B. zonata* population showed negative and significant correlation with maximum temperature (-0.68) but minimum temperature (0.16) represented positive non-significant correlation. The correlation coefficient indicated significant positive correlation of fruit fly population with relative humidity (maximum 0.74 and minimum 0.79). In the year 2010 the sp. showed negative but significant correlation with maximum temperature (-0.47). The correlation coefficient was found significant and positive correlation with minimum temperature (0.49). The same trend of correlation coefficient was found significant and positive correlation with minimum temperature (0.49) like previous year. The significant positive correlation observed between population of *B. zonata* and relative humidity (maximum 0.79 and minimum 0.83).

EFFECT OF AMBIENT WEATHER ON POPULATION DYNAMICS OF MAJOR INSECT PESTS OF TAMARIND

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The present investigation was conducted at Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur, Chhattisgarh during *kharif-rabi*, 2015–16 to see the effect of different abiotic factor on major insect pests of tamarind. Three species of different insect pests viz. fruit borer, mealy bug, scale insect was recorded as a major pests. Maximum fruit borer infestation of 19.91 infested pods / unit area was recorded during second week of October. Peak population of mealy bugs was recorded during second week of October with 29.58 nymphs and adults / unit area. Two peaks of scale insects were observed, first in the fourth week of September followed by second week of November with 28.83 and 29.95 scale insects / unit area. Morning relative humidity around 95 per cent and evening relative humidity around 60 per cent were found congenial for the fruit borer multiplication on tamarind. Mealy bug and scale insects were also significantly positively influence with morning relative humidity.

CONIDIUM PRODUCTION BY ENTOMOPATHOGENIC FUNGUS *VERTICILLIUM LECANII*

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Verticillium lecanii, an entomopathogenic fungus, was evaluated for production of conidial mass on different grain of wheat, barley, sorghum, rice and bajra. Out of five grain the highest conidial sporulation was observed on rice grain. However, it was difficult to produce the



conidia at mass level due to boiling of rice grain and conversion into compact mass during sterilization resulting in difficulty for harvesting the conidial mass from conidial flask in solid state fermentation conditions. So, sorghum grain was found better than rice grain for mass production of conidia by *Verticillium lecanii*.

MANAGEMENT PRACTICES FOR ROOT - KNOT NEMATODE (*MELOIDOGYNE GRAMINICOLA*) IN RICE CROP.

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Rice is grown in diverse environments either as a sole crop (rain fed, irrigated or deepwater) or as a major component in various cropping systems. Rice cultivation cover large area in India, even a smallest pest problem would have great impact on yield and farmers income. Soil borne diseases are becoming increasingly important in the rice-based cropping systems. One of the most important soil borne pests is plant parasitic nematode. About three hundreds nematode species belonging to thirty five genera have been reported infesting rice. Among them, *Meloidogyne graminicola* (Golden and Birchfield) causing rice root knot disease has emerged as a major pest recently throughout the world due to its broad host range and ability of causing potential and yield loss. The losses caused by *M. graminicola* may vary from negligible to heavy depending on the severity of disease. This nematode reduced the rice yield by causing more than 10% yield loss in a greenhouse experiment and the yield losses might go as high as 80%¹. The main symptoms of root knot disease of rice are yellowing, dwarfing and gall formation on the roots of rice plants. The degree of symptom manifestation differs with time of infection, age of the plants and load of inoculums². To prevent yield losses and improve productivity, it is necessary to find out the effective sustainable management strategy. Indiscriminate use of chemicals for managing this disease, results in the development of pathogen resistance and risk to the environment which has favored the introduction of various eco-friendly approaches of management such as, removal of host weeds, flooding of fields, summer ploughing, organic amendments, and use of effective bio-control agents. Since each management approach has some advantage, an integrated approach can be a better option to management of the root knot nematode³. Fumigant or non fumigant nematicide can be included in integrated management of this Nematode, during heavy infestation conditions.

EFFECT OF STRESS MITIGATING CHEMICALS ON CORIANDER VARIETIES IN IRRIGATED SEMI-ARID EASTERN PLAIN ZONE OF RAJASTHAN

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Jaipur) during *rabi* seasons 2016-17 to study the effect of stress mitigating chemicals on coriander varieties grown on irrigated loamy sand soil of semi-arid eastern plain zone of Rajasthan. The experiment consisting of four varieties (RCr-435, RCr-728, RCr-436 and RCr-41) and six stress mitigating chemicals (water sprayed control, salicylic acid @ 100 ppm, thiourea @ 500 ppm, kinetin @ 30 ppm, DMSO @ 78 ha⁻¹ and TGA @ 100 ppm at 40 and 60 DAS) making 24 treatment combinations were replicated three times in randomized block design. Application of stress mitigating chemicals responded favorably to coriander crop wherein foliar spray of 500 ppm thiourea, being at par with salicylic acid, was found most effective and significantly increased the growth parameters viz., plant height, branches/plant, dry matter accumulation, yield attributes and seed (15.19 q ha⁻¹), straw (42.22 q ha⁻¹) and biological yield (57.41 q ha⁻¹) and highest net returns (Rs 47376 ha⁻¹) as compared to other stress mitigating chemicals. The foliar application of stress mitigating chemicals might be act as a powerful tool in enhancing the growth, productivity, quality and also in combating the ill effects generated by various biotic and abiotic stresses in plant in the near future.

EFFECT OF DIFFERENT SPACING ON GROWTH AND YIELD OF LIMA BEAN

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A field experiment was carried out at Department of Horticulture, Dr. PDKV, Akola during the year 2015-2016 to study the effect of plant spacing on growth and yield and quality of lima bean. The experiment was laid out in Randomized block design with seven treatments and three replications. It was observed that growth and yield parameters were significantly influenced by different plant spacing. Plant height was found to be maximum in closer plant spacing of 0.75 m × 0.75 m whereas leaves per plant, primary and secondary branches per plant and leaf area were found to be maximum in wider plant spacing of 1.5 m × 1.0 m. Yield contributing characters, days to first pod set, number of pods per cluster, length of pod, width of pod, seeds per pod, weight of fresh pod, weight of fresh seed, weight of dry seed, weight of dry seed per pod, weight of 100 dry seeds, seed yield per plant and seed yield per hectare were found to be maximum in the plant spacing of 1.0 m × 0.75 m.

STUDIES ON *BRYOPHYLLUM PINNATUM* LEAVES POWDER AND ITS FORTIFICATION IN SNACK PRODUCT

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Bryophyllum pinnatum is a medicinal plant belongs to the family *Crassulaceae*. The native of plant is Madagascar. It is used in folk medicine in tropical Africa, tropical America, India, China, and Australia. *Bryophyllum Pinnatum* used in traditional medicine for the treatment of variety of ailments like anthelmintic, immunosuppressive, Hepatoprotective, antioxiative, anti-inflammatory and neproprotective, antimicrobial



activity, analgesic. *Bryophyllum Pinnatum* used for the treating Urinary Tract Infection (UTI) are the most widespread microbial diseases in India as per WHO. A number of bioactive compound groups including alkaloids, triterpenes, lipid, flavonoids, glycosides, bufadienolides, phenol, and organic acids has been covered. We have studied on the *Bryophyllum Pinnatum* leaves powder by using two different drying methods (tray dryer and microwave oven) at five different temperatures for specific hours. We have studies on nutritional composition of *Bryophyllum Pinnatum* leaves powder like carbohydrate, fat, protein, mineral, crude fiber, ash content and its fortification into snack product.

INTEGRATED WEED MANAGEMENT: A OVERVIEW

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Integrated weed management (IWM) combines different agronomic practices and herbicides use to manage weeds, so that the reliance on any one weed control technique is reduced. Reducing the reliance on one or two specific weed control techniques means that those techniques or tools will be effective for future use. The objective of integrated weed management is to maintain weed densities at manageable levels while preventing shifts in weed populations to more difficult-to-control weeds. Losses caused by weeds will be minimized without reducing farm income. Controlling weeds with one or two techniques give the weeds a chance to adapt to those practices. For example, use of herbicides with the same mode of action (belonging to the same herbicide group) year after year has resulted in weeds that are resistant to those herbicides. Continuous production of certain types of crops also gives weeds a chance to adapt (downy brome has increased on fields where winter cereals are frequently grown). Integrated weed management uses a variety of control techniques to keep weeds "off balance". Weeds are less able to a constantly changing system that uses many different control practices, unlike a program that relies on one or two weed control tools. There are three main types of agronomic practices for an integrated weed management program are Practices that limit the introduction and spread of weeds (prevent weed problems before they start), Practices that help the crop compete with weeds (help "choke out" weeds), and Practices that keep weeds "off balance" (make it difficult for weeds to adapt).

MICROORGANISM AS A BIOWEAPONS FOR DEGRADATION OF XENOBIOTIC COMPOUNDS IN ARABLE LAND FOR SUSTAINABLE AGRICULTURE PRODUCTION

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The living soil system is of primary importance in sustainable agricultural production. Soil quality is considered as an integrative indicator of environmental quality, food security and economic viability. Environmental pollution is one the greatest challenges that the world is facing today. It began since industrial revolution, increasing day and causing irreparable damage to Mother earth. They adversely the agricultural lands nearby leading to the accumulation of xenobiotic and heavy metals in the soil followed by barrenness, Major environmental problems today are the accumulation of recalcitrant xenobiotic in the ecosphere; they are relatively stable and persist in the environmental for several decades. The microbial degradation of xenobiotic is seen as a cost effective method of removing these pollutants from the environment by a process now known as bioremediation. Microbial treatment of industrial effluents is also possible. Fundamental work has revealed that a wide variety of microorganisms are capable of degrading an equally wide range of organic pollutants. Employing the indigenous microbes with degradative capabilities in situ has been a solution to it. In this way, we can double the income of the farmers by using the new technology to maintain the goodness of the soil.

INTEGRATED PEST MANAGEMENT AND INTEGRATED NUTRIENT MANAGEMENT IN HORTICULTURAL CROPS.

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The IPM approach used by organic growers should be nearly identical to the one employed by conventional growers. The difference is that the organic grower needs to monitor more closely and rely more heavily on cultural and physical techniques for preventing and managing problems and use only acceptable organic sprays. Keep in mind that organic pesticides are not generally as effective as chemical pesticides. And they still can negatively impact the pollinator population. To grow any type of fruit successfully, you must grow healthy plants and anticipate and prevent problems. The appearance and severity of pest problems varies between neighborhoods, areas of the state, and growing seasons. When symptoms of a problem are noticed, accurately identify the problem (weed, insect, disease, cultural/environmental), monitor for changes (increasing severity), and be prepared to act. Prevention and control measures at your disposal may be physical (e.g., handpicking Japanese beetles, removing diseased plants), cultural (e.g. pruning brambles to improve air circulation), or chemical (e.g. spraying horticultural oil to smother San Jose scale.)

The continuous use or excess supply of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing economic inefficiency, damage to the environment and in certain situations, harm the plants themselves and also to human being who consume



them. On the other hand, increase in productivity of horticultural produce removes large amounts of essential nutrients from the soil. Without proper management, continuous production of crops reduces nutrient reserves in the soil. The new approach to farming often referred to as sustainable agriculture, seeks to introduce agricultural practices that are ecofriendly and maintain the long term ecological balance of soil ecosystem. The judicious use of organic inputs with inorganic is considered as the alternative source to meet the nutrient requirement of the crops.

MODIFIED ATMOSPHERE PACKAGING OF INDIAN JUJUBE (*ZIZIPHUS MAURITIANA* LAMK.) FRUIT: EFFECT OF ATMOSPHERE ON PHYSIOLOGY AND CHILLING INJURY

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Short shelf life and chilling injury at low temperature storage is a major problem in Indian jujube storage. Modified atmosphere packaging is utilized in many fruits to extend the shelf life and also useful in alleviating chilling injury. The effect of active modified atmosphere packaging (MAP) on physiology, color and chilling injury (CI) was assayed on 'Gola' Indian jujube fruits during storage at 6 °C for up to 35 d. Seven gaseous compositions of 2 kPa and 5 kPa O₂ and 5, 10 and 15 kPa CO₂ combinations including air control were used for fruit packaging. Low density polyethylene packages were used for storage. Head space O₂, CO₂ and C₂H₄, respiration rates, ethylene production, moisture percentage, firmness, chilling injury index and hunter color parameters were evaluated at 7 d intervals. MAP technique found useful to delay the ripening process of Indian jujube fruit delaying color change, ethylene production rates, firmness and weight loss, prolonging shelf life compared to controls. Desirable fruit characters and lowered CI were optimum with 5 kPa O₂ and 5 kPa CO₂.

RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON TURNIP(*BRASSICA RAPAL.*) CV. PURPLE TOP WHITE GLOBE.

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The Turnip (*Brassica rapa*) belongs to the family *Cruciferae* 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. Turnip 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 P.T.W.G. 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 (7.8 cm), total no. of leaf per plant(17), the number of fully opened leaves per plant(14.5), length of the largest leaves (20.4cm),width of the largest leaf(38.2cm) at harvest. Besides, the fresh weight of root(2.043gm), length of the whole root(25.5cm), diameter of storage root the shoulder point(2.55cm) and total root yield 250 Q/ha. Were recorded under T2(80%RDF+FYM+Vermicompost) followed by T4(60%RDF+FYM+Vermicompost).

ESTIMATION OF HETEROSIS FOR SEED COTTON YIELD AND BIOCHEMICAL PARAMETERS IN GENETIC MALE STERILE BASED HYBRIDS OF *GOSSYPIMUM ARBOREUM* L.

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The present investigation was undertaken to study heterosis and explore its commercial utilization in *desi* cotton (*G. arboreum* L.) by using Line x Tester design with four genetic male sterile females and fifteen male parents. Out of sixty hybrids studied, a total thirty three hybrids showed positive heterobeltiosis and seventeen hybrids showed positive economic heterosis over standard check, AAH 1 and thirty nine crosses showed positive mid parent heterosis for seed cotton yield. The F1 hybrids DGMS 34 x HD 517 (53.19 %), DGMS 34 x HD 523 (40.00 %), DGMS 2 x HD 528 (39.96 %) and DGMS 1 x HD 432 (39.97 %) recorded positive standard heterosis for number of bolls, seed cotton yield and low gossypol content, while the maximum heterobeltiosis for seed cotton yield per plant was exhibited by the hybrid DGMS 2 x HD 528 (121.82 %) followed by DGMS 1 x HD 432 (114.48 %) and DGMS 1 x CNA 398 (84.62 %). Hybrid DGMS 34 x HD 517 had reduced level of gossypol and DGMS 1 x LD 1026 had high level of protein while DGMS 9 x CNA 398 had high level of oil content over standard check AAH 1.

EVALUATION OF NEWER FUNGICIDE FOR MANAGEMENT OF EARLY BLIGHT OF TOMATO

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The present study were conducted to test the efficacy of some newer molecules like pyraclostrobin, boscalid, vand their combination maccani, pristine along with commonly used chemicals viz., mancozeb, copper oxychloride and chlorothalonil against early blight of tomato cultivar Pusa Ruby. A variant with no application of fungicide was used as a control. Average yield was calculated after fifteen pickings. Phytotoxicity effect of newer molecules was evaluated using a single spray. All fungicide treatments reduce the disease severity as compared to untreated check. Pristine 38%WG @ 64+126g a.i. /ha (31.88%) significantly reduced the disease followed by maccani 16%WG @ 60+180g a.i./ha (33.31%) and increase the yield from 33.50 tonnes/ha (Pristine 38%WG @ 64+126g a.i. /ha) and 32.44 tonnes/ha (maccani 16%WG @ 80+ 240g a.i./ha) as compared to a maximum disease (76.2%) and minimum yield of only 21.15 tonnes/ha in control. Overall results revealed that Pristine at both concentrations (64+126g a.i./ha and 76.8+151.2g a.i./ha) was found significantly effective in reducing the disease and increasing the fruit yield over control.

EFFECT OF DIFFERENT DOSES OF HERBICIDES AND MECHANICAL WEEDING ON YIELD ATTRIBUTES AND GRAIN YIELD OF DIRECT SEEDED RICE (*ORYZA SATIVA* L.) VARIETIES IN CHHATTISGARH PLAIN

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The experiment was conducted at Research cum Instructional Farm, IGKV, Raipur (Chhattisgarh) during *Kharif* season 2015-2016. The soil of experimental field was sandy loam in texture (*Inceptisols*) known as *Matasi*. The Experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The treatment consisted of three varieties viz. MTU-1010 (V_1), Indira barani dhan (V_2) and IR-64 (V_3) and four weed management practices viz. H_1 - Rinskor @ 37.5 ml a.i. ha⁻¹ at 20 DAS, H_2 - Rinskor @ 75 ml a.i. ha⁻¹ at 20 DAS, H_3 - Mechanical weeding at 20 and 40 DAS and H_4 - Control. The results of experiment indicated that variety MTU-1010 (V_1) registered significantly highest values of growth characters of rice like leaf area, plant population, dry matter accumulation and number of tillers. It was at par to variety IR-64 for above parameters. Among weed management practices, Mechanical weeding at 20 and 40 DAS (H_3) registered significantly highest values of growth parameters of rice like plant population, leaf area, dry matter accumulation and number of tillers, but it was comparable to Rinskor @ 37.5 ml a.i. ha⁻¹ at 20 DAS (H_1). Among the varieties, higher grain yield and B:C ratio was recorded under MTU-1010 (V_1) as regards to weed management practices maximum grain yield and B:C ratio were obtained under Mechanical weeding at 20 and 40 DAS (H_3).

INFLUENCE OF SEED INOCULATION WITH CARRIER AND LIQUID-BASED *RHIZOBIUM* CULTURES AND PHOSPHORUS LEVELS ON NUMBER OF RHIZOBIA IN SOIL AND YIELD OF SOYBEAN

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The present investigation was carried out to evaluate the effectiveness of *Rhizobium* cultures with supplementation of inorganic P fertilizer on soybean (cv. JS 97-52) rhizobial population in a black soil. The field soil was initially low in N and rhizobial population. The experiment comprised of 12 different treatments including 2 types soybean rhizobial inoculations (liquid and carrier based) in combination with 3 different levels of inorganic P supplementation (@ 40, 80 and 120 kg P₂O₅/ha) and one control of unfertilized + uninoculated (UFUI). Other package of practices including application of fertilizers @ 20:20 kg/ha (N: K₂O) were followed as recommended, application of phosphorus was taken as parts of scheduled treatments. From the experimental observations on the different parameters, the significant findings were interpreted as the influence of *Rhizobium* inoculum (liquid and carrier based) at different level of inorganic phosphorus on rhizobial population in soil at different crop growth stages and yield of soybean. The treatment of P₈₀+LRh also economically increased grain yield of soybean by 75.41% over the control and straw yield by 88.80% over the control. Population of *Rhizobium* in rhizospheric soil at 21 DAS, 45 DAS and at harvest of soybean was found more with the treatment of P₈₀+LRh by 1.69, 1.55 and 1.57 log folds, respectively over the control. While the treatment of P₁₂₀+LRh exhibited numerically higher values but statistically non-significant to that of the former. Further, P₈₀+LRh responded better than P₈₀+CRh.

BEST MEDIA PREPARED FOR CALLUSING OF A MEDICINAL PLANT VASAKA (*ADHATODA VASICA* NEES)

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The present investigation shall explore the possibility of callus culture in *Adhatoda vasica* Nees (known as “Vasaka” in Sanskrit and “Arusa” in Hindi), belonging to the family Acanthaceae, and an important medicinal plant of India. The plant is appreciated for containing bronchodilator alkaloids, mainly vasicine. The callus culture of vasaka (*Adhatoda vasica* Nees) were obtained from different explants such as cotyledon, stem segment and leaf base explants. The present study was conducted with the objective to find out the best media for callusing and shoot and root regeneration capacities of callus in *Adhatoda vasica*. In this investigation seven media's were tried. Out of them, five Medias were of Murashige and Skoog's (MS) media and the other two media's were Gamborg B5 and White's media respectively. The Different combinations and concentrations of 2, 4- Di chloro phenoxy acetic acid (2,4-D), Kinetin (Kn), benzyl amino purine (BAP) and Naphthalene acetic acid (NAA) were used in the present study. Among these seven media's M2 media contained MS + 1mgL⁻¹ 2,4-D + 0.5mgL⁻¹ Kinetin + 1mgL⁻¹ IBA. The M3 media was Murashige and Skoog's (MS) media which contained 2mgL⁻¹ BAP + 2mgL⁻¹ Kinetin + 1mgL⁻¹ IAA + 0.5mgL⁻¹ NAA and 150mL⁻¹ Coconut water. The M4 media contained MS salts + 2mgL⁻¹ 2,4-D + 1mgL⁻¹ Kinetin + 1mgL⁻¹ BAP. Among these media's tried, the best media found for callusing and shoot regeneration was M3 media followed by M4 and M2 media's respectively. The best media found for root regeneration was M2 media followed by M3 media. Doubling the amount of sucrose was found to be the best for root regeneration.



STUDIES ON POWDERY MILDEW OF RAPESEED-"MUSTARD (BRASSICA JUNCEA L.) CAUSED BY *ERYSIPHECRUCIFERARUM* OPIZ. EX. JUNELL. AND ITS MANAGEMENT

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Rapeseed-mustard is the major rabi oilseed crops of the country. It occupies a prominent place being next in importance to groundnut, both in area and production. A number of diseases of different origins attack rapeseed-mustard in which, *Erysiphecruciferarum* Opiz. Ex. Junellis taking heavy toll every year by decreasing the quantity and quality of produced. In order to ascertain the severity and distribution of disease, a survey was conducted at different locations of Kanpur. The maximum disease intensity (70%) was recorded at Oilseed Research farm, Kalyanpur, Kanpur and minimum disease intensity (24.4%) was recorded at farmer's field, Chaubepur, Kanpur. The symptoms of the disease were first appear on all the above ground parts of the plant are affected by the disease which appearances in form of dirty white circular, floury powdery patches on leaves, stem and pods with the increase in temperature white floury patches increase in size and coalesce to cover entire plant. Stem covered with mildew growth appear purplish and are bleached brown below the fungal growth. Severely diseased plant appears to be dusted with white granular powdery mass. Such plant poor growth and produce fewer pods. The young green siliques show white to dirty white circular mildew growth in the initial stage of infection. Later such pods are completely covered with white mass in size and produce few small sized shriveled seed. The pathogen is an obligate parasite. The mycelium of the fungus is amphigenous, white-septate, spreading and persistent. Conidia are hyaline, borne singly or in short chain 25-45x12-16µm in size and cylindrical in shape. Perithecia are scattered, globose at first yellowish orange, becoming brown to dark brown and black with maturity, 90-130µm in diameter. Cells of perithecia are irregular brown and 10-25µm in diameter. Appendages are numerous myceloid present all over the surface of perithecia, Asci oval to pyriform 3-12 in number usually 6-8 with indistinct stipe and 50-70x30-45µm in size. Ascospores are ovoid 2-7 in number and 16-22x11-14µm in size. Conidia germinate only from one end the germ tube in normally branched having up to three branches. Out of tested 42 genotypes of *Brassica*, was found resistant and genotype viz. UDN-11-32, UDN-11-03, UDN-11-28 and UDN-11-26 were observed to be moderately resistant. Out of tested ten treatments of fungicide, bioagent and nutrients seed treatments Iprodione + carbendazim (1:1) @ 2g/kg seed, was found to be most effective in reducing disease intensity with increasing yield and 1000 seed weight, followed by removal of three lower leaves. ZnSO₄ + Sulphur as per recommendation was the most effective fungicide for the management of Powdery mildew.

SECONDARY METABOLISM IN *PENICILLIUM EXPANSUM*: EMPHASIS ON RECENT ADVANCES IN PATULIN RESEARCH

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The plant pathogenic fungus *Penicillium expansum* is a major concern of the global food industry due to its wide occurrence and ability to produce various mycotoxins, of which the most significant is patulin. Relatively less highlighted in the literature, in comparison with the other food-borne mycotoxins, patulin is one of the main factors in economic losses of vegetables and fruits. Otherwise, patulin is a health hazard which results in both short-term and long-term risks. This review includes knowledge on the biosynthetic mechanisms used for secondary metabolite production in *P. expansum*, with special emphasis on patulin biosynthesis. The abiotic factors triggering the production of patulin and the strategies developed to reduce or prevent the contamination by this mycotoxin are comprehensively discussed. The database presented in this review would be useful for the prioritization and development of future research.

VEGETABLE CROPS FOR FOOD AND NUTRITIONAL SECURITY

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Last decade of the twentieth century was a witness to series of enormous reformation and changes in all aspects of life including social and economic upheavals necessarily. Have ramifications for present and future generations. Food and nutrition insecurity is cumulative in nature, as the conditions presents in each link of the chain affect food and nutrition security. Nutritional status is a measure of health condition of an individual as affected primarily by the intake of food and utilization of nutrients. Health is not only the absence of disease but a state of complete mental and physical well being in relation to the productivity and performance of an individual. Good nutritional status can only be realized and sustained when individuals within 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. Food security has three important dimensions: adequate availability of food supplies; assured access to sufficient food for all individuals, and its proper utilization to provide the proper and balanced diet. Nutrition plays a critical role in human resource development since deficiencies in essential nutrients lead to malnutrition, which affects an individual's 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, poorly 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, traders, 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.



CROP DIVERSIFICATION AND PROTECTED CULTIVATION: POWERFUL TOOL FOR MANAGING CLIMATE CHANGE**Neerja Sharma**

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Environmental changes may affect many different aspects of agricultural production. Recognition that climate change could have negative consequences for agricultural production has generated a desire to build resilience into agricultural system which will continue to provide a vital service such as food production if challenged by severe drought or by a large reduction in rainfall. One rational and cost effective method may be the implementation of increased agricultural crop diversification, which can improve resilience in variety of ways. By engendering a greater ability to suppress pest outbreak and dampen pathogen transmission, which may worsen under future climate scenarios, as well as buffering crop production from the effects of greater climate variability and extreme events. Horticulturists, especially floriculturists located near national capital region of the state are fetching some good money with flowers and greenhouse. In Jammu and Kashmir in recent years area under horticultural crop production, micro-irrigation and green house has been increased due to more production and better marketing price. The proficient knack of educated farmers in the region and the influx of new technology are contributing to the increasing horticulture market not only in the metros but also in the middle east and European countries. Apart from this, fallow, poor and marginal land in the state can be brought cultivation of various horticultural crop requiring very low water, and care like bael, aonla, custard apple, jamun etc. according to the type of soil and availability of irrigation water. The development of resilient agricultural system is an essential topic of study because many communities greatly depend upon the provisioning ecosystem services of such systems (food, fodder, fuel) for their livelihood. Many agricultural based economies have few other livelihood strategies, and small family farms have little capital to invest in expensive adaptation strategies, which increase the vulnerability of rural, agricultural communities to a changing environment. The challenge for the research community is to develop resilient agricultural system using rational, affordable strategies such that ecosystem functions and services can be maintained and livelihood can be protected. In this regard, adoption of horticulture and protected cultivation can be instrumental in developing a sustainable and climate resilient system.

BIODEGRADATION OF ENDOSULFAN AND IMIDACLOPRID USING INDIGENOUS FUNGAL ISOLATES OF AGRICULTURE FIELDS OF KUMAUN REGION OF UTTARAKHAND**Ashish Kumar, Saurabh Gangola, Anita Sharma**

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Endosulfan and Imidacloprid degrading fungal isolates were isolated from the contaminated agricultural fields of Udham Singh Nagar Uttarakhand. The fungal isolates were enriched to grow in minimal broth in the presence of pesticides and the maximum tolerance for both the pesticides was 350 ppm. Two fungal isolates were selected for the study on the basis of their ability to degrade and utilize them as Carbon and sulphur sources. Fungal isolates FII and FIII were characterized on the basis of morphological, biochemical and molecular tests. Isolate FII was characterized as *Aspergillus Oryzae* and FIII showed 100% similarity with *Trichoderma longibrachiatum*. Endosulfan and Imidacloprid were degraded using the isolate FII, FIII and their consortium in minimal broth. After 15 days the pattern of Imidacloprid degradation was FIII (81%) < FII (85%) < consortia (92%), whereas for Endosulfan the pattern was FIII (α -81%, and β 86%) < FII (α -85%, and β 87%) < consortia (α -93%, and β 95%). Effect of amendment of waste material (Bagass, Hen Manure, Farm yard manure) in soil on biodegradation of the pesticide, revealed that maximum degradation of Endosulfan and Imidacloprid was obtained in the soil amended with bagass and degradation was 97%. In a pot experiment conducted on maize using sterilized and unsterilized soil spiked with pesticides (100mg/ Kg) again best performance on biodegradation was observed in consortium treatment. GC-MS analysis of intermediates of Endosulfan biodegraded with fungal isolates and their consortium showed the presence of the non toxic metabolites. Fungal consortium degraded endosulfan into the Dodecane, Diisodecyl ether, Benzyl chloride, Dotriacontane, Heneicosane, Isopropyl Myristate, 1,2- Benzenedicarboxylic acid, Bis (2- Methylpropyl) Ester, Hexacosane, Dotriacontane.

DIVERSITY OF CULTURABLE BACTERIA ASSOCIATED WITH THE RHIZOSPHERE OF INDIAN WESTERN HIMALAYAN RED KIDNEY BEANS**Deep Chandra Suyal, Saurabh Kumar, Prasenjit Debbarma, Divya Joshi, Reeta Goel**

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The entire Himalayan mountain range is well known for its unique biodiversity. Agriculture is an important livelihood activity in these high altitude agro-ecosystems; preferring the natural farming over chemical based farming and therefore, causative for emergence of hilly agri-lands as a gold mine for adaptable potential microorganisms. Moreover, scattered habitations, inaccessibility and uneconomic holdings keep these regions free from any anthropogenic contamination. Red kidney bean (RKB) is one of the major pulse crops of Western Indian Himalaya (WIH). Its cultivation in these habitats is strongly influenced by several environmental stresses and therefore, there must be a selection of RKB associated microorganisms that are adapted to these harsh conditions. Our previous Metagenomic studies highlights the presence of unique and "yet not cultured" microflora from RKB rhizosphere. In this perspective, a total of 160 bacteria were isolated from RKB rhizospheric soil of two different agro-ecosystems of WIH namely S1 (Chhiplakot, 30.70°N/80.30°E) and S2 (Munsyari, 30.60°N/80.20°E). In both the rhizospheric samples, similar bacterial communities were encountered which apparently consists mainly of the genus *Bacillus*. All the bacteria were



found to affiliate with three phyla Proteobacteria, Actinobacteria and Firmicutes including a wide range of genera viz. *Ochrobactrum*, *Advenella*, *Acinetobacter* and *Pseudomonas* etc. In conclusion, present study provides the overview of bacterial diversity from WIH soils which could be explored for improved crop production and sustainability.

CORRELATION AND PATH COEFFICIENT ANALYSIS OF SEED YIELD AND YIELD RELATED TRAITS OF LINSEED (*LINUM USITATISSIMUM* L.)

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The present study on correlation and path coefficient analysis for yield and yield contributing characters in 30 genotypes of linseed was conducted at experimental farm of the department of crop improvement, CSK HPKV, Palampur to ascertain the genetic and phenotypic correlation and contribution of these traits towards the yield directly and indirectly in linseed. The results indicated that seed yield had significant positive correlation with secondary branches per plant, aerial biomass, seeds per capsule, capsules per plant, harvest index, 1000 seed weight and oil content. The results obtained in the present investigation clearly indicated that improvements of seed yield are simultaneously possible through indirect selection for aerial biomass followed by number of capsules per plant which is highly correlated with seed yield. The path analysis also indicates that aerial biomass and capsules per plant are the most important traits in influencing seed yield. Thus, selection for high number of capsules per plant is pre-requisite for attaining higher seed yield in linseed.

ROLE OF NATIVE ALGAL SPECIES IN BIOREMEDIATION OF CYPERMETHRIN, FIPRONIL AND HEAVY METALS UNDER LABORATORY CONDITIONS

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Biodegradation/Biosorption of two pesticides (cypermethrin and fipronil) and two heavy metals (arsenic and cadmium) was tested under laboratory conditions using three algal species (A1, A2, A3), recovered from polluted drains of G.B. Pant University of Agriculture and Technology, Pantnagar. Synthesis of algae mediated silver nanoparticles was also attempted. Algal species, grown in modified Chu 10 medium were characterized microscopically and on the basis of chlorophyll type. Biodegradation potential of algal species was tested in minimal medium to which cypermethrin and fipronil were supplemented @ 20 ppm under axenic/anaxenic conditions, after 15 days of incubation. Anaxenic algal cultures showed better biodegradation of fipronil as compared to naturally occurring bacterial population. Percent degradation of fipronil was 86, 90 and 90.15 by impure A1, A2, and A3, algal species respectively. Naturally occurring bacterial population (without algae) performed better biodegradation of cypermethrin as percent degradation was 95, 82 and 79.4 for B1, B2 and B3 respectively. In biosorption study of heavy metals, A1 performed better than the rest of the two algal species showing 3.84 ppm (for Cd) and 2.4 ppm (for As) biosorption, out of 50 ppm of individual metal after 30 days. Presence of metal particles was also observed on the algal biomass in Scanning Electron Microscopic (SEM) studies. Synthesis of silver nanoparticles using algal extract (A1 and A2) was confirmed on the basis of visual observation for colour change, absorption spectra and by Scanning Electron Microscopy (SEM) analysis. Anti-fungal activity of the synthesized nanoparticles was checked against *Rhizoctonia* and *Fusarium* and it was observed that A1 nanoparticles were better in controlling these plant pathogens with a zone size of 5.5 mm and 15 mm for *Rhizoctonia* and *Fusarium*, respectively. Biodegradation of cypermethrin was also tested in a sterile soil column in presence of algal consortium (A1 + A2). Results of column experiment revealed the almost complete degradation of cypermethrin as confirmed by HPLC analysis after 30 days.

EFFECT OF FOLIAR NUTRITION ON PRODUCTIVITY AND PROFITABILITY OF SOYBEAN [*GLYCINE MAX* (L.) MERRILL]

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A field experiment was conducted during *Kharif* season of 2015 at the Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur to evaluate the effect of foliar nutrition on productivity and profitability of soybean [*Glycine max* (L.) Merrill] under *Vertisols* of Chhattisgarh plains. The experiment was laid out in Randomized Block Design with three replications. The results revealed that application of RDF + spray of DAP @ 2 % at pod initiation stages of crop growth resulted significantly higher plant height, number of leaves, leaf area, leaf area index, number of pods⁻¹ (68), number of seeds pods⁻¹, (3.02) seed index, higher grain yield (2157 kg ha⁻¹) and an increment of 19 % was noticed higher seed yield in over controlled plot that is application of RDF, and water spray at pod initiation only. Number of pods plant⁻¹ and grain yield, respectively higher with 2% DAP spray as foliar application at flowering and at early pod development stage, when compared with control. Foliar spraying with 2% DAP at flowering and at early pod development in addition to soil application of NPK fertilizer was found to be more beneficial to improve the productivity of soybean than application of RDF + Water spray at pod initiation stage and RDF. The foliar application of RDF + spray of DAP @ 2 % recorded significantly higher net return of Rs 60,279 with B: C ratio of 3.07.



SUSTAINABLE AGRICULTURAL DEVELOPMENT THROUGH INNOVATIVE BIOTECHNOLOGICAL APPROACHES**Kavita Gururani and Dinesh Pandey**

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Most of the surveys predicting ~50% increase in world population by 2050, clearly indicating the need of more crop production to provide food to large population and animals. While most of the regions of the world exert a negative pressure on crop productivity by global climate change; it also compromises the natural genetic resources beyond sustainable agricultural production, food security, water scarcity, environmental pollution and soil degradation. Conserved genetic materials have been referred to as plant genetic resources for food and agriculture (PGRFA) which facilitates vital ecosystem functions related to soil structure, nutrient cycles, hydrological flows, agro-ecosystem stability and defense against pests and diseases. The requirement for the conservation of genetic resources mainly focused on to develop crops and medicinal plants for providing long-term food security, nutrition and health to world's population. Recent advancement of biotechnology to facilitate all plant genes which can be useful for crop improvement through genetic manipulation, genetic engineering of tropical crops to make them suitable for more temperate climates and production of high nutritional value substitutes from the less available raw materials and competing with other developing countries establishing their agricultural enterprises. Collection, characterization, database creation, gene banks and exchange of genetic material need a concern for the conservation and efficient use of plant genetic resources with innovative approaches. In this sequence genetically improved crops having higher yield potential, more productivity and resistance to biotic and abiotic stresses require public and private investment in the area of plant breeding and biotechnology. PGRFA are continuously providing new varieties with the use of newer biotechnological techniques and playing significant role for agricultural improvement to increase productivity, facilitating greater food and nutrition security and increasing the economy of farmers.

EFFECT OF DIFFERENT PACKAGING MATERIAL AND CONCENTRATIONS OF CaCl_2 ON SHELF LIFE AND FRUIT QUALITY OF PEACH (*PRUNUS PERSICA*) CV. SHAN-E-PUNJAB**Manpreet Singh Preet¹, Amit Jasrotia², Parshant Bakshi², Rakesh Kumar²,**¹Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar-263 145, U.S. Nagar, Uttarakhand²Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu- 180010, J&K

Peach is one of the high ranking stone fruit grown in temperate zones of the world. In later half of 19th century Indian people started cultivation of peach at very few places. Nowadays it is being cultivated in mid hill zone of Himalaya extending from Jammu and Kashmir to Khasi hills 1000-2000 m above mean sea level. Development of various low chilling peach cultivars have made it possible for its cultivation in subtropical regions like sub-mountainous region of Punjab, Haryana, Delhi and Western UP, Uttarakhand due to its specific climatic requirements. Being perishable in nature peach can sustain in ambient condition up to 3-5 days. Due to high seasonal flush and more perishable nature peaches are being marketed only in the short distance domestic markets in India and minor share of total peach is being exported from India. It is need of hour to develop postharvest technologies for extending the shelf life for maintaining the fruit quality. An investigation was carried out to study the effect of postharvest application of CaCl_2 (2, 4 and 6%) on peach (*Prunus persica* L. Batsch) cv. Shan-e-Punjab which were packed in polythene bags and corrugated fiber boxes and stored at $3\pm 2^\circ\text{C}$ and 85–90% RH for 24 and 15 days respectively followed by storage at ambient conditions (28 to 30°C , 65–70% RH) for 3 and 6 days. The results pretended that fruits treated with CaCl_2 (6%) and packed in polythene bags showed reduced physiological loss in weight (PLW) and maintained fruit firmness, acidity, TSS content and ascorbic acid activity during storage as compared to the fruits packed in cardboard boxes. Maximum PLW of 25.50 per cent was seen in the fruits which were untreated fruits and stored under ambient conditions while it was minimum 6.22 % in fruits treated with 6% CaCl_2 on 24th day of storage under refrigerated condition. The fruits treated with 6 % CaCl_2 showed maximum firmness (13.28lb/inch²), acidity (0.71 %), TSS (10.88) and ascorbic acid (3.58 mg/100 g) content on 24th day under refrigerated conditions while all these parameters were minimum in fruits packed in cardboard boxes. Thus, 6 % CaCl_2 was found to be the best as it showed minimum PLW and maximum firmness and ascorbic acid under both ambient and refrigerated conditions.

EFFECTS OF PRE- AND POST-EMERGENCE HERBICIDES ON PHOSPHATE SOLUBILIZING BACTERIA (PSB) AND RHIZOBIUM LEGUMINOSARUM IN GRAM (*CICER AERITINUM* L.)**Prasenjit Debbarma^{*1}, C.D. Deokar¹, Saurav Das²**¹Department of Plant pathology and Agricultural Microbiology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413722, India²Department of Soil Science and Agricultural Chemistry, College of Agriculture, Lembucherra, Tripura 799210, India

The most commonly used microbial inoculants in chickpea are nitrogen fixer, *Rhizobia* and phosphate solubilizing bacteria (PSB). The present experiments were conducted to examine the effects of herbicides on the growth of *Rhizobium leguminosarum* and phosphate solubilizing bacteria (PSB). The experiments determined the sensitivity/resistance of the recommended pre-emergence herbicide, pendimethalin (stomp xtra) in two doses @ 9×10^4 ppm and 15×10^4 ppm and post-emergence herbicide, quizalofop-p-ethyl (targa super 5EC) @ 80 ppm on the growth and survival of chickpea *Rhizobium* and PSB, under both *in vitro* and *in vivo* conditions. At laboratory level, it was found that the lower concentration of pendimethalin (9×10^4 ppm) and quizalofop-p-ethyl (80 ppm) did not adversely affect the growth of both *Rhizobium* and PSB. It was also determined that the higher concentration of pendimethalin (15×10^4 ppm) had retarding effect on *Rhizobium* but it showed no adverse effect on PSB. At field level experiment, to study the effects of herbicides chickpea seeds were bio-primed with respective microbial biofertilizers to improve grain yield of chickpea. In this study, it was revealed non significant effects of herbicides on the growth population of *Rhizobium* and



PSB at their minimum concentration level. It was also determined that the co-inoculation of *Rhizobium* and PSB was the most effective treatment under *in vivo* conditions.

HIGH DENSITY PLANTING: BOOSTING PRODUCTION AND PRODUCTIVITY OF FRUIT CROPS

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With the increasing human population the demand of food is increasing day by day. Presently, the continue decline in the availability of cultivated land, rising energy and land cost together with increased demand of fruit product have given thrust to the concept of high density planting (HDP) in fruit crops. There is a pressure on researchers to increase the productivity of these crops. It can be increased either by increasing the production capacity of crop or by utilizing the available resources. To achieve this, high density planting is a major tool and one of recent concept of planting of fruit trees at a closure spacing than the recommended one with the sole objective of obtaining maximum productivity per unit area without sacrificing quality and yield of fruit crops. For the efficient use of horizontal and vertical space, HDP technology have been used in mango, citrus, apple, peach, guava and various other fruit crops. HDP not only shortens juvenility but also give early crop and higher yield for a long time. It permits efficient use of resources like light, water and fertilizers, reduce labour cost, allow efficient pesticides and growth regulators application and make harvesting easier along with improving the fruit quality. However, the success of this technology depends upon right choice of planting system, cultivar and nutrition status of soil.

LOW COST RIPENING CHAMBER IN MANGO: A NEW VISTA TO ENHANCE QUALITY AND SHELF LIFE

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Mango (*Mangifera indica* L.) belongs to the family anacardiaceae originated in Indo-Burma region. Mango is one of the major fruits of Asia and has developed its own importance all over the world. India is the largest producer and exporter of mango in the world with 56 % of world's production. Maturity at harvest plays an important role for postharvest life and eating quality, in particular for climacteric fruits. Fruits harvested at an immature stage may not achieve normal ripening characteristics. Mango fruits are generally harvested during their physiological maturation i.e., mature but unripe condition to get optimum fruit quality and is subsequently allowed to ripen further. In natural conditions, they ripen slowly, leading to high weight loss, desiccation and ripening is also uneven. To overcome this, ethylene gas has been commercially used in modern ripening chambers, which require huge investments and are not economically viable option for the farmers. An alternative simple economical method has been standardized for enhancing ripening of fruits by exposing fruits to ethylene gas in the plastic tents. In this small quantity of alkali is added to ethrel to release ethylene gas and for the ripening process. However, ripening of the mangoes in these chambers is affected by some factors like maturity stage of the fruits harvested and duration of the ethrel treatment to be given. Not only the ripening but also quality and the shelf life of the mango fruits are effected under these chambers.

TOLERANCE AND COMPATIBILITY OF *TRICHODERMA VIRIDE* AGAINST COMMON PESTICIDES

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A pot experiment conducted to check the tolerance and compatibility of *Trichoderma viride* in soil against common pesticides. Maximum population (5.33 cfu g⁻¹ soil) of *T. viride* was recorded in untreated control followed by monocrotophos (5.33 cfu g⁻¹ soil), fipronil (5.33 cfu g⁻¹ soil), mancozeb (5.0 cfu g⁻¹ soil), acetamiprid (5.0 cfu g⁻¹ soil), acephate (5.0 cfu g⁻¹ soil), crossman (4.66 cfu g⁻¹ soil), hexaconazole (4.33 cfu g⁻¹ soil) and carbendazim (3.33 cfu g⁻¹ soil) in pesticides treated pots at recommended doses after 30 days of inoculation. All these pesticides were found highly compatible with *T. viride*. Whereas, carbendazim was moderately compatible with *T. viride* at 30 and 60 days after inoculation. All above tested pesticides were found highly compatible with the *T. viride* at recommended dose after 90 days of inoculation.

AN INTRODUCTION TO LAKOOCHA (*ARTOCARPUS LACUCHA* ROXB.)

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Artocarpus lacucha is a perennial fruit plant commonly known as Lakoocha, Monkey jack and Badahara native to the Indian subcontinent and South East Asia which comes under moraceae family. It is a deciduous tree about 10-15 meter tall in height with branchlets 3-6 mm thick and densely covered with stiff light brown to yellow velvety hairs. Leaves are large about 25-30 cm long and 15-20 cm wide. The fruits are



nearly round or irregular in shape. The fruits are sweet sour in taste which contains 20-30 seeds that are fleshy with thin seed coat. It is occasionally eaten raw but mostly made into curries or chutney. The lakoocha tree is also used for timbers for construction, furniture, boat making, and cabinet work etc. It is also rich source of minerals such as potassium magnesium, phosphorus, calcium, iron, zinc, manganese and copper etc. There is strongest use of this fruit in the terms of nutritional as well as medicinal point of view. It is rich source of antioxidants, flavonoids, antibacterial, anthelmintic, insecticidal and phenolic acids etc. Artocarpin are isolated from seeds which precipitates several galactomannans. stem bark of lakoocha contains oxyresveratrol which is used for tapeworm. The fruit of lakoocha which contains β -amyrin acetate and lupeol acetate which reduces the diabetes and also used for atherosclerosis medicine. The fruit pulp act as curative properties as well as treatment of skin ailments. In conclusion, this perennial fruit plant has multipurpose uses. Fruit can be consumed as alternative nutritional food and plant used as raw materials of pharmaceuticals due to its pharmacological properties.

VERTICAL FARMING: SCOPE IN INDIAN HORTICULTURE

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Vertical farming is the practice of producing the food in vertically inclined surfaces or vertically stacked layers which could help raise production without occupying space, without soil or compost i.e., hydroponically or aeroponically. Growing of horticultural crops mainly fruits vegetables and flowers in soilless culture and in controlled condition has advantages like use of pesticides would be minimized as most of the disease producing microbes comes from the soil and removal disease, pest or predator attacks. Hence, the citizens would get farm fresh fruits and vegetables from their neighborhood itself. In this system, there are no such things as seasonal crops and no crop losses which means our farms can be established in any climatic region irrespective of seasonal daylight hours and extremes in temperature as they are not dependent on fertile arable land. If the vertical farming/ gardening system has to be taken outside the house, it is possible to take up normal cultivation that uses soil and also light emitting diodes (LED) lights can be tried out as a substitute for sunlight in soilless farming inside the house or on a commercial basis. The concept of vertical farming has already been introduced in the United States, Europe, Japan and Singapore. It is well predicted that by 2050, 70 percent of the world population will live in urban areas. With the fast-shrinking farming land and increase in population, to reach the increasing food requirements, modern concepts like vertical farming has to be still more focused and improved on a large scale basis in developing countries like India.

AUGMENTING GROWTH, PHYSIOLOGICAL AND BIOCHEMICAL ACTIVITIES AND ESSENTIAL OIL PRODUCTION IN *M. SPICATA* L. THROUGH FOLIAR APPLICATION OF IRRADIATED CARRAGEENAN

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Menthaspicata L., commonly known as spearmint (family Lamiaceae), is one of the important medicinal and aromatic plants with an enormous economic importance due to its widespread applications in food, cosmetics, pharmaceutical industries etc. It is cultivated worldwide mainly for its essential oil and phenolic compounds. Carvone, limonene, and 1,8-cineole are the major components of spearmint essential oil (EO). It has antifungal, antiviral, antimicrobial, insecticide and antioxidant properties due to which a number of research organizations are engaged in enhancement of EO percentage of spearmint. Recently, a new agro-technique has been evolved in which it has been proved that if natural polysaccharides (e.g. alginate, carrageenan and chitosan) are exposed to gamma radiation, they are depolymerized into various oligomers. The aqueous solution of these oligomers, when applied to the plants, proved as potent plant promoters. Keeping this in mind, a pot experiment was designed to test the effect of water-soluble irradiated carrageenan (IC) on the growth, physiology and EO production of spearmint. Among different concentrations of IC [0 (control), 20, 40, 60, 80 and 100 mg L⁻¹], 80 mg L⁻¹ proved to be the optimum foliar spray treatment for most of the parameters studied including peltate glandular trichomes density. Measurements made at 120 days after planting revealed that foliar application of IC at 80 mg L⁻¹ increased the content and yield of spearmint EO by 36.0 and 122.6%, respectively, in comparison to the control. Gas chromatography mass spectrometry (GC-MS) analysis also showed increase in the carvone content of EO of spearmint. Conclusively, the yield and quality of EO of spearmint may be improved by this economical and ergonomic agricultural strategy.

Keywords: *M. spicata*, irradiated carrageenan, essential oil, GC-MS.

TO ASSESS THE SCOPE OF SUMMER MOONG (*VIGNA RADIATA* L.) IN TERMERIC (*CURCUMA LONGA* L.)

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On farm trial on effect of intercropping of summer moong (*vigna radiata* L.) on growth, yield, and economics of turmeric (*curcuma longa* L.) was conducted at farmer's fields in adopted villages of Krishi Vigyan Kendra viz. Kandola Kalan, Kaimwala, Mehsampur and Fatehpur in district Jalandhar during 2012 and 2013. The experiment was laid out in randomized complete block design and each location was considered as replication. The treatments were T₁ - sole turmeric flat (30 cm x 20 cm), T₂ - sole turmeric ridge (45 x 15 cm), T₃ - sole turmeric ridge (60 x 10 cm), T₄ - sole turmeric bed (67.5 cm), T₅ - turmeric : summer moong (1:1) flat, T₆ - turmeric : summer moong (1:1) ridge 45 x 20 cm, T₇ - turmeric : summer moong (1:1) ridge 60 x 20 cm, T₈ - turmeric : summer moong (2:1) bed 67.5 cm and T₉ - turmeric :



summer moong (2:2) bed 67.5 cm. In intercropping treatments, the sowing of turmeric was done on the top of ridge and bed and summer moong was sown in furrows. The data on emergence count (30 and 60 DAS), plant height, tillers per plant (No.), dry matter accumulation, number of rhizomes (mother, primary, secondary), total rhizomes plant⁻¹, rhizome yield (q ha⁻¹) (fresh, dry and processed) were recorded and showed significant difference in all the treatment expect emergence count at 60 days of sowing. The treatment T₈ and T₉ where turmeric was sown on bed with summer moong in the furrow was found better for all the characters under study. The highest net returns of Rs 2.27 x 10⁵ ha⁻¹ with B : C ratio 4.89 was obtained in T₉ -turmeric : summer moong (2:2) bed 67.5 cm followed by T₈ -turmeric : summer moong (2:1) bed 67.5 cm and recorded lowest net returns of Rs 1.58 x 10⁵ ha⁻¹ with benefit: cost ratio 3.51 in T₅ - turmeric : summer moong (1:1) flat. The study revealed that summer moong can be better option as intercrop in turmeric than the sole turmeric crop for proper utilization of all resources.

EFFECT OF FOLIAR APPLICATION OF NITROGEN ON GROWTH AND YIELD OF VEGETABLE PEA (*PISUM SATIVUM* L.) CV.KASHI UDAI

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Foliar feeding of nitrogen was given on vegetable pea (*Pisum sativum* L.) Cv.Kashi Udai at flowering stage with doses of nitrogen 1%, 2% and 3% as urea by dissolving in per litre of common water as well as distilled water separately. The experimental finding revealed that pea respond well to foliar feeding of nitrogen. Data recorded on height of plant, length of pod, fresh weight of pod, yield of pods per plant as well as per hectare significantly increased with application of 2% nitrogen (20 g urea/litre of water), and non- significant effect noticed only on number of pods per plant. It had also been observed that higher dose of nitrogen beyond 2% promoted plant growth but yield attributing characters adversely affected.

IMPACT OF BIOFERTILIZER ON GROWTH, YIELD AND QUALITY OF CAULIFLOWER (*BRASSICA OLERACEA* L. VAR. BOTRYTIS) CV. PUSA SNOWBALL K-1

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The present investigation entitled "Impact of Biofertilizer on Growth, Yield and Quality of Cauliflower (*Brassica oleracea* L. var. botrytis) cv. Pusa snowball K-1" was conducted on the Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow-226025 (U.P.), India during the year 2015-2016. The experiment was laid out in Randomized Block Design (R.B.D.) with 3 replication and 12 treatments. Treatment combination are T₁- Control, T₂-FYM (20t/ha), T₃-Vermicompost (5t/ha.), T₄- *Azotobacter* (2 kg/ha.), T₅- PSB (2 kg/ha.), T₆- Neem Cake (10 t/ha.), T₇- FYM + Vermicompost (5 t/ha.), T₈- FYM + *Azotobacter*, T₉- FYM + PSB, T₁₀- FYM + Neem Cake, T₁₁- FYM + Vermicompost + *Azotobacter*, T₁₂- FYM + Vermicompost + *Azotobacter* + PSB. Our experiment was combination to the effect of various biofertilizer on the trail plant cauliflower in the tropical region of Lucknow. Result show that the combinatorial use [FYM + Vermicompost + *Azotobacter* + PSB] increase the growth of plant and significantly increases total yield 312.34 quintal per hectare. These result are own experiment and unique and can be very use full in research from trial to field, so it will be of interest to implement these result to the field to harvest good yield of cauliflower.

EFFECT OF NITROGEN AND PLANT GROWTH REGULATORS ON ECONOMIC OF AJWAIN (*TRACHYSPERMUM AMMI* L. SPRAGUE)

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner in Jaipur district of Rajasthan during *rabi* season of 2016-17 on loamy sand soil. The experiment consisted of four levels of nitrogen (0, 30, 60 and 90 kg/ha) and five PGRs (control, NAA @ 50 ppm at 40 DAS, NAA @ 50 ppm at 40 and 60 DAS, thiourea @ 500 ppm at 40 DAS and thiourea @ 500 ppm at 40 and 60 DAS). The total 20 treatment combinations were tested in factorial randomized block design with three replications. The results showed that application of nitrogen up to 60 kg/ha recorded significantly higher yield attributes viz., number of umbels per plant, number of seeds per umbel and seed (1081 kg/ha), straw (3012 kg/ha) and biological yields (4093 kg/ha), net returns (□ 46310/ha) and B:C (2.29) ratio of ajwain over preceding levels but remained at par with 90 kg N/ha. The results further revealed that foliar application of thiourea @ 500 ppm spray at 40 and 60 DAS significantly increased yield attributes and yield viz., seed (1112 kg/ha), straw (3082 kg/ha) and biological yields (4195 kg/ha) and net returns (□ 48354/ha) and B:C (2.33) ratio over thiourea @ 500 ppm spray at 40 DAS, NAA @ 50 ppm spray at 40 DAS and control but remained at par with NAA @ 50 ppm spray at 40 and 60 DAS in yield attributes and yields.



A STUDY ON THE MEDICINAL WEEDS OF KANNAUJ DISTRICT OF U.P.**S.K. Verma and R.B. Yadav**

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The district of Kannauj is part of Kanpur Division. It covers a total area of 1993 sq km. Ganga is the main river at the northern border of the district while Ishan and Kali rivers are in other parts of the district. Wide range of topography, physiographic composition and soil texture pave the way for rich floristic diversity especially weed plants having medicinal importance. The term weed is used in a variety of senses, generally centered around a plant that is not desired within a certain context. Some plants usually thought of as weed may actually provide herbal medicines for the treatment of various diseases. These plants have phytochemicals, secondary metabolites or primary metabolites with a medicinal action in human and animals. Weeds as medicinal plants are important because our 80% rural population depends on these plants for their herbal medicines.

In this paper 48 weed plants were collected, processed and identified for their utilization from different parts of the study area. Study was conducted during different seasons of the year. Out of documented 48 plant species, 31 plants were found to be herbs, 9 shrubs and 8 climbers. Some important plants are *Acalypha indica*, *Ageratum conyzoides*, *Amaranthus viridis*, *Boerhaavia diffusa*, *Coccinia indica*, *Cyperus irria*, *Lathyrus sativus*, *Melilotus alba*, *Phyllanthus niruri*, *Solanum nigrum*, *Tinospora cordifolia*, *Vicia hirsuta* etc. Many weed plants of the district still remain to be explored for their medicinal value, but due to anthropogenic pressure biodiversity of these medicinal plants is declining. Considering these facts there is an urgent need to explore, manage and conserve these plants for present and future generations.

ISOLATION AND CHARACTERIZATION OF ENDOCHITINASE (ECH42) GENE FROM TRICHODERMAMAHARZIANUM**Sorabh Chaudhary*, Sushma Sagar*, Mukesh Kumar* and Akash Tomar****

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In the present investigation an endochitinase gene was isolated and characterized from a native strain of *Trichodermamaharizianum*, which is involved in mycoparasitism. Ten *Trichoderma* spp. were screened for their chitinolytic activity via dual plate method. The *Trichodermachitinase* enzyme activity was monitored for all isolates under study. The highest chitinase activity was observed in S21 and Sug5viz., 17.21 and 13.11 enzyme µg/ml, respectively. *Trichodermamaharizianum* isolate S21 was used for isolation and characterization of an endochitinase gene due to its high chitinolytic enzyme activity. The genomic DNA (gDNA) of *Trichodermamaharizianum* isolate S21 was extracted and amplified using PCR with gene specific primers. The PCR product was cloned into pGEMT vector by TA cloning technique and sequenced commercially. The cloned DNA sequence was 1,464 base pairs. The endochitinase gene was characterized using bioinformatics tools. It showed 99% homology with *Trichodermamaharizianum* isolate SG3303 endochitinase (*ech42*) gene. The putative endochitinase gene, was then subjected to *in-silico* analysis to obtain physio-chemical, evolutionary and structural information of this protein. The results showed that gene has the open reading frame (ORF) of 1,206 bp long. The ORF encoding 408 amino acids which showed 96% homology to *Trichodermamaharizianum* endochitinase Chit42 (ABR12394.1). The maximum parsimony analysis showed that ChitS21 protein was clustered into Group III with other fungi. Ultimately, the *in-silico* analysis of ChitS21 implicated the involvement of this gene/protein in chitin catabolism.

DETERMINATION AND DEMARCATION OF SUITABLE AREA FOR ARTIFICIAL RECHARGE AND RAINWATER HARVESTING USING GIS**Jhalesh Kumar, Omprakash Patel, Nirmal Kumar and Sugat bagde**

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The scope for installation of large and medium irrigation projects is limited due to lack of availability of proper sites, paucity of funds, equity issues and other social factors in many regions of the country. Therefore the installation of "Determination and demarcation of suitable watershed area for artificial recharge and rainwater harvesting through GIS" for ground water recharge and water harvesting has a great potential in the times to come and the objectives like harvesting every drop of rainwater for purposes of irrigation to create sustainable sources of income for the village community as well as for drinking water supplies. The study of project area i.e. Patan Block, Gundrdehi and Durg block their rainfall, temperature, humidity and also the recommended for determination and demarcation of suitable watershed area for artificial recharge and rainwater harvesting through GIS with harvesting structures and their diagrams and images. The results of the project i.e. the changes in crop production, ground water level and human community improvement is positively. The essential and overall view of the project to development of ground water level, production of crop and also reduced in soil erosion.

EFFICACY OF EDIBLE COATING ON SHELF LIFE AND QUALITY OF GUAVA FRUITS (PSIDIUMGUAJAVA L.)**Pankaja B.D*, C. Indu Rani**, S. Elain Apshara* and Lokesh Bora***,**

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Edible coatings inhibit migration of moisture, oxygen, carbon dioxide, or serve as a carrier for food additives like antioxidants or antimicrobials and reduce decay without affecting quality of the fruits and thereby extending shelf life of many horticultural commodities. In the present study, effect of edible coating on shelf life and quality of three guava varieties was conducted in the Department of Fruit crops, Horticultural College and Research Institute, Coimbatore during 2015-16. In this experiment, effect of edible coating on shelf life and quality of guava varieties viz., Lucknow-49, Banarasi, and ArkaKiran was evaluated. Two natural polymers are used namely, 10% Gum Arabic



and 5% Soy Protein with three additives namely 1.5% ascorbic acid, 1.5% calcium chloride and 1% coconut oil. Guava fruits were dipped in edible coating solution for 10 minutes, air dried and stored under ambient conditions for observations. In edible coating, the variety Lucknow-49 variety coated with 10% Gum Arabic + 1% coconut oil retained fruit color values such as 'L' (32.54), 'a' (-7.01) and 'b' (20.50), total chlorophyll content (71.98 mg/100g), higher marketable fruits (94%) and higher sensory score (8.5) up to 12 days compared to 4 days in control fruits. Hence from this experiment we can conclude that using natural polymers we can extend the shelf life and maintain the quality up to consumer without any chemical treatments which will harm the living organisms in the environment. From this move we can check the environmental pollution by using hazardous elements and monitor the environment by chemical residues.

A NOVEL METHOD TO MANAGE SHEATH BLIGHT OF RICE

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Sheath Blight of rice caused by *Rhizoctonia solani* (teleomorph: *Thanatephorus cucumeris*), is a complex pathogen and has a wide host range with worldwide distribution, a very destructive disease under favorable weather conditions in rice growing areas of the world which ultimately causes substantial yield losses. Field experiment were laid out during the *kharif* season 2016-17 at N.E. Borlaug Crop Research Centre, Pantnagar (29° N latitude, 79.3° E longitude), Uttarakhand on rice cultivar Pant Dhan-4 to evaluate the effect of different fungicides, Botanicals and Bioagents in controlling sheath blight of rice. Seven fungicides viz; Validamycin 3 %L, Propiconazole 25 %, Tricyclazole 75 % WP, Tebuconazole 16 %, Hexaconazole 5 % WP, Carbendazim 50 % WP and Azoxystrobin 23 % SC were evaluated for the control of the pathogen at different stages of the plant growth while the control plots were left un-treated. Among these seven fungicides, Azoxystrobin 23 % SC showed maximum disease control over check (46.03%) with maximum yield (69.39 q/ha) and *in vitro*, it showed 100 per cent inhibition of mycelial growth of *R.solani*, even at 25 ppm. Among bioagents PBAT-3 and in botanicals neem was found most superior one. This study showed that Azoxystrobin 23% SC, PBAT-3 and neem is superior overall, and among these three a new generation fungicide Azoxystrobin is more effective.

EFFECT OF SOWING DATES AND CULTIVARS ON GROWTH AND YIELD VARIABILITY IN SOYBEAN

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The field experiment was conducted at research farm, Department of Physics and Agro-meteorology, College of Agricultural Engineering, JNKVV, Jabalpur (M.P.) during *Kharif* season 2015. The experimental site lies between 23°10'N latitude and 79°56'E longitude and 411.78 m above mean sea level. The rainfall during the crop season was 989.2 mm, which was received in 43 rainy days. The experiment was conducted in a split-plot design with three replications. The treatments consist of 3 dates of sowing i.e. D₁ (19th June-early), D₂ (07th July-medium) and D₃ (24th July-late); and 3 cultivars i.e. V₁ to V₃ ('JS 95-60', 'JS 20-29' and 'JS 97-52'). Dates of sowing were taken as main plot treatments and cultivars as sub-plot treatments. The growth parameters like plant height (cm), branches per plant and dry weight per plant (g) decreased at medium to late sown dates than early sown dates. The physiological parameter as leaf area index decreases with 07th July and 24th July sown dates. The aforesaid characters were significantly superior under 19th June sown date over 07th July and 24th July sown dates. Various yield attributing characters like number of pods per plant, number of seeds per pod and 100-Seed weight (g) were significantly higher in 1st sown date (19th June) while lowest in 3rd sown date (24th July) resulted in lowered values of yield attributing characters. The seed and biological yield was maximum (1408.67 kg/ha and 3527.83 kg/ha) under 19th June sown date and it proved significantly superior over 07th July and 24th July sown crop which produced 1218.61 kg/ha and 3294.63 kg/ha and 910.37 kg/ha and 2950.10 kg/ha seed and biological yield, respectively. As regards, soybean cultivar seed and biological yield was maximum in JS 97-52 cultivar under 19th June sown date and it proved significantly superior over 07th July and 24th July sown dates, while minimum seed and biological yield was found in JS 95-60 cultivar. Hence, JS 97-52 variety proves beneficial if planted early from 2nd to 3rd week of June under normal moisture conditions.

STUDIES ON VARIABILITY AND SCOPE OF SELECTION FOR YIELD AND YIELD ATTRIBUTES IN TOMATO (*SOLANUM LYCOPERSICON* (MILL.) WETTSD)

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The experiment was conducted at Main Experimental Station of Department of Vegetable Science, NDUAT, Kumarganj, and Faizabad (U.P.) during *Rabi*, 2014-15. Experimental material for study was consisted of 46 genotypes including 3 checks (DVRT-2, H-24, and H-86). The experiment was conducted in Randomized Complete Block Design with three replications. Each treatment consisted of 20 plants in two rows, having spacing of 60 cm x 45 cm. Observations were recorded on sixteen characters viz. days to 50 percent flowering (days), primary branches per plant, number of fruits per plant, days to first fruit harvest, average fruit weight (g), fruit circumference (cm), pericarp thickness (cm), number locules per fruit, TSS(%), fruit length (cm), harvesting duration and fruit yield per plant (kg). The analysis of variance revealed that the mean sum of squares due to treatments was found highly significant for all the characters. The higher magnitude of coefficient of variation at phenotypes as well as genotypic levels was observed for number locules per plant and plant height (cm). While low GCV and PCV were observed for days to 50 percent flowering (days) and days to first fruit harvest. High heritability coupled with high genetic advance in per cent of mean was recorded for number of fruits per plant, plant height (cm), primary branches per plant, fruit circumference (cm) and number locules per fruit indicating that these traits were less influenced by environment. On the basis of mean performance the genotype



viz. NDT-383, NDT-386, NDT-377 and NDT-344 found best for fruit yield per plant and other yield attributes. Thus during selection in tomato number of fruit per plant, plant height(cm), primary branches per plant and fruit length(cm) should taken into consideration for selection of elite genotypes.

EFFICACY OF SOME ESSENTIAL OILS AGAINST THE GREATER WAX MOTH (*Galleria mellonella* L.) UNDER STORAGE CONDITION

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The experiments were carried out to check the efficacy of some essential oils against the greater wax moth (*Galleria mellonella* L.) under storage condition. The oils of five plants and one plant extract viz., neem oil, cedar oil, clove oil, peppermint oil, karanj oil and neem seed kernel extract. Essential oils tested at various concentrations were found to exhibit varying degree of activity against the larvae *G. mellonella*. Two-three year old wax combs were collected from apiary which were heavily infested with *G. mellonella*. Rectangular pieces of comb with size (5 × 3 inches) were cut and placed in clean glass jar. Emerged moths were collected and transferred to another clean jar added with fresh comb for further egg laying and mouth of the jar was covered with muslin cloth. All the jars were autoclaved to avoid any infection while experiment was conducted at temperature $20 \pm 5^\circ\text{C}$ and R.H. $65 \pm 5\%$. Larvae were monitored carefully to obtain the suitable instars for treatment. The highest mortality was recorded from neem-oil-5% (highest mortality 65.33% at 7 DAT) while lowest mortality was recorded from karanj oil (lowest mortality 2.33% at DAT). In present studies some essential oils were taken to understand their effectiveness at different concentrations for GWM larvae, since these treatment seem to be safe for pollinators, human and environment, also the applied essential oils are easily available and cheap.

CRISPR/CAS SYSTEM: A GENOME EDITING TOOL FOR CROP IMPROVEMENT

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Targeted genome editing is a type of genetic engineering in which DNA is specifically deleted, inserted or replaced in the genome of a living organism at by the use of engineered nucleases. The field of genome editing is experiencing intensive growth as the new technologies continue to emerge. Alongside having potential for boosting crop yields, genome editing is now one of the best tools for reverse genetics and also appeared as a versatile tool for studying basic biology. The integration of genes in the genome is completely random, which can have marked effects on the host, such as inactivation of an endogenous gene, differential levels of transgene expression and silencing of the transgene when inserted into a heterochromatic region. To overcome these issues, a technology that allows introducing gene at a precisely identified chromosomal locus, also stacking of a number of genes in a single multigene array thereby manipulating the array by genome editing was needed. Clustered regularly interspaced short palindromic repeat (CRISPR)/CRISPR associated protein system (CRISPR/Cas) offers potential for efficient targeted plant genome engineering. This system contains mainly three components: Photo spacer adjacent motif (PAM), CRISPR RNA (cr RNA) and trans-activating cr RNA (tracr RNA). Later on CRISPR RNA and trans-activating cr RNA joined together to form single guide RNA (sgRNA). This technique simply involved changes of a few base pairs in the plant's DNA and has promising applications in agriculture. It creates *in vivo* double-stranded breaks at target loci that stimulate the cellular DNA repair mechanisms either by nonhomologous end joining (NHEJ) or by homologous recombination (HR), resulting in targeted gene insertion or gene replacement. In plants, the use of such targeted genome modifications has many applications, ranging from diffracting gene function to creating plants with new traits like disease resistance, metabolite profile alteration, and resistance to herbicides etc. The technique is suitable for multiplex genome editing in a variety of cell lines and in living organisms. To refocus it on a new target needs only replacing the 20-nucleotide guide sequence of sgRNA. Moreover, simultaneous editing of several genes is greatly simplified by introducing a combination of sgRNAs.

Effect of manures and nitrogen levels on soil fertility, nutrient content and uptake of pearl millet under semiarid climatic conditions

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A field experiment was carried at Agronomy Research Farm, CCSHAU, Hisar during *Kharif* 2016 with the objective to study the effect of manure and different nitrogen levels on nutrient content and uptake of pearl millet hybrid HHB-223. The experiment was conducted in split plot design with three replications. In the main plot there were manurial treatment viz. control, biomix, vermicompost @ 2.5 t ha^{-1} and vermicompost @ 2.5 t ha^{-1} + biomix and nitrogen levels viz. 70, 80, 90 and 100 per cent RDN were kept under subplot. Availability of nutrient (N, P and K) after harvest in soil increased with increasing level of nitrogen and was highest in biomix + vermicompost @ 2.5 t ha^{-1} treatment among manurial treatment (126.1, 17.9 and 252.5 resp.). Higher N, P, K content and uptake both in grain as well as in straw was with biomix + vermicompost @ 2.5 t ha^{-1} and 100 per cent RDN. The N, P and K content in grain were highest with the treatment of biomix + vermicompost @ 2.5 t ha^{-1} and were 1.79, 0.22 and 0.53% resp. while, in the straw the concentration were 0.81, 0.25 and 1.51% resp. The N, P and K uptake was also higher with the treatment of biomix + vermicompost @ 2.5 t ha^{-1} . Also, under different nitrogen levels uptake was maximum with the 100% RDN but almost comparable with the 90% RDN. Hence, to increase the fertility and nutrient content in both grain and straw pearl millet seed should be treated with biomix and fertilized with 100% RDN along with vermicompost application @ 2.5 t ha^{-1} .



HYDROPONICS: AN ALTERNATIVE TECHNOLOGY FOR PROFITABLE HORTICULTURE IN ADVERSE CLIMATIC SITUATIONS

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As global warming becomes a bigger issue for the average citizen, consumers and government leaders are always looking for better ways to cut down on carbon dioxide emissions and help the environment. Perhaps one of the greatest ways countries can cut back on harmful greenhouse gasses is through examining how they produce and distribute their food supply. Hydroponic growing has numerous possibilities to not only produce, larger, better tasting vegetables, but also help the environment. Here are the main ways that hydroponic growing may be the way to "go green" in the future. Hydroponic Growing Uses Less Land – It is estimated that approximately 10 million hectares of arable land is lost every year for a variety of reasons. With farmers being increasingly pinched on the amount of land that can be used for traditional soil gardening, hydroponics may prove to be the solution. Because every element of this style of growing can be closely controlled, it can produce larger yields, making the same amount of vegetables in just 1/5th of the space. It is increasing rapidly in Australia, in Canada, in the US and in 1, to mention the most important countries. Hydroponics is the art of growing plants in water. The word comes from the Greek "hydro = water" and "ponos = work". **Hydroponics** – growing plants without soil, instead using a nutrient-rich solution to deliver water and minerals to their roots. This technique has proven to be commercially successful for propagation, seed germination, seed potato production other horticultural crop productions.

NOTES ON *ADORETUS* SPP. (COLEOPTERA: SCARABAEIDAE: RUTELINAE) FROM RAJASTHAN, INDIA

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White grubs are the pestiferous species that belong to family Scarabaeidae under order Coleoptera. The group includes over 27,800 species worldwide and 2500 species in India. Scarabaeidae constitutes nearly 80% phytophagous species, where white grubs mainly belong to subfamilies Melolonthinae and Rutelinae that cause serious damage to several economic crops. The subfamily Rutelinae is diverse and composed of approximately 200 genera and 4,100 species that are dispersed worldwide. The subfamily is divided into six tribes i.e. Spodochlamyini, Anoplognathini, Geniini, Rutelini, Anomalini, Adoretini, of which Anomalini and Adoretini are speciose. Explorations of scarab species diversity in Rajasthan, India revealed four white grub species, *Adoretus flavus* Arrow, *Adoretus lasiopygus* Burmeister, *Adoretus versutus* Harold, *Adoretus testaceus* (Hope) belonging to tribe Adoretini as most abundant ruteline species in Rajasthan next to *Anomala* species. All four species resemble each other closely and hence a study has been taken up to study the distinguishing characters with brief illustrations. Elytral setae intermixed with a few long erect hairs in *A. lasiopygus* differentiate it from all other three species. *Adoretus lasiopygus* and *A. versutus* closely resembling each other can be differentiated by the pronotal punctations and setae, which are denser in the middle than at the sides in *A. versutus* and denser at the sides than in the middle in *A. lasiopygus*. Also *A. versutus* bears a quadrate lamina at the base of the longer claw of all legs. This character is also observed in *A. flavus* but the species can be easily distinguished by the presence of carina extending along each side of the abdomen, which unites by a short ridge, cutting off the last spiracle on each side. *Adoretus testaceus* also closely resembles *A. lasiopygus* and *A. versutus* but differs from in possessing the serrations on basal part of fore tibia in addition to larger claw being distinctly clefted in fore and mid leg. In the latter species serrations are absent and fore and mid tarsal claw feebly clefted.

PERFORMANCE OF DIFFERENT NITROGEN LEVELS ON GROWTH, SEED YIELD AND QUALITY OF GUM CLUSTER BEAN GROWN UNDER SUMMER CONDITIONS

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PanjabraoDeshmukhKrishiVidyapeeth, Akola during the period from summer season of the year 2014-2015 to determine the growth, seed yield and quality of gum cluster bean as influenced by different nitrogen levels. The study was conducted with four nitrogen levels viz., control (N_1), 30 kg N/ha (N_2), 45 kg N/ha (N_3) and 60 kg N/ha (N_4). Among the nitrogen levels, N_3 - 45 kg N /ha was found significantly superior for number of branches per plant (6.00), pod length (6.02 cm), number of clusters per plant (9.41), number of pods per cluster (9.69), number of pods per plant (88.71), weight of dry pod per plant (29.22 g/plant), weight of dry pod per plot (701.30 g/plot), weight of dry pod yield per hectare (21.64 q/ha), number of seed per pod (7.56), hundred seed weight (3.49 g), seed yield per plant (21.00 g), seed yield per hectare (15.55 q/ha) and seed endosperm (37.80 %).

MANAGEMENT OF INSECT PEST OF RICE THROUGH BIOLOGICAL AGENT

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Rice is the staple food of at least half of the world's population and is grown in approximately 148 million ha of land globally. Integrated pest management (IPM) is a broad ecological approach for pest management which employs all available skills, techniques and practices



such as cultural, genetic, mechanical and biological methods including application of chemical pesticides. The IPM is a dynamic approach and process which varies from area to area, time to time, crop to crop and pest to pest etc., and aims at minimizing crop losses with due consideration to human and animal health besides safety to environment. IPM approach has been globally accepted for achieving sustainability in agriculture. IPM is importance in order to minimize the indiscriminate and judicious use of chemical Pesticides, IPM has been formulated as principle of plant protection in over all crop for sustainable crop production without affecting environment. Rice is attacked by insect - pests, diseases, weeds, rodents and nematodes. Some of the pests are of national significance, while others are pests of regional significance. Insect pests like gallmidge (*Orseolia oryzae*), white backed planthopper (*Sogatodes oryzae*), white backed planthopper (*Sogatella furcifera*), yellow stemborer (*Scirpophaga incertulas*), leafhopper (*Cnaphalocrosis medinalis*), and brown planthopper (*Nilaparvata lugens*). Use of biological agent like such as Spider, Water bug, Frog, Mirid bug, Damsel fly, Dragon fly, Grasshopper, Coccinellids, Bracon, Wasp, Trichogramma, Telenomus etc should be conserved.

STUDIES ON CANOPY MANAGEMENT PRACTICES ON NPK STATUS OF LEAVES IN HIGH DENSITY PLANTING OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR

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Investigation was carried out during 2014-15 at experimental orchard and the chemical analysis was undertaken in the laboratory of the Department of Horticulture and Soil Science, Chaudhary Charan Singh Haryana Agriculture University, Hisar during winter season to standardize level of pruning and pinching of guava plants planted under high-density orcharding. A significant difference was observed in N, P and K content due to different pruning levels and pinching numbers at different planting density of guava during winter season. The highest N, P and K content was recorded in leaves taken from plants subjected to severe pruning up to 60% removal of shoot followed by 40 and 20% removal of shoot as compared to leaves taken from unpruned plants irrespective to pinching and spacing. Regarding pinching, the maximum N, P and K content was recorded in leaves taken from plants pinched twice, which was followed by leaves taken from plants pinched one time and the minimum in leaves taken from control plants with no pinching irrespective to pruning and spacing, while irrespective of pruning and pinching spacing also significantly affected the leaves nutrient composition as highest N, P and K content was registered in leaves taken from plants at 5x5 m spacing, which was followed by leaves taken from plants at 5x4 and 5x3 m spacing and the minimum in leaves taken from plants at closer spacing (5x2 m). The interaction between pruning and spacing was significant in respect to nitrogen content of leaves during winter season, while other interactions were non-significant. However, the interaction effect due to pruning levels, pinching numbers and spacing was non significant in respect to P and K content of leaves during winter season.

SHELF LIFE OF SOME PLANT EXTRACTS AGAINST TWO STAGES OF MUSTARD APHID, *LIPAPHIS ERYSIMI*

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Investigation were carried out to study the shelf life of freshly prepared and thirty days old plant extracts against 2nd instar nymph and adult of *L. erysimi* namely, *Ageratum conyzoides* leaf, *Calotropis procera* leaf and stem, *Cannabis sativa* leaf, *Cassia angustifolia* leaf and seed, *Lantana camera* leaf, *Livistona chinensis* fruit, *Parthenium hysterophorus* leaf and *Solanum nigrum* leaf against nymph and adult stage of *L. erysimi* (Kalt.) during 2017 under laboratory conditions. Plant extracts was prepared by boiling of washed, dry 250gm leaves in 500ml of tap water and allowed to boil slowly up to half of the original volume and then it was cooled. At nymphal stage, it was found that insecticidal property of *A. conyzoides* leaf, *L. chinensis* fruit and *P. hysterophorus* leaf extract was decrease up to range of 30% with increase age of plant extract. Whereas, the extracts of *C. procera* leaf, *C. procera* stem, *C. angustifolia* seed, leaf extracts of *C. angustifolia*, *L. camera* and *S. nigrum* gave nearly same mortality (53.33-48.46) after treated with thirty days old extract. At adult stage, there was no significant difference in mortality by application of freshly prepared plant extract and thirty days old plant extracts except *A. conyzoides* leaf (32.33). It revealed that the extract of *S. nigrum* leaf, *C. angustifolia* seed, *C. angustifolia* leaf, *C. sativa* leaf, *C. procera* stem, *L. camera* leaf, *C. procera* leaf, *P. hysterophorus* and *L. chinensis* fruit had a mortality range from 50.4-55.6. This revealed that above extracts had shelf life of 30 days.

TO STUDY ON GROWTH PARAMETERS AND YIELD ATTRIBUTES THE INTERCROPPING OF MUSTARD, LINSEED AND CHICKPEA WITH WHEAT IN RAISED BED AND FLAT BED SYSTEM UNDER INNER WHEEL PATTERN IN DIFFERENT RATIO

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The experiment comprised of 10 treatments was laid out in Randomized Block Design replicated thrice treatment combination were Wheat sole, Mustard sole, Linseed sole, Chickpea sole, Wheat+Mustard (1:1), Wheat+Mustard (2:1), Wheat+Linseed (1:1), Wheat+Linseed (2:1), Wheat+Chickpea (1:1) and Wheat+Chickpea (2:1). The experiment was sown on sandy loam soil having low Organic Carbon, medium available Nitrogen, Phosphorous and Potash with 7.8 pH. The variety of the main crop was Mahi(k-402), Mustard (Kranti), Linseed (Shekhar) and Chickpea (Awroddhi) were intercropped in wheat as per row proportion. The experimental crop was sown on 24 November 2015 as per treatment under inner wheel pattern in raised bed and flat bed system. The row to row spacing of main crop was 20 cm while sub-crops were sown at a row distance of 40 cm. Only chickpea was sown on raised bed and remaining were sown on flat bed system. All the remaining package and practices for the cultivation of experimental crop was made as per recommendation. Result showed that tillers/m² at final stage was significantly higher in sole crop of wheat over all the treatments. The root length was significantly highest in sole crop over all



treatments but among the intercropping treatments, Wheat +Chickpea was found significantly more over Wheat+Mustard (1:1), Wheat+Mustard (2:1) and Wheat+Linseed (1:1) at 45 and 90 days. The ear/plant, grains /plant and length/ear of Wheat was significantly highest in sole crop over all the treatments but at par Wheat+Chickpea (1:1) and Wheat+Linseed (2:1) under inner wheel pattern in raised bed and flat bed system.

IMPORTANT OF PULSES CROP AND THEIR ROLE OF CLASSICAL BREEDING METHODS

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Large and more stable yields are the goals of most food legume breeding programmers, classical breeding of many crop has been instrumental ensuring food security by developing now variety that are higher yielding, resistant to pests and disease, drought resistant or regionally adopted to different environments and growing condition. The different pulses crops including chick pea, pigeon pea, mungbean, lentil continued and sustained progress from breeding will depend on the identification of new combination of existing gene and on discoveries of new genes in germplasm sources, cyclical selection to recombine genes from various sources is proposed as a means of providing breeders with improved germplasm. Aspects of conventional breeding methods mass- pedigree selection, pedigree, selection, mass selection, of pulse crop. The use of cyclical schemes and the exploitation of related wild species for breeding are described and discussed.

INFLUENCE OF TEN ROOTSTOCKS ON FRUIT QUALITY AND FOLIAR NUTRIENT STATUS OF KINNOW MANDARIN

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The most important commercial citrus cultivars in India are the mandarins followed by sweet orange and acid lime and lemons. One of the main reasons of low productivity in India is the non-availability of good quality planting material to the farmers. Rootstocks play an important role for success and failure in citrus industry. Besides supporting the tree in soil, the rootstock is responsible for absorption of water and nutrients thus altering fruit quality. Trials for the selection of suitable rootstock for Kinnow mandarin under Punjab conditions were carried out at Punjab Agricultural University, Ludhiana during 2015-2016. During 2016, maximum mean TSS content (11.3 °Brix) was recorded on NRCC-1. In the year 2017, minimum total soluble solids was recorded in fruits on NRCC-3 (9.1 °Brix). During 2017, highest titratable acidity (1.09 %) was recorded on CRH-12 and minimum was on Volkamer lemon (0.62 %). In 2016, maximum ascorbic acid content was recorded on CRH-12 (25.0 mg/100ml juice). Foliar nitrogen content was recorded on Rough lemon (2.8 %) and Kinnow trees on CRH-12 and NRCC-2 had maximum K content (1.1 %).

EFFECTS OF POTASSIUM LEVELS ON CONVENTIONAL AND MINI-TUBERS OF POTATO (*SOLANUM TUBEROSUM* L.) ON GROWTH AND TUBER YIELD

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The conventional and mini-tubers derived *via* tissue culture (G_2 stage) of two varieties of potato viz., Kufri Badshah and Kufri Pukhraj were field grown at SKUAST, Jammu during *rabi* 2013-14 in factorial RBD replicated thrice using five levels of potassium comprising 0, 60, 90, 120 and 150 kg K_2O /ha. The results indicated relatively better performance of tissue culture multiplied mini-tubers (TC) over conventionally multiplied tubers (C) for most of the growth and yield traits. Seed multiplication revealed that number of tubers per plant and tuber yield increased with increasing dose of K_2O . Best results were obtained with highest dose of K_2O (150 kg/ha) for plant height (64.19cm), number of stolons per plant (8.37), number of tubers per plant (8.55), weight of tubers per plant (1.19kg), average tuber weight (140.06g), polar diameter of tubers (70.30mm), equatorial diameter of tubers (100.37mm), tuber yield per plot (31.25 kg) and tuber yield (347.20q/ha). Among the different treatment combinations, higher number of tubers per plant of (9.54) was observed in V_2K_4 (Kufri Pukhraj-C+150 kg K_2O /ha), which was statistically at par with V_2K_3 (Kufri Pukhraj-TC+120 kg K_2O /ha) and V_4K_4 (Kufri Pukhraj-C+150 kg K_2O /ha). Maximum average tuber weight (154.27 g), maximum polar diameter (72.31 mm) and maximum equatorial diameter (106.31 mm) was observed in V_1K_4 (Kufri Badshah-TC+150 kg K_2O /ha). The mini-tubers of Kufri Badshah and Kufri Pukhraj performed relatively better over conventionally derived tubers for most of the growth and yield traits with best results recorded on higher dosage of potassium.

PRESENT AND FUTURE PROSPECT OF WHEAT IMPROVEMENT IN INDIA

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India is the second largest producer of wheat in the world, with production hovering around 78–85 million tons for past few years. The latest estimated demand for wheat production for the year 2020 is approximately 87.5 million tons, or about 15 million tons more than the record production of 75 million tons harvested in crop season 1999–2000. It was sheer coincidence that the advent of dwarf wheat and establishment of the All India Coordinated Wheat Improvement Project (AICWIP) happened concurrently in the year of 1965. This was an important milestone that brought about systematic developments in wheat research and had resulted in the real breakthrough in wheat productivity.



Since then the wheat research had made spectacular advances in yield potential, productivity and sustainability of wheat system. Since 2000, India has struggled to match that record production figure and thus faces a critical challenge in maintaining food security in the face of its growing population. The current major challenges facing future wheat production in India are increasing heat stress; dwindling water supplies for irrigation; a growing threat of new virulence of diseases such as wheat rusts (yellow, brown, and black) and leaf blight; continuous adoption of rice-wheat systems on around 11 million hectares; changes in urbanization patterns, and demand for better quality wheat. In addition, the threat posed by the new stem rust race Ug 99 cannot be underestimated. The wide gap (around 2.5 t/ha) between the potential and harvested yield in the eastern Gangetic Plains also cries out for solutions. Addressing issues related to different stresses will require harnessing genes discovered in landraces and wild relatives following conventional as well as non-conventional approaches. For effective technology delivery in areas that suffer from poor linkages with farmers, participatory research needs to be strengthened. The future germplasm requirements from a dependable collaborator such as CIMMYT are largely being dictated by the above factors.

ETHNOBOTANICAL INVESTIGATION OF SOME HERBAL DRUGS SOLD BY VENDORS TO CURE COMMON DISEASES

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The present paper deals with botanical sold by the vendors in Dhule, Nandurbar, Jalgaon, and Nasik Districts of North Maharashtra (India) ethnobotanical survey was carried out few years and information was obtained through open discussions and interviews with tradipracticitioners. Presently, 25 plant species belonging to 25 genera and 25 families are communicated. Of these, 08 species are noted for first time from Indian region, as where 03 species although recorded so useful, but their parts are different These are administered in different forms of recipes e.g.- paste, powder, extract, ash, decoction etc. Even they are used raw or sometimes simply warmed. In many cases, they use them as a sole drug or occasionally supplemented by other domestic substances like sugar, cow ghee, honey etc. These are used to combat about 20 human disease such as piles, asthma, sperm count, urinary complaints, heart problems, rheumatism, diabetes, dropsy, Jaundice, gonorrhoea, hydrocil, kidney stone, liver, leprosy, tumor, diarrhoea, throat infection, Diptheria, ulcer, spermatorrhoea, Herpes, Tuberculosis, sperm count etc. The data accrued is assessed by cross-cultural comparisons with other Indian clams to bring out their veracity and uniqueness of the claims. The objective of investigation was to gather and document information on utilization of botanicals by the vendors in the region. They must be testified on scientific line involving chemical, biological and clinical screening.

LUPEOL: SUPERFICIAL TRITERPENOID FROM HORTICULTURE CROPS

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Human body requires vitamins, minerals, proteins, energy etc. for its health. All these are supplied by horticultural crops. Fruits and vegetables are the chief sources of vitamins, minerals, carbohydrates, fats; proteins etc. are recognized as protective foods as they are necessary for the maintenance of human health. In horticulture medicinal plants are considered as a rich source of ingredients which can be used in drug development either pharmacopoeial, non pharmacopoeial, or synthetic drugs. Apart from that, these plants play a critical role in the development of human cultures around the whole world. Moreover, some plants are considered as important source of nutrition and have therapeutic values. Natural products and herbal remedies used in traditional folklore medicine have been the source of many medically beneficial drugs because they elicit fewer side effects, relatively cheap, affordable and claimed to be effective. Numerous phytochemicals are present in mango peel and pulp, such as triterpene, lupeol which is under basic research for its potential biological effects. It is very potential triterpene which acts against many diseases especially cancer for this purpose a large scope in the pharmaceutical industries. Lupeol exhibited an array of biological activities like anti-inflammatory, anti-arthritis, anti-mutagenic and anti-malarial activity both in in vitro and in vivo systems.

EFFECT OF INSECTICIDES INCLUDING A NOVEL MOLECULE, TRIFLUMEZOPYRIM ON RICE PLANT HOPPERS

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Rice is one of the important staple food crop for more than 50 per cent of the world population. Its production is subject to influence of several abiotic and biotic constraints in which hoppers is the major pest, among them Brown plant hopper (BPH), *Nilaparvatalugens Stal.* is the most important pest of rice. Insecticides have been successfully used to control plant hoppers. However, their indiscriminate use has resulted in several undesirable effects including development of insecticide resistance. Keeping this in view, the present study on efficacy of insecticides against rice planthoppers was undertaken. In field experiment, insecticides viz, spinetoram (6%) + methoxyfenozide (30%) 36EC @ 400 ml/ha, triflumezopyrim 106SC @ 237.5 ml/ha, flubendiamide 48SC @ 50ml/ha, chlorantraniliprole 20SC @ 150ml/ha, acephate 95SG @ 526 g/ha and dinotefuran 20SG @ 200g/ha along with an untreated check were evaluated against planthopper on the cultivar, Pusa Basmati 1121 during kharif 2016. The insecticides were applied at 25, 65 and 75 days after transplanting (DAT). Planthopper population comprising of both brown planthopper (BPH) and white backed planthopper (WBPH) was enumerated at 10 days interval from 20 DAT and continued until crop maturity. Until 60DAT, population of planthoppers remained very low. While, at 70DAT, there was a drastic increase in planthopper population as high as 1068 hoppers/10 hills in untreated control. Following insecticide application at 65 DAT, planthopper population in triflumezopyrim treated plots was as low as 18.7 hoppers/10 hills at 70 DAT followed by dinotefuran treated plots (154.7 hopper/10 hills), while it varied from 492-1024 hoppers/10 hills in other treatments. Similarly, at 80 DAT also, planthopper population was found to be lowest in



triflumezopyrim (7.3 hoppers/10 hills) followed by dinotefuran treated plots (25.7 hoppers/10 hills); both being significantly lower than untreated check. However, planthopper population in other treatments (183-344 hoppers/10 hills) did not differ significantly from untreated check (153 hoppers/10 hills). Yield was also found to be highest in triflumezopyrim treated plots followed by dinotefuran. Triflumezopyrim, a novel molecule was thus observed to be most effective insecticide against planthoppers followed by dinotefuran.

SUGARMILL EFFLUENT INDUCED HISTOLOGICAL CHANGES IN LIVER OF *CHANNAPUNCTATUS* (BLOCH.)

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Histological analysis appears to be a very sensitive parameter and is crucial in determining cellular changes that may occur in target organs, such as the gills, liver and gonads. A histological investigation may therefore prove to be a cost effective tool to determine the health of fish populations, hence reflecting the health of an entire aquatic ecosystem. The fish liver appears as does the liver of other vertebrates, as a key organ it controls many life functions and plays a prominent role in fish physiology, both in anabolism and catabolism including detoxification; Brusle and Gonzalezi (1996). The liver has an important function in the metabolism and biochemical transformations of pollutants from the environment, which inevitably reflects on its integrity by creating lesions and other histological alterations of the liver parenchyma or the bile duct. The liver is a detoxification organ and is essential for both the metabolism and excretion of toxic substances. Exposure to toxicants may cause histological changes in the liver, which in turn could be used as a biomarker to indicate prior exposure; Hinton and Lauren, (1990). The liver has the ability to degrade toxic compounds but its regulating mechanisms can be overwhelmed by elevated concentrations of these compounds and could subsequently result in structural damage. Similar studies on various fish species exposed to different toxicants showed histological changes in the livers of those specimens as recorded in the present observations. Fish liver histology could therefore serve as a model for studying the interactions between environmental factors and hepatic structures and functions. Histological analysis does however require the ability to discriminate between toxically induced lesions and normal variations in structure. In conclusion, the present study proved that sugar mill effluents affected the structure and histochemical contents of the liver of *Channapunctatus* (Bloch.) and this effect was time-dependent.

GROWTH AND FLOWERING OF *JASMINUM SAMBAC* (L.) AS INFLUENCED BY TIME AND DIFFERENT LEVELS OF PRUNING

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An experiment entitled "Growth and flowering of *Jasminum sambac* (L.) as influenced by time and different levels of pruning" was conducted at Satpuda Botanic Garden, College of Agriculture, Nagpur (M. S.) during 2013-14 and 2014-15 in factorial randomized block design with 16 treatment combinations. The treatments comprised four timings of pruning viz., 2nd week of December, 4th week of December, 2nd week of January and 4th week of January and four levels of pruning viz., light pruning (45 cm above ground level), medium pruning (30 cm above ground level), hard pruning (15 cm above ground level) and no pruning (control). The treatments were imposed on already existing three year's old plants of *Jasminum sambac* (L.). The results revealed that significantly maximum length of primary shoot, leaves/primary shoot and productive shoots/plant were recorded when the jasmine plants were pruned at 4th week of December, whereas, sprouts/plant, weight of 100 flower buds and shelf life of flower were non-significantly influenced by time of pruning during both the years of experimentation. In respect of level of pruning, sprouts/plant, length of primary shoot, leaves/primary shoot, productive shoots/plant, weight of 100 flower buds and shelf life of flower were noted significantly maximum with medium pruning. Interaction effect of time and severity of pruning was found significant in respect of flower yield in jasmine. Significantly the highest flower yield in terms of flower buds/plant, flower yield/ plant and flower yield/ha were noted when the plants were pruned during 4th week of December at 30 cm above ground level (medium pruning).

EXTENSION STRATEGIES FOR INCREASING PULSE PRODUCTION IN GRIDIH DISTRICT OF JHARKHAND

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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. Hence, India needs to produce the required quantity of pulses. The present study was conducted with a specific objective to find out the extension strategy to increase the pulses production. Perception of farmers and extension personnel was recorded to find out the constraints in different aspects of pulse based cropping system and related technologies. Among the bio- physical constraints, lack of improved varieties of pulses has been found as the most serious of the all. Infestation of pest and diseases and no plant protection measure are another two most important constraints in pulses production. Among the socio- economic constraints, lack of knowledge and skill about improved technologies of pulses got the highest rank followed by lack of availability of input at proper time, low size of land and fragmented holdings and poor economic condition of the farmers.



EFFECT OF ORGANIC, INRGANIC & BIOFERTILIZERS ON ECONOMY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA).**Madan Kumar Jha^{*}, Bharti Jha^{**}, and Manju Rani Sahu^{*}**^{*} Dept. of Vegetable science, BTC CARS, Bilaspur (C.G.), ^{**} Dept. of Horticulture OUAT, Bhubneshwar (Odisha)

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). The maximum net profit/ha was recorded under treatment T₁₀ (Rs. 185967.68) while minimum net profit/ha was obtained in treatment T₄ (Rs. 91028.40). The significantly maximum gross profit/ha was recorded in treatment T₁₀ (Rs. 233690.00) whereas, minimum gross profit/ha was recorded in treatment T₄ (Rs. 146785.00). Thus, the maximum income (both gross and net) was obtained with T₁₀. The significantly maximum B:C ratio 4.59 was recorded under the application of 125% RDF (T₆). And the minimum B:C ratio 1.63 was recorded under the application of 100 % from organic FYM+VC+AZ+PSB (T₁₁).

EFFECT OF DIFFERENT DOSES OF SULPHUR ON YIELD AND SHELF LIFE OF ONION.**N.A.Ganai, Zahoor Ahmed, Tahir Saleem and S.A.Hakeem**

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Onion (*Allium cepa* L.) also known as bulb onion or common onion, a bulb vegetable is a widely cultivated species of the genus *Allium*. Its close relatives include garlic, shallot, leek, chive and Chinese onion. Sulphur is one of the important nutrients to improve shelf life and yield parameters of onion. Sulphur is a constituent of secondary compounds viz., allin, cycloallin and thiopropanol which not only influence the taste, pungency and medicinal properties of onion besides inducing resistance against pests and diseases. Sulphur is also required for the synthesis of three important essential amino acids such as homocysteine (27%S), cysteine (26%S) and methionine (21% S) besides increasing allyl propyl disulphide alkaloid (43%S) and the capsaicin, the principle alkaloids responsible for pungency in onion and chilli, respectively. Keeping in view the importance of sulphur the present investigation was undertaken to study its effect on yield and post harvest shelf-life of onion bulbs. An On Farm Testing was conducted on onion (*Allium cepa* L.) cv. Red Globe during the *Rabi* season of 2011-12 to investigate the influence of sulphur on growth, yield and quality in onion. The treatments comprised of three levels of sulphur (10, 20 and 25 kg ha⁻¹) as basal application from the sulphur source as elemental sulphur. The farmers practice was used as control with no application of sulphur. Harvested onion was kept for three months in low cost storage structure at farmers level. The results depicted that treatment of elemental sulphur at 25Kg ha⁻¹ recorded the highest yield to the tune of 237 q ha⁻¹ followed by 228 q ha⁻¹ with the application of 20Kg ha⁻¹ of elemental sulphur. The observations were recorded for losses due to rotting and sprouting and the results revealed that the shelf life increased from 35 to 70 days after harvest with no signs of rotting and sprouting with the application of 25Kg ha⁻¹ elemental sulphur as against farmers practice. The study suggested that soil application of elemental sulphur @ 25 kg ha⁻¹ is to be made for better yield quality and shelf life of onion.

EVALUATION OF SEED QUALITY OF THE RICE GENOTYPES**Nitin Vikram^{*}, R. N. Kewat^{*}, Raja Husain^{**} and Kunvar Gyanendra^{**}**^{*}Department of Biochemistry, N D University of Agriculture & Technology, Kumarganj, Faizabad-224229, ^{**}Department of Biotechnology, N D University of Agriculture & Technology, Kumarganj, Faizabad-224229

Rice is the staple food of the people of the world. Rice is an important cereal because it has high digestibility, biological value and protein efficiency ratio among all the cereals. The head rice recovery, hulling percentage, milling percentage, water uptake, gel consistency, amylose content, protein content, lysine content, methionine content and tryptophan content were determined in this study. Ankur-7042, XRA-27934, KPH-466, MEPH-113, Push RH-42, Narendralalmati, Sarjoo-52, IR-64, NDR-2064 and NDR-97 were collected for the physico-chemical and biochemical study of rice genotypes. In the overall study of rice genotypes NDR-97 was recorded superior among all the genotypes. In NDR-97 protein, lysine, methionine and tryptophan content etc were recorded highest among all rice genotypes.

COMPARATIVE BIOEFFICACY OF NATIVE ENTOMOPATHOGENIC NEMATODE AGAINST GALLERIA MELLONELLA.**Om Datta**

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A Laboratory trial was conducted to evaluate the Bioefficacy of four native strain of entomopathogenic nematode viz. *Galleria mellonella*, Gau (A), *Steinenenema megha* and Kalyani -5 against fifth instar of *Helicoverpa armigera*. The experiment was conducted in 24 well culture plate lined with moist double layer Whatmann filter paper no.1 containing one larvae in each well. The IJs of each strain were inoculated @ 10, 20, 40, 60, 80, 100, IJs per insect larvae. The plate were kept at 28 ± 2°C temperature. Observations were recorded after 24, 48, and 72 hrs to check mortality. The data, thus obtained revealed that *Steinernema thermophilum* 10 IJs caused 55% mortality in 48 hrs and 72 hrs while 20 IJs caused 75% mortality in 48 hrs and 80% mortality in 72 hrs. 40 IJs caused 80% mortality in 48 hrs and 85% mortality in 72 hrs. 60 IJs caused 100% mortality in 48 hrs and 72 hrs, and 80 IJs caused 100% mortality 48 hrs and 72 hrs while 100 IJs caused 100% mortality in 48 hrs and 72 hrs. In Gau A strain, 10 IJs caused 35% mortality in 48 hrs 50% mortality in 72 hrs while 20 IJs caused 30% in 48 hrs and 45% mortality in 72 hrs and 40 IJs caused 30% and 40% mortality in 48 and 72 hrs respectively. 60 IJs caused 55% and 60% mortality in 48hrs and 72 hrs



respectively. While 80 IJs caused 65% and 70% mortality in 48 hrs and 72 hrs respectively and 100 IJs caused 85% and 100 % mortality in 48 hrs and 72 hrs respectively. *Steinernema megha* 10 IJs caused 25% mortality in 48 hrs and 72 hrs respectively while 20 IJs caused 10% and 30% mortality 48 hrs and 72 hrs respectively. 40 IJs caused 25% mortality 48 hrs and 72 hrs respectively and 60 IJs caused 30% mortality 48 hrs and 72 hrs respectively. 80 IJs caused 55% and 70% mortality 48 hrs and 72 hrs respectively. 100 IJs caused 65% and 70% mortality in hrs and 72 hrs respectively. In kalyani ,10 IJs caused 40% mortality in 48 hours and 72 hrs respectively and 20 IJs 30% and 45% mortality 48 hrs and 72 hrs respectively. 40 IJs caused 15% and 40% mortality 48 hrs and 72 hrs respectively and 60 IJs caused 40% and 45% mortality 48 hrs and 72 hrs respectively. 80 IJs caused 65% and 80% mortality 48 hrs and 72 hrs respectively and 100 IJs caused 70% and 85% mortality in 48 hrs and 72 hrs respectively. Among the tested strain/species, *Steinernema thermophilum* was found to be the most effective inducing 100% mortality @ 60, 80,100 IJs/larvae within 48hrs. While other strain caused 65-85% mortality in 48 hrs @ 100IJs/ larvae.

DETERIORATION IN QUANTITATIVE PARAMETERS OF SUGARCANE DUE TO *EUCALYPTUS GRANDIS* INTERCULTURE IN WESTERN U.P.

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The agriculture land is diminishing day by day from cultivation in western Uttar Pradesh. Sugarcane mono-cropping is of a great socio-economic need for area, highly influencing the environment, the agro-forestry (AFs) has been considered as an alternate of it giving a sustainable alternative. Due to this farmers are compelled to adopt planting Eucalyptus along with Sugarcane. This *Eucalyptus grandis* requires more water and minerals as compare to other plants from the soil because of its fast growth. So the adjacent crops are deprived of these resources and deteriorate or badly affected. The shadow effect of *Eucalyptus grandis* is observed to affect the crop growth as well as yield of sugar cane plant.

In the present study, plant growth yield is measured of Sugarcane, cultivated near to *Eucalyptus grandis* at Sugar Cane Research Centre Muzaffarnagar farm. The *Eucalyptus grandis* trees were about 10 year old and the Sugarcane field was approximately 5 meter close to it. Parameters under consideration were measured and compared between Sugarcane of the outer first four lines nearby it with the matrix crop. The field result showed that the existence of *Eucalyptus grandis* inversely affected the sugarcane crop growth and yield with respects to their distance from the tree. The sugarcane growth (number of green leaf, leaf area (cm²), stalk observations (height, girth and weight) and yield decreased from 20% to 43%, depending upon their position from tree along the transect. So the study suggested that the sunlight the shadowing effect has also one of the main cause of the crop reduction, but the importance of competition for water and nutrients within two systems cannot be ruled out as it is supposed to increase inversely with advancement of the distance from the tree.

IMPACT OF PRUNING INTENSITIES ON PRODUCTIVITY OF TURMERIC UNDER *DALBERGIA SISSOO* ROXB. BASED AGROFORESTRY SYSTEM

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Agroforestry is a sustainable land use system where two or more component are growing simultaneously on the same piece of land. Tree architecture plays an important role in deciding the growth and performance of under storey crops. Crown spread affects not only the soil properties and micro environment but also performance and yield potential of associated agricultural crops. Pruning of tree component is a powerful approach to regulate light, nutrients and other resource competition. Keeping above in view an field experiment was conducted at dusty acre research farm, department of forestry; JNKVV Jabalpur for access the impact of pruning intensities on productivity of turmeric under *Dalbergia sissoo* Roxb. based agroforestry system. Present experiment consisted four pruning intensity i.e. P₀- no pruning, P₂₅- 25% pruning, P₅₀- 50% pruning and P₇₅- 75% pruning and open condition. The result revealed that, 25% pruning intensity have significantly highest plant height at harvest (cm), stem diameter, leaf area index and No. of fingers per rhizome of turmeric i.e., 74.7, 18.7, 3.2, 5.0, respectively followed by 50% pruning i.e., 68.8, 18.1, 2.8, 4.8, respectively, No pruning P₀ i.e., 65.9, 17.6, 2.8, 3.7 respectively, and 75 % pruning i.e., 68.0, 17.5, 2.3, 4.3 respectively. However, the lowest was under open condition i.e., 61.4, 16.8, 2.7, 3.6, respectively. The significantly maximum fresh yield of rhizomes (3385.9 kg ha⁻¹) was measured under 25% pruning followed by 50% pruning (3221.3 kg ha⁻¹), no pruning (3072.8 kg ha⁻¹) and open conditions (3012.9 kg ha⁻¹). Whereas, the lowest fresh yield of rhizomes (2960.6 kg ha⁻¹) was observed under 75% of pruning intensity. The present study suggested that, 25% of pruning of the *Dalbergia sissoo* is best for increasing the productivity of turmeric under *Dalbergia sissoo* based agroforestry system.

INFLUENCE OF SEEDLING AGE AND PLANT HORMONES ON YIELD AND VARIOUS TREATMENTS ON ECONOMICS OF ONION CULTIVATION (*ALLIUM CEPA* L.)

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The response of three seedling age (6, 8 and 10 week old seedling) of onion cultivar N-53 was studied against different plant hormonal treatments viz., Cycocel(500&1000ppm), Ethephon(2000& 2500ppm) and Paclobutrazol(1000&2000ppm) along with control in factorial RBD replicated thrice during Rabi season of 2014-2015. The results showed that 8 week old seedlings outperformed other aged seedlings with highest yield, quality and plant establishment (86.95%). Data with respect to yield attributes clearly pointed out that 8 week old seedlings



performed better and showed statistically highest bulb size (25.34cm^2), bulb weight (94.44g) and marketable yield (205.40q/ha). All plant hormones significantly reduce vegetative growth as compared to control. Paclobutrazol 2000ppm was found statistically superior in increasing bulb size (25.11cm^2), bulb weight (80.73g) and marketable yield (190.38q/ha) as compared to other treatments. Interactive effect of Paclobutrazol @ 2000ppm sprayed on 8 week old seedlings (A_2P_2) produced maximum bulb size (32.13cm^2), bulb weight (110.93g) and marketable yield (279.50q/ha). Economics of the experiment showed maximum B:C ratio in 8 week old seedling with 2000 ppm paclobutrazol (4.4) with higher net returns of (Rs. 3,46,869) as compared to other treatment as well as control.

PROCESSING AND VALUE ADDITION IN RICE

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Rice is the staple food for nearly two-thirds of the world's population. Food components and environmental load of rice depends on the rice form that is resulted by different processing conditions. Present post-harvest losses in the developing country are increasing tremendously so we have to improve the post-harvest value chain, as well as identify and verify the effectiveness of post-harvest technologies with ultimate users. Processing of rice involved cleaning, hulling, milling, polishing, grading, sorting and packaging. These are the steps which enhance the commercial value of rice, which can fulfill the present as well as future demand of nutritive food. Rice properties are known to be dependent on the variety of rice, methods of cultivation, processing and cooking conditions. Although the parboiling treatment helps in retaining some of the nutrients, reduce breakage loss during milling and increase head rice recovery (whole rice kernels after milling), consumed a considerable amount of energy and labour. It has also been reported that the nutritional value and head rice recovery reduce with the higher degree of milling (DOM). So, demand for rice by-products is increasing globally. Supplying rice cultivar for these high-value markets will increase economic benefits to farmers and nutritional benefits to a consumer that's why we have finds ways to select for quality and specialty characters through taste, flavor, texture and identifies components in grain that determine sensory and cooking properties. Development of automatic or semi-automatic machineries with hygienic way of preparation, ready-to-serve and with more shelf life is required for commercial exploitation.

Keywords: - Post-harvest, milling, quality, machine.

EFFICACY OF OIL CAKES EXTRACTS AGAINST LARVAL MORTALITY OF RICE ROOT KNOT NEMATODE (*MELOIDOGYNE GRAMINICOLA*).

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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 J_2 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 J_2 of *Meloidogyn graminicola* with 100% larval mortality within 24 hours of inoculation.

EVALUATION OF SOME INSECTICIDES AGAINST CITRUS PSYLLA, *DIAPHORINA CITRI* KUWAYAMA ON SWEET ORANGE

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A field experiment on evaluation of some insecticides for the control of citrus psylla, *Diaphorina citri* Kuwayama conducted at the experimental orchard, Department of Horticulture, CCSHAU, Hisar during 2015-16 revealed that among the different insecticidal treatments, imidacloprid (200 SL) @ 20 g a.i. /ha, clothanidin 50 WDG @ 25 g a.i. /ha, dimethoate 30 EC @ 468.7 g a.i. /ha proved to be most effective treatments followed by thiomethoate 36 WSC @ 450 g a.i./ha, quinalphos 25 EC @ 250 g a.i./ha, spinosad 45 SC @ 0.17 g a.i./ha, novaluron 10 EC @ 0.14 g a.i./ha whereas NSKE 5% @ 5ml/l were found to be least effective against the pest.

Keywords: Evaluation, insecticides, *Diaphorina citri*, sweet orange

SUPPORT VECTOR MACHINES AND THEIR APPLICATIONS IN AGRICULTURE



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The analysis and interpretation of existing data for correct classification or prediction of the state of nature has been an important research area for many years. Classification problems can be roughly categorized as either unsupervised or supervised learning in machine learning literature. Fisher's Linear Discriminant Function (LDF) and related classifiers for binary and multiclass learning problems have performed well for many years and for many data sets (Izenman, 2008). Recently, a new learning methodology, Support Vector Machines (SVMs) has emerged, which competes with the performance of LDF and in many instances has proved to be superior for solving classification problems. SVM was initially developed for linear classification for linearly separable and non-separable data, and was later extended to nonlinear domain with the application of kernel functions (Cortes & Vapnik, 1995). A Kernel function serves as a bridge from linearity to non-linearity. Compared with traditional neural networks, SVM gains great enhancement in generalization ability and overcomes some problems, such as local minimum and the curse of dimensionality (Vapnik, 1995), which gives SVMs a quite strong competitive advantage over methods such as discriminant analysis and Artificial Neural Networks (ANN). SVM has been widely applied to classification problems in agriculture, such as plant tissue classification, protein recognition, protein secondary-structure prediction, plant disease detection, nutrients stress detection and multiclass crop classification based on morphological and qualitative characters.

Keywords: Classification, Discrimination, Kernel functions, Support Vector Machines.

EFFICACY OF *TRICHODERMA HARZIANUM* CA-07 IN COMBINATION OF *PSEUDOMONAS FLUORESCENS* AND FUNGICIDE AGAINST ANTHRACNOSE OF CHILLI

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Biocontrol strategies have been mainly focused on proposing the use of biocontrol agents (BCAs) isolated from the rhizospheric region of the plant for protection against phytopathogens. The present study evaluates the effectiveness of *Trichoderma harzianum* CA-07 isolate in chilli against *Colletotrichum capsici* infection and comparing its efficiency in combination with fungicides (Topsin-M) and bacterial bioagent (*Pseudomonas fluorescens*). Pot trail was conducted in glass house compound of Department of Plant Pathology, CSAUA&T, Kanpur. The combined application of *Trichoderma harzianum* CA-07 + *Pseudomonas fluorescens* and *Trichoderma harzianum* CA-07 + Topsin-M through seed treatment and soil application resulted in a significantly lower incidence of anthracnose of 8.0 and 11.2%, respectively, and accounting for 88.0 and 79.0% of reduction over control. A combination of *Trichoderma harzianum* CA-07 and *Pseudomonas fluorescens* resulted in increased the plant growth (shoot length of 16 cm, root length of 4.0 cm, respectively) also increased the fruit yield (green fruit yield increased from 119 g/plant). This study suggests that the combination treatment of bioagents might have involved in the reduction of anthracnose incidence and increased the yield of chilli.

PRODUCTION POTENTIAL, NUTRIENT UPTAKE AND ECONOMIC FEASIBILITY OF DROUGHT TOLERANT RICE (*ORYZA SATIVA* L.) VARIETIES UNDER VARIOUS CROP ESTABLISHMENT METHODS AND MOISTURE CONSERVATION TECHNIQUES

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Rice is primarily grown by transplanting of seedling in puddled field which is very cumbersome and labour intensive and it requires 30 mandays/ha (Prasad, 2004). Puddeling takes upto 30% of total irrigation water application in rice (Aslam *et al.*, 2002). This leads to higher nutrient losses through leaching, besides causing high evapo-transpiration (ET) losses during the hot summer months. Conventional flooded rice receiving the largest amount of fresh water compared to any other crop is the major contributor to the problem of declining ground water table and increasing energy use (Singh *et al.*, 2002). Keeping these points into consideration, 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 to study the performance of drought tolerant rice (*Oryza sativa* L.) varieties under different establishment methods and moisture conservation techniques. 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 but medium in available phosphorus and potassium. Four crop establishment methods (PTR, UPTR, DSR with wheat straw and DSR without wheat straw mulch), three varieties (Sahbhagi, IR 64 and IR 64 drt 1) and two moisture conservation practices (application of pusa hydrogel @ 1.5 kg/acre and no application) were tested in split-split plot design with 3 replications. Results revealed that the growth parameters and yield attributing characters of rice viz., panicle length (26.1 cm) and number of filled grains/panicle (113.2) were significantly higher under PTR rice whereas, the number of effective tillers/m² (227.0) and test weight (22.55 g) was highest under DSR with wheat straw. The PTR rice exhibited 13% more grain yield as compared to DSR with wheat straw whereas, 6.2% more straw yield of rice was recorded under DSR with wheat straw as compared to PTR. The highest total nitrogen (92.0 kg/ha) and phosphorus (15.0 kg/ha) uptake was recorded under PTR whereas, the highest potassium (105.2 kg/ha) uptake was noticed under DSR with wheat straw. The variety IR 64 produced significantly highest dry matter (1115.4 g/m²), effective tillers/m² (207.3), panicle length (25.2 cm), filled grains/panicle (93.2), test weight (22.41 g), besides 8.0 and 18.6% more grain yield/ha than Sahbhagi and IR 64 drt 1, respectively. The highest nutrient, protein content and total uptake of N, P and K (11.5, 15.4 and 13.0% more over Sahbhagi, respectively) was recorded under IR 64 which fetched 8.1 and 15.7% more gross and net returns, respectively than Sahbhagi. The application of pusa hydrogel @ 1.5 kg/acre over no application at harvest resulted into 4.1, 6.0 and 5.8% more plant height, number of tillers/m² and dry matter production/m², respectively. Further, rice took significantly more number of days to attain 50% flowering and maturity and produced 0.8, 3.4, 3.1 and 3.4% more number of effective tillers, panicle length, biological and grains yield/ha, respectively over without hydrogel. This treatment also had significantly (8.1, 5.5 and 5.0%) more total uptake of NPK, respectively, besides higher gross



returns/ha. Among the crop establishment methods, PTR fetched 9.5 and 11.1% more gross and net returns, respectively along with B:C ratio over DSR with wheat straw.

MICROBE MEDIATED FERTI-FORTIFICATION OF ZINC IN RICE-WHEAT CROPS FOR INCREASED PRODUCTIVITY AND QUALITY

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Zinc (Zn) is an exceptional micronutrient regarding its relevance in biological systems because it is the only trace metal represented in all classes of enzymes. A large diversity of essential cellular functions and metabolic pathways are directly influenced by Zn including function and structural stability of proteins, integrity of biological membranes and protection against reactive oxygen species. Nearly 2,800 proteins in biological systems require Zn for their activity and structural stability. It is, therefore, not surprising that crop plants show rapid and particular disturbances in growth and development when they are growing on low Zn soils. At least one-third of the cultivated soils globally are estimated to contain too low amounts of bioavailable Zn for optimal crop production. Low bioavailability of Zn not only reduces plant productivity, it also impairs nutritional quality of the harvested products by lowering Zn density in seeds/grains/straw. Biofortification of cereal grains with Zn, therefore, a high priority area of research and will contribute to minimizing Zn deficiency-related health problems in humans. Agriculture provides two cost-effective and sustainable solutions to the problem: i) Breeding new plant genotypes with high Zn and iron concentrations (genetic biofortification) by using classical and modern breeding tools, and ii) application of Zn fertilizers to the target food crops such as rice and wheat (agronomic biofortification or ferti-fortification). About 50% of world soils are deficient in Zn as this is also true of India. Good response of rice to Zn application has been reported from India, China, Japan and USA. Zinc is now recognized as the fifth leading health risk factor in developing Asian countries, where rice and wheat are the staple food and Zn nutrition of humans and animals has recently received considerable attention. However, no reports are available on the effect of microbe-mediated Zn fertilization on rice and wheat varieties. Plant growth promoting rhizobacteria (PGPR) represent a wide variety of soil bacteria which, when grown in association with a host plant, result in stimulation of growth of their host due to increased mobility, uptake and enrichment of nutrients in the plant. PGPR are known to employ one or more direct and indirect mechanisms of action to improve plant growth and health, although the major mode of action of many PGPR is through increasing the availability of nutrients for the plant in the rhizosphere region. PGPR produce plant growth-promoting compounds, and can also play a pivotal role in the cycling of macro- and micronutrients by modifying the root morphology, resulting in greater root surface area for the uptake of nutrients within the soil, and also protect crops against disease. Rice and wheat are the staple food and the grains of these crops contain very low amount of Zn. So there is need to improve the Zn concentration in the economic produce of these crops. This can be possible through by development of genotypes those are capable to uptake Zn from soil and transmit it to grain but it takes time and also we are not sure that developed genotype will serve the purpose or not. So, there is another option that is agronomic ferti-fortification. In this method we apply Zn in soil and foliar spray to increase the Zn concentration in the economic produce and also require very less time to serve the purpose.

Key word- Zn, Genetic biofortification, Agronomic biofortification or ferti-fortification, PGPR

PYRACANTHA CRENULATA LEAF EXTRACT MEDIATED SYNTHESIS OF ZNO NANOPARTICLES AND THEIR ANTIBACTERIAL ACTIVITY

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In this work, ZnO nanoparticles were synthesized using leaf extract of *Pyracantha crenulata* because plant mediated synthesis of metallic nanoparticles is a cost effective and environmental friendly way of generating nanoparticles. At controlled temperature and pH range, ZnO nanoparticles were synthesized by interacting Zinc acetate hexahydrate with leaf extract of *Pyracantha crenulata*. The resulted nanoparticles were characterized and it was found that these are highly crystalline, in nanoscale, spherical and polyphenolic in nature. Antibacterial activity of ZnO nanoparticles (100µl) was studied against *Bacillus subtilis*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* strains by measuring the diameter of zone of inhibition (mm). And this study showed that these nanoparticles are of highest value of diameter of zone of inhibition against *Bacillus subtilis* (45mm) and lowest for *Pseudomonas aeruginosa* (25mm).

Keywords: Nanoparticles, Crystalline, Antibacterial activity.

NEW EMERGING MOLECULES OF INSECTICIDES AND THEIR ROLE IN IPM ALONG WITH ITS FUTURE CHALLENGES

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Mankind has a history of using crop protection products from non-selective, naturally occurring compounds to highly specific synthetic and biological materials for assured food production and protection of environment since long time. Researchers are adhere to develop safer molecules which could undergo photo-degradation, microbial degradation as well as chemical degradation leaving very less amount of residues in the environment. Indiscriminate use of insecticides, leads to resistance development by insect and ill effect posed on environment opened the new modern era of chemicals having novel mode of action with higher bioefficacy on insect control and safer to environment. These new groups of insect control insecticides includes neonicotinoids such as Imidacloprid, Acetamiprid, Thiacloprid etc. spinosyns, avermectins,



oxadiazines, IGR's such as Benzoyl Urea, Thiadiazines etc, fiproles, pyrroles, pyridine azomethine, ketoenols and benzenedicarboxamides. Most of these groups of pesticides play an important role in managing many arthropod pests with good bioefficacy, high selectivity and low mammalian toxicity, which make them attractive replacement for synthetic organic pesticides. These novel groups of pesticides are likely to play an important role in IPM programme in future but still there are several future challenges as to develop more and more new molecules having Low dose compounds high efficacy and quick knock down against target pest, low mammalian toxicity, relatively safer formulations such as SC, WG, contains water soluble pouches, less soluble in water, less or no leaching potential, new chemistry, less harmful to beneficial insects such as honey bees and natural enemies, less residual effect, high persistence in the plant, more discoveries in macromolecular pesticides, more innovations required for new neo-nicotinoids, more biotechnological innovations to be directed in transgenic plants etc. and more innovative technology to be developed in application of pesticides, a special care shall be given on the nozzles, sprayer or applicator with an intention to minimize the loss of applied pesticide or target organisms. The prime motto for these developments is to give protection to the crops along with safety to the natural enemies of different pests as a whole safety to environment.

Keywords: neonicotinoids, photo-degradation, toxicity, innovations and protection.

STUDY OF LOCAL MAIZE (ZEA MAYS L.) GENOTYPES OF NORTH-EAST INDIA AT DIFFERENT LEVELS OF NITROGEN.

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A field research was conducted at Instructional-Cum-Research (ICR) farm of Assam Agricultural University, Jorhat, during *Rabi* season of 2015-16 in order to evaluate the a yield and yield related traits of ten maize germplasm in RCBD design with three replications. The experimental materials in the present study were collected from different regions of North East India and compared to a proprietary hybrid namely, PAC-740. The study was conducted with the objective to estimate genetic parameters for yield and other important component traits. The analysis of variance clearly indicated the presence of sufficient variation among the genotypes for all the traits studied. High GCV was observed for ear height, 100-kernel weight and ears per plant at N₀ level and for days to 50 % pollen shed, days to 50% silk emergence, 100-kernel weight, ears per plant and grain yield at N₈₀. The heritability estimates were high for all the characters under study at N₀ and N₈₀ level. Expected genetic advance as per cent of mean was the high for ear height, 100-kernel weight, and ears per plant in N₀ and for days to 50 % pollen shed, days to 50 % silking, 100-kernel weight and grain yield per plant at N₈₀. Both heritability estimates and genetic advance were high for ear height, 100-kernel weight, and ears per plant at N₀ and for days to 50% pollen shed, days to 50 % silking, 100-kernel weight and grain yield per plant at N₈₀ level. This indicates that additive gene action was preponderant for these traits and simple selection would be effective for improving a population with respect to these traits, and hence increasing diversity and sustainability of the maize germplasm.

Keywords: local maize germplasm, Yield, Grain Yield, kernel

CORRELATION AND PATH COEFFICIENT ANALYSAIS IN BRINJAL (SOLANUM MELONGENA L.)

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The study was carried out with eight parents and 28 F₁ hybrids of brinjal at SVPUA&T Meerut during Kharif 2010 to find out correlation and path coefficient analysis among the different yield attributing traits and direct and indirect effect of traits on yield. Data recorded for twelve characters Viz. "plant height, primary branches per plant, plant spread, days to first flowering days to first fruit set, days to first harvest, average fruits weight, fruit length, fruit diameter, fruit index, fruits per plant and yield per plant. Highly significant and positive association of fruit yield per plant was recorded with fruit length, fruit index, plant height and average fruit weight while non significant and positive correlation were found between fruits per plant and fruit diameter. Fruit yield per plant showed negative and significant correlation between days to first harvest, days to first fruit set and days to first flowering. Fruits per plant showed negative and significant correlation between average fruit weight, fruit index, fruit diameter, days to first harvest, plant spread, fruit length and days to first fruit set. Path coefficient analysis for fruit yield involving 11 independent variables revealed that fruit diameter gave maximum positive and direct effect on yield per plant followed by fruit length, fruits per plant, average fruit weight and days to first fruit set. Fruit Index showed maximum indirect effect via fruits per plant at genotypic level. At phenotypic level, fruit diameter showed maximum direct effect on fruit yield per plant followed by fruit length, fruits per plant, average fruit weight and days to first fruit set, while fruit index showed maximum indirect effect on yield per plant via fruits per plant and plant height via fruits per plant.

MULCHING EFFECTS TO CONTROL WEEDS IN ORGANIC POTATO CROP

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The experiment was conducted during Rabi 2016-17 at Research Farm, College of Agriculture, Gwalior (M.P.) to find out the effect of mulching for weed management in potato under organic farming. The soil was sandy clay loam in texture, low in available nitrogen (234 kg/ha), medium in phosphorus (14 kg/ha) and potash (240 kg/ha). The 5 treatments replicated thrice were white plastic mulch (T₁), black plastic mulch



(T₂), straw mulching at 5 DAS as 5 t/ha (T₃), one hand weeding at 20 DAS + straw mulching at 25 DAS (T₄) and weedy check (T₅) was tested in Randomized Block Design (RBD). The sowing was done on 15th November, 2016.

Seed of variety *Kufri Chandramukhi* was used for sowing keeping row to row spacing 60 cm and plant to plant 20 cm with uniform seed rate 30 q/ha. Seed treatment was done with Phosphate Solubilising Bacteria (PSB) 1.50 g/kg seed by dipping tubers for 30 minutes for controlling soil and tuber born diseases before sowing. A uniform manure dose of FYM 10 t/ha and Vermicompost 10 t/ha were applied at the time of field preparation. Neem cake 250 kg/ha was applied in the soil to control the termite. Different mulching materials were placed five days after sowing. After 45 days of sowing, the mulches were removed and reapplied immediately after the completion of earthing. The crop was harvested on 20th February, 2017. Observations for different weed spp., weed population and dry weight were recorded at 30 and 60 DAS. Crop growth parameters i.e. plant height, no. of stems/plant and no. of leaves/plant was recorded at 30 and 60 DAS. Fresh weight of plant, fresh weight of haulm were recorded at harvest stage while yield attributes viz. no. of tubers/plant, fresh weight and dry weight of tuber/plant and yield of tuber t/ha were recorded at harvest stage. Weed control efficiency was also worked out at 60 DAS for different weed control treatments. Overall, it was concluded that one hand weeding at 20 DAS with straw mulch 5 t/ha controlled the weeds with 74.65% WCE as well as gave higher yield of potato (13.89 t/ha) with 74.86% WCE followed by straw mulching at 5 DAS as 5 t/ha (9.20 t/ha) with 60.30% WCE.

SUITABILITY OF *CRAMBE ABYSSINICA* IN SUPPORTING OF GROWTH AND DEVELOPMENT OF MUSTARD APHID *LIPAPHIS ERYSIMI* (KALT.)

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The present investigation was undertaken to investigate the suitability of *Crambe abyssinica* in supporting of biology and growth & development of mustard aphid *Lipaphis erysimi* (Kalt.) which help to identify and development of resistance/tolerance cultivar of oilseeds *Brassica*. The results revealed that the nymphal period mustard aphid was observed 11 days (on leaf of *Crambe abyssinica* cv. CA3), alate forms 0% (*Crambe abyssinica* cv. CA1&2), nymphal survival was 0% (*Crambe abyssinica* cv. CA1&2), oviposition period was 0% (*Crambe abyssinica* cv. CA1&2), fecundity was 0% (*Crambe abyssinica* cv. CA1&2) and total life span was 12 days (*Crambe abyssinica* cv. CA1&2) whereas these biological parameters was observed in *B. nigra* cv. PBR-I 11 days, 33.3 %, 80%, 27 days, 0 days, 71.4 nymph per female and 37 days, respectively. Growth and development indices were calculated with observed data. Various parameters of growth indices were showed that the nymphal index and reproduction index was recorded 0.0 (*Crambe abyssinica* cv. CA1&2) while in *B. nigra* cv. PBR-I was 1.0. Low success index (0.42 to 0.68) and Howe index (0.092 to 0.095) was observed in different *Crambe abyssinica* cultivars shows less suitability to mustard aphid while in *B. nigra* cv. PBR-I success index (1.50) and Howe index (0.10).

Keywords: *Crambe abyssinica*, *Lipaphis erysimi*, *B. nigra*, Growth and development indices

IMPACT OF WEATHER ON TRAP CATCHES OF APHIDS INFESTING WHEAT

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Wheat is the second most important cereal crop after rice. Incidence of aphids on wheat has increased during the last decade. Aphids damage the crop directly by sucking sap and indirectly by transmitting several plant viruses (e.g. barley yellow dwarf Luteo virus) and developing moulds on their honey dew. Present study was thus conducted during rabi 2016-17 at ICAR-Indian Agricultural Research Institute farm to investigate the occurrence of aphids on wheat and their relation with meteorological parameters.

The wheat variety, HD-3086 was sown in 1st week of December, 2016 in an area of 2600m². For monitoring number of alate aphids, five yellow sticky traps of size 33×22 cm² were placed in the experimental field. Weekly data were recorded on the number of trapped aphids. The weather data was collected from the meteorological observatory at the institute. Correlation was computed between different weather factors viz., maximum, minimum and mean temperature, morning (RH1), evening (RH2) and mean relative humidity, rainfall, bright sunshine hours (BSS) and wind speed, of the same week and one-lag week vis-à-vis aphid counts. Aphid population had significantly positive correlation with maximum, minimum and mean temperature, BSS and wind speed of the same week and one-lag week whereas, a significantly negative relation was found with RH-I and mean RH of the same week and RH-I of one-lag week. The data so generated will be utilized to develop pest weather model for forewarning.

DEVELOPMENT OF TRICHODERMA BASED NOVEL BIO-FORMULATIONS WITH INCREASED SHELF LIFE FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS

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Insect, pest and diseases are the major constraints for achieving higher production in agriculture. The use of microorganisms to control plant pathogens, known as biological control is now in practice. It is accepted as a suitable and environmentally friendly alternative or a supplemental way of reducing the use of chemicals in agriculture against plant disease management. Therefore, the present studies have been proposed with the main focus on the identification of *Trichoderma* based novel bio-formulations to replace chemicals in fertilizing soils and improving plant resistance against phytopathogens. A total of 8 *Trichoderma* species viz; *T. harzianum*, *T. asperellum*, *T. koningiopsis*, *T. virens*, *T. reesei*, *T. koningii*, *T. atroviride* and *T. longibrachiatum* were isolated from soil samples collected from 12 districts of Uttar Pradesh and sent to Indian Type Culture Collection (ITCC), New Delhi for confirmation. The isolated and identified strains of the *Trichoderma* sp. were characterized based on cultural, morphological, physiological, biochemical and molecular analysis to study the growth pattern, characteristics of the mycelium / spores, nutritional behavior, physiological and phylogenetic analysis and were evaluated for their antagonistic potential against *Fusarium oxysporum* f.sp. *ciceri*, *Fusarium udum*, *Rhizoctonia bataticola*, *Rhizoctonia solani*, *Sclerotinia sclerotiorum*, and *Sclerotium rolfsii* using dual inoculation method. Effect of volatile and non-volatile compounds of *Trichoderma* sp. on the growth and sporulation of the phytopathogens was also studied. Based on these studies *T. harzianum* (ITCC 9864) was found best in reducing growth & sporulation of the test pathogen. Pure *Trichoderma* spores (PTS) were harvested from *T. harzianum* (ITCC 9864) and compared with commercially available talc based formulations. Different dosage of pure spore mass of *T. harzianum* @ 0.004g/kg, 0.04g/kg, 0.4g/kg and 0.2g/kg and commercially available talc based formulation (*Trichoderma harzianum*) @ 4g/Kg were mixed in FYM with 2×10^8 cfu/g for substrate colonization and mass multiplication and studied periodically upto 18 months. Pure *Trichoderma* spore in FYM @ 0.04g/kg maintained 1×10^8 cfu/ml even upto 18 months while commercially available talc formulation showed no cfu after 10 months of storage.

Shelf life of pure *Trichoderma* spores (PTS) alone and in combination with Chitin and Carboxymethyl Cellulose (CMC @ 5%) was studied to find out the efficacy of these adjuvants to increase shelf life. Shelf life of pure *Trichoderma* spores mixed with chitin proved to be more effective as compared with pure *Trichoderma* spores (PTS) alone and with Carboxymethyl Cellulose, thereby indicating that chitin helps in maintaining cfu for long duration (even up to 18 months). Therefore, it may conclude that formulation prepared by these two methods has given better shelf life as 2×10^{12} cfu/ml even after 18 months of storage and is cost-effective, which is a new finding.

These findings clearly indicated that pure *Trichoderma* spores (PTS) even in a very small quantity are very potent and effective for longer survival as compared to commercially available talc based formulations and can effectively be used for the management of soil borne pathogens.

AN ECOLOGICALLY BASED SUSTAINABLE IPM APPROACH AGAINST POD BORER *HELICOVERPA ARMIGERA* IN CHICKPEA

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Chickpea, (*Cicer arietinum* L.) is an important pulse crop world-wide. There are many constraints in the production of the crop, of which pod borer, *Helicoverpa armigera* Hubner is the notorious one which causes both quantitative and qualitative loss. On an average it causes 10 to 90% yield losses in chickpea. In conventional IPM practices farmers still prefer to use the chemical insecticides as a main tool. Therefore, to overcome this one can go for an eco-friendly based IPM practices which is an otherwise suitable approach for sustainable agriculture. Deep summer ploughing immediately after harvesting to destroy the resting pupae is of first step for IPM to be successful. Taking up early and synchronous sowing of resistant/tolerant varieties is recommended. Intercropping with wheat/linseed/mustard/coriander/rabi sorghum is shown to reduce the pod borer incidence by increasing the activity of natural enemies. These crops are recorded to conserve and encourage parasitoids like *Trichogramma* spp., *Campoletis chloridae* and predators like *Eucanthecona* sp, *Chrysoperla* sp and Coccinellids. Mixing of sunflower/maize/rabi sorghum @50g per ha along with chickpea seeds while sowing or provision of bird perches @ 40 per ha at 1m height above ground level of gram crop that serve as resting sites for insectivorous birds such as Myna (*Acridotheris tritis*) and Drongo (*Dicrurus macrocercus*) helps to reduce the numbers of *H. armigera* larvae. Sex pheromone traps can be installed 1m above the crop canopy at 45 days after sowing (DAS) @20 per ha. The bird perches/traps are recommended to remove from the field during post pod maturation stage as they will act as resting sites for grain eating birds. Spraying of crude NSKE@5% or Azadirachtin @300 ppm or neem oil based wsp @5000 ml per ha during pre-flowering stage at 15 days interval reduce the oviposition to greater extent. Spray HaNPV @500 LE + 0.5 % Jaggery + 0.1% fabric whiteners (tinopal or blue) per ha on noticing first instar larvae for about 3 times at weekly interval during evening hours. Spraying of microbial agents like *Bacillus thuringiensis* var. *kurstaki* @1 kg per ha and *Beauveria bassiana* 1% WP @3 kg per ha is shown to be effective against larvae. Cow urine @20% alone or in combination with botanicals like Neem, Pongamia, Aloe vera and Chilli-Garlic extracts are also shown to reduce the pest incidence and per cent pod damage. Therefore by combining the all possible nonchemical pest management tools in as compatible manner as possible we can achieve an ecologically sound IPM approach for the sustainable development in agriculture.

Keywords: Chick pea, *Helicoverpa armigera*, sustainable agriculture and IPM

MANAGEMENT OF PIGEONPEA WILT CAUSED BY *FUSARIUM UDUM* BUTLER THROUGH INTEGRATED APPROACHES

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Pigeonpea (*Cajanus cajan* (L.) Millsp.) is one of the most important legume crops of India. It is known as red gram, arhar and tur in the country. India is the world's largest producer and consumer of pulses including pigeonpea. About 90% of the global pigeonpea area is in India contributing to 90% of the global production. It occupies 36.3 lakh ha area with 27.6 lakh tones production which accounts for a productivity of 760.33kg/ha. There are various diseases like wilt, Phytophthora blight, Cercospora leaf spot, collar rot, dry root rot, Alternaria leaf spot, powdery mildew, sterility mosaic and phyllody which reduces the yield. Among the above mentioned diseases, pigeonpea wilt caused by *Fusarium udum* Butler, is highly devastating disease and causes 30-60% crop losses. Integrated disease management (IDM) combines a wide array of all the above methods and practices for the control of diseases and at the same time protects the environment in the long run as natural enemies are conserved and fungicide use are minimized. The wisdom to adopt this technology is that no single method of disease control was



useful in containing the losses. Various cultural practices like field sanitation, soil solarisation through summer ploughing or using polythene sheets, green manuring reduces the incidence of wilt disease. Three to four year rotations with tobacco, sorghum and cereal crops reduce intensity of wilt disease. Intercropping pigeonpea with sorghum is a well demonstrated technology against wilt disease. Seed treatment with *Trichoderma harzianum* and *T. viride* @ 4g/kg seed followed by soil application @ 10g in 1kg of FYM reduces wilt. Seed treatment with Carbendazim + Thiram (1:2) @ 2.5g/kg of seed reduces the incidence of wilt. In India no specific IDM module for pigeonpea crop for disease management is available. In fact IDM should be now the backbone of the entire disease management programme.

SYNTHESIS OF POLICIES AMONG STAKEHOLDERS TO COMBAT ANTIMICROBIAL RESISTANCE IN LIVESTOCK ANIMALS: INDIAN PERSPECTIVE

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Objective: Synthesise the policies to Combat Antimicrobial Resistance among Stakeholders in livestock animals with sharp focus on Indian perspective. **Result and discussion:** The rapid rise in use of antimicrobial seeks the judicious extension approaches and outreach to track the decision-making among the stakeholders. Absence of synthesis and approach focussed on behavioural science resulted weak stress on practices related to judicious use of antimicrobials among stakeholders. The active participation of all stakeholders in decision making, valid veterinary-client relationship, meta-ethnography on antimicrobial themes, insight in to perceived behavioural control, addressing the descriptive norms and adequate consideration resulting wider costs and benefits (and knock-on effects) of related behaviour change can be alternative extension approaches which need insight to address the antimicrobial resistance and increase the field outreach. **Implication:** Antimicrobial stewardship and social capital framework can be corpus of the grass-root research to incorporate a clear understanding of the social and economic contexts of antimicrobial usage practice and behaviours ensuring its effectiveness for policy formulations. These aspects can establish effective surveillance and feasible policies at the grass-root level for the control of antimicrobial resistance.

Keywords: Antimicrobial stewardship, veterinary-client relationship, surveillance, decision-making, sub-optimal use.

BORER'S MANAGEMENT THROUGH TRICHO-CARDS (*TRICHOGRAMMACHILONIS*) IN SUGARCANE CROP AT NICRA ADOPTED VILLAGE BAGHPAT

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Studies regarding the management of sugarcane early shoot borer, through Tricho-cards (*Trichogramma chilonis*) and selective use of insecticides i.e. Cartap hydro chloride @ 10 kg/ Acre and Rynaxypyr @ 150 ml /Acre in comparison with *T. chilonis* were carried out in 100 farmer's field of the NICRA adopted village Sikhera during 2014-15 and 2015-16. In the first experiment regarding the *T. chilonis* i.e. four time release at 15 days interval (T_1 , @ 2 Trichocards/Acre), T_2 Cartap hydro chloride @ 10 kg/ Acre and T_3 Rynaxypyr @ 150 ml /Acre and T_4 (Control, no release). Highest mean percent infestation was found (27.2%) in T_4 (control plot) and lowest mean percent infestation (2.15%) of the sugarcane early shoot borer was observed in T_1 (Trichocards @ 2 cards /Acre). It was followed by the Rynaxypyr @ 150 ml /Acre with mean percent parasitism of 2.74% and increased yield 450 qtls / Acre was also recorded in T_1 (Trichocards @ 2 cards /Acre). Rynaxypyr @ 150 ml /Acre insecticides showed statistically same response in percent infestation of sugarcane early shoot borer and also yield of sugarcane, while higher percent infestation was recorded in the Cartap hydro chloride @ 10 kg/ Acre treated plots as compared with the T_3 . Based on these results Tricho-cards (@2 Tricho-cards/Acre) are recommended for the management of sugarcane early shoot borer's infestations instead of insecticides. Moreover, this practice may have significant role to protect the environment and conserve the natural resources from insecticides contamination.

PLANT GRAFTING: INSIGHTS INTO TISSUE REGENERATION

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For millennia, people have cut and joined different plants together through a process known as grafting. The severed tissues adhere, the cells divide and the vasculature differentiates through a remarkable process of regeneration between two genetically distinct organisms as they become one. Grafting is becoming increasingly important in horticulture where it provides an efficient means for asexual propagation. Grafting also combines desirable roots and shoots to generate chimeras that are more vigorous, more pathogen resistant and more abiotic stress resistant. Thus, it presents an elegant and efficient way to improve plant productivity in vegetables and trees using traditional techniques. Despite this horticultural importance, we are only beginning to understand how plants regenerate tissues at the graft junction. By understanding grafting better, we can shed light on fundamental regeneration pathways and the basis for self/non-self recognition. We can also better understand why many plants efficiently graft whereas others cannot, with the goal of improving grafting so as to broaden the range of grafted plants to create even more desirable chimeras. Here, I review the latest findings describing how plants graft and provide insight into future directions in this emerging field.



Keywords: *Arabidopsis*, callus, grafting, horticulture, regeneration, vasculature, wounding

NEW TRENDS AND STRATEGIES FOR DEVELOPING GREEN SUPER RICE

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From a global viewpoint, a number of challenges need to be met for sustainable rice production: (i) increasingly severe occurrence of insects and diseases and indiscriminate pesticide applications; (ii) high pressure for yield increase and overuse of fertilizers; (iii) water shortage and increasingly frequent occurrence of drought; and (iv) extensive cultivation in marginal lands. A combination of approaches based on the recent advances in genomic research has been formulated to address these challenges, with the long-term goal to develop rice cultivars referred to as Green Super Rice. On the premise of continued yield increase and quality improvement, Green Super Rice should possess resistances to multiple insects and diseases, high nutrient efficiency, and drought resistance, promising to greatly reduce the consumption of pesticides, chemical fertilizers, and water. Large efforts have been focused on identifying germplasms and discovering genes for resistance to diseases and insects, N- and P-use efficiency, drought resistance, grain quality, and yield. The approaches adopted include screening of germplasm collections and mutant libraries, gene discovery and identification, microarray analysis of differentially regulated genes under stressed conditions, and functional test of candidate genes by transgenic analysis. Genes for almost all of the traits have now been isolated in a global perspective and are gradually incorporated into genetic backgrounds of elite cultivars by molecular marker-assisted selection or transformation. It is anticipated that such strategies and efforts would eventually lead to the development of Green Super Rice.

keywords: Green Super Rice, Strategies, Molecular Marker-Assisted Selection

PLANT GRAFTING: A NEW FRONTIER APPROACHES IN FRUIT CROP IMPROVEMENT

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Grafting, an old plant propagation practice, is still widely used with fruit trees and in recent decades also with vegetables. Taxonomic proximity is a general prerequisite for successful graft-take and long-term survival of the grafted, composite plant. However, the mechanisms underlying interspecific graft incompatibility are as yet insufficiently understood. Hormonal signals, auxin in particular, are believed to play an important role in the wound healing and vascular regeneration within the graft union zone. Incomplete and convoluted vascular connections impede the vital upward and downward whole plant transfer routes. Long-distance protein, mRNA and small RNA graft-transmissible signals currently emerge as novel mechanisms which regulate nutritional and developmental root/top relations and may play a pivotal role in grafting physiology. Root grafting is a wide spread natural phenomenon; both intraspecific and interspecific root grafts have been recorded. Root grafts have an evolutionary role in the survival of storm-hit forest stands as well as in the spread of devastating diseases.

Keywords: epigenetics; genome transfer; graft hybrids; incompatibility; long-distance signals; microRNA

MICRO PROPAGATION: CHALLENGES AND OPPORTUNITIES IN HORTICULTURAL CROPS

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Micropropagation is a rapid multiplication of a selected plant using in vitro culture techniques. In this chapter various aspects of micropropagation have been discussed. The propagation of selected plant through micropropagation would be useful for raising plantation using apical and nodal segment. They are best for micropropagation and mostly result in true to type plants. These segments upon the subsequent subcultures result in a number of multiple shoots. These multiple shoots on elongation allowed to root in vitro. After rooting, they are in vitro hardened and transferred to field. The potential of plant tissue culture is well recognized, as it increases agricultural production and generates rural employment. But the high cost of production on micropropagation is a major bottleneck. Low-cost protocol development can popularize this method. High multiplication rate, use of low-cost chemicals, high rooting and survival percentage, and use of ex vitro rooting method can minimize the expense of any protocol. Presently, both the developing and the developed countries require low-cost technologies to progressively reduce the cost of production. The performance of tissue plants generally better than cutting and seedling. Initially, some morphological changes occur in micropropagated plant, but in the course of time, they minimize. Somaclonal variation caused during callus cultures can be used to generate variants for hybridization. Variation in phenotype of plants produced in tissue culture can be characterized as either temporary or permanent. Temporary variation includes increased branching, greater susceptibility to disease, and lack of uniform response. Micropropagated plants need to be monitored to get long-term data for its growth, survival, yield, and disease attack under field condition as very limited information is available for many plants. In this chapter micropropagation of commercially important plants like *Jatropha curcas*, *Eucalyptus*, banana, and bamboo has been discussed.

keywords: Micropropagation, rooting, Somaclonal, banana, and bamboo



NEW EMERGING MOLECULES OF INSECTICIDES AND THEIR ROLE IN IPM ALONG WITH ITS FUTURE CHALLENGES

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Mankind has a history of using crop protection products from non-selective, naturally occurring compounds to highly specific synthetic and biological materials for assured food production and protection of environment since long time. Researchers are adhere to develop safer molecules which could undergo photo-degradation, microbial degradation as well as chemical degradation leaving very less amount of residues in the environment. Indiscriminate use of insecticides, leads to resistance development by insect and ill effect posed on environment opened the new modern era of chemicals having novel mode of action with higher bioefficacy on insect control and safer to environment. These new groups of insect control insecticides includes neonicotinoids such as Imidacloprid, Acetamiprid, Thiacloprid etc. spinosyns, avermectins, oxadiazines, IGR's such as Benzoyl Urea, Thiadiazines etc, fiproles, pyrroles, pyridine azomethine, ketoenols and benzenedicarboxamides. Most of these groups of pesticides play an important role in managing many arthropod pests with good bioefficacy, high selectivity and low mammalian toxicity, which make them attractive replacement for synthetic organic pesticides. These novel groups of pesticides are likely to play an important role in IPM programme in future but still there are several future challenges as to develop more and more new molecules having Low dose compounds high efficacy and quick knock down against target pest, low mammalian toxicity, relatively safer formulations such as SC, WG, contains water soluble pouches, less soluble in water, less or no leaching potential, new chemistry, less harmful to beneficial insects such as honey bees and natural enemies, less residual effect, high persistence in the plant, more discoveries in macromolecular pesticides, more innovations required for new neo-nicotinoids, more biotechnological innovations to be directed in transgenic plants etc. and more innovative technology to be developed in application of pesticides, a special care shall be given on the nozzles, sprayer or applicator with an intention to minimize the loss of applied pesticide or target organisms. The prime motto for these developments is to give protection to the crops along with safety to the natural enemies of different pests as a whole safety to environment.

Keywords: neonicotinoids, photo-degradation, toxicity, innovations and protection.

CULTIVATION OF CAPEGOOSEBERRY (*PHYSALIS PERUVIANA* L.) UNDER SOUTH-EAST RAJASTHAN CONDITIONS

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Capegooseberry (*Physalis peruviana* L.) is indigenous to South America but was cultivated in South Africa in the region of the Cape of Good Hope during the 19th century, imparting the common name "Capegooseberry". Its somatic chromosome number; $2n=24$. It is the only important annual herbaceous, minor tropical fruit crop of India. The crop has potential for use as nutraceutical. Capegooseberry is a member of solanaceae family. This family has many tribes and contributes many plants which are important to mankind as food or medicine. Capegooseberry is a self pollinated, herbaceous in nature and reaches 2 to 3 feet in height under favourable growing conditions. After the flower falls off, the persistent calyx expands, forming a straw- coloured husk much larger than the fruit enclosed, which take 70 to 80 days to mature. Fruits of capegooseberry are small with 1-3.5cm in diameter, they are very juicy, aromatic yellow orange in colour and round in shape at maturity. Capegooseberry has high significance for diversification of fruit bowl in market. It is usually cultivated as a short cycle (3-4 months), annual crop but in absence of frost it can be perennial. Capegooseberry is tropical crops in it requires warmer climate and dry weather at the time of fruit development and maturity stages. It is susceptible to frost. It grows well under well fertile and drained soil with a pH range of 6-7. Capegooseberry is usually propagated by seed. Seeds may be sown in poly bags (22x15cm with 150 gauges) 6 weeks prior to transplanting; about 250 g seeds are required for one hectare area, its seeds are small and seedlings are planted when they are 15-20cm tall during September-October. Fertilizer ingredient require 15 tones FYM, 120kg N₂, 80kg P₂O₅ and 60kg K₂O for per ha. apply after planting. Intercultural practices such as weeding should be done after in which 30 days of planting. It's should be irrigated once in 12-15 days in winter and 6-8 days in summer. Capegooseberry fruits 80-90 days taken to first harvesting from transplanting. When persistent calyx, fruit stalk dried completely and fruit colour changes into yellow colour its optimum stage for harvesting. The average yield is 30-40 q/ha. Pest and disease can not harmful effect on the crop during growing condition also yield. Though, Capegooseberry is important in view of its horticultural crops its fruit fetch in the market at high prices. It needs to be accentuated in order to cultivation adoption of this crop to also help in improve socio-economy of the farmer. Cultivation adoption is worth adoption under S-E Rajasthan conditions.

ZINC FERTILIZATION APPROACHES FOR AGRONOMIC BIO-FORTIFICATION AND FIND OUT HUMAN BIOAVAILABILITY OF ZINC IN MAIZE GRAIN

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Maize (*Zea mays* L.) is generally low in bioavailable zinc (Zn); however, agronomic biofortification can cure human Zn deficiency. In the present experiment, Zn was applied in pots as ZnSO₄ · 7H₂O to maize cultivar DK- 6142 as foliar spray (0.5% w/v Zn sprayed 30 days after sowing and 0.5% w/v at tasseling), surface broadcasting (16.5 kg Zn ha⁻¹), subsurface banding (16.5 kg Zn ha⁻¹ at the depth of 15 cm), surface broadcasting + foliar and subsurface banding + foliar in comparison to an unfertilized control. As compared to control, all treatments significantly ($P \leq 0.05$) increased growth, yield and nutritional attributes in maize. Grain Zn and protein concentrations were correlated and ranged from 22.3 to 41.9 mg kg⁻¹ and 9 to 12 %, respectively. Zinc fertilization also significantly reduced grain phytate and increased grain Zn concentration. Zinc fertilization, especially broadcasting and subsurface banding combined with foliar spray decreased grain [phytate]:[Zn] ratio to 30 and 24 and increased Zn bioavailability by trivariate model of Zn absorption to 2.04 to 2.40, respectively. Conclusively,



broadcasting and subsurface banding combined with foliar spray is suitable for optimal maize yield and agronomic Zn biofortification of maize grain. This would also be helpful to optimize Zn and protein concentration in maize grain.

Keywords: Maize (DK-6142), Zinc sulphate, Pot.

DIFFERENTIAL EXPRESSION OF BLAST DISEASE AT YOUNG AND MATURITY STAGES IN RICE (*ORYZA SATIVA* L.)

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Experiment was conducted to identify blast-resistance varieties for the study of expression pattern of the disease during different stages and the extent of leaf blast on the further infection stages i.e. neck blast, and also to identify the potential genotypes which showed overall resistance. The investigation consisted 81 rice genotype in which, 34 released varieties, 43 traditional varieties and four checks (two resistant and two susceptible). Here 13 genotypes proved resistant for both neck and leaf infection and few varieties which were severely infected with leaf blast could not show any neck/ panicle damage and varieties showed less infection at initial stage found with neck infection. The experiment concludes the expression pattern of the blast disease is different at leaf and neck blast stage and the severity at one stage is not influenced by the other stage.

Keywords: genotype, leaf blast, *Magnaporthe*, neck blast, varieties

QUANTIFICATION OF PHYSIOLOGICAL TRAITS AND MECHANISMS IN PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP.] GENOTYPES AFTER RECOVERY FROM WATERLOGGING

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An experiment was conducted at Jawaharlal Nehru Agricultural University, Jabalpur, Madhya Pradesh, India during rainy seasons of 2011-12 and 2012-13. The experimental material comprised of twelve pigeonpea genotypes. The crop was exposed to eight days continuous waterlogging stress imposed 40 days after sowing under natural field conditions. The root zone was subjected to completely drainout of water from plots after eight days waterlogging stress period. Thereafter, all plots were kept under natural conditions for recording the observations eight days after drainout. The physiological traits were significantly affected by waterlogging. Under normal conditions highest values for net photosynthetic rate, stomatal conductance, intercellular CO₂ concentration, quantum efficiency and water use efficiency were observed in ICPL 20241, transpiration rate in KPBR 80-2-1, carboxylation efficiency in ICPL 20128 and greening index in ICPH 2431. However, after recovery from waterlogging net photosynthetic rate, stomatal conductance and quantum efficiency were higher in KPBR 80-2-1, intercellular CO₂ concentration, water use efficiency in ICPL 20241, transpiration rate and carboxylation efficiency in ICPL 20128, and greening index in ICPL 87051. Four genotypes viz KPBR 80-2-1, ICPL 20241, ICPL 20128 and ICPL 87051 were considered as tolerant to waterlogging over the remaining genotypes.

Keywords: Waterlogging, Pigeonpea, Net Photosynthetic Rate, Stomatal Conductance, Intercellular CO₂ Concentration and Transpiration Rate

STUDY ABOUT THE KNOWLEDGE OF ICT AMONG THE FARMERS OF SOUTHERN RAJASTHAN

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This study was carried out in Banswara and Dungarpur districts of Southern Rajasthan. These districts were selected on the basis of availability of maximum facilities and infrastructures to promote use of ICT. Two tehsils from each district were identified following the same criteria. The four progressive villages from each selected tehsils were taken for inclusion in investigation with the assumption that the use of ICT was more in progressive villages. Finally ten respondents were selected from each village by random sampling technique, thereby, making a sample of 160 respondents for the study purpose. The findings revealed that majority of the respondents 57.50 per cent had medium level of knowledge about information and communication technologies whereas, 28.13 per cent respondents were observed in low level knowledge group. While only 14.37 per cent of the total respondents had high level of knowledge regarding ICTs in the study area. The knowledge of respondents of Banswara district was from 47.50 to 96.25 per cent, whereas, in case of respondents of Dungarpur district the knowledge was observed between 46.87 to 94.38 per cent in all aspects of cell phone. It means the respondents of Banswara district possessed more knowledge than respondents of Dungarpur district about all the aspects of cell phone technology. It was observed that knowledge with respect to all the aspects of touch screen computer technology was found 49.79 to 36.50 per cent in Banswara district respondents, whereas, in Dungarpur district was from 37.25 to 48.95 per cent. It was inferred that respondents of Banswara district had comparatively more knowledge than respondents of Dungarpur district about various aspects of touch screen computer technology. It was found that knowledge among the farmers of Banswara district was 37.50 to 71.25 MPS, while in case of respondents of Dungarpur district it was 36.25 to 73.75 MPS about all aspects of kisan call center.

TOPIC: MANAGEMENT PRACTICES FOR ROOT - KNOT NEMATODE (*MELOIDOGYNE GRAMINICOLA*) IN RICE CROP.

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Rice is grown in diverse environments either as a sole crop (rain fed, irrigated or deepwater) or as a major component in various cropping systems. Rice cultivation cover large area in India, even a smallest pest problem would have great impact on yield and farmers income. Soil borne diseases are becoming increasingly important in the rice-based cropping systems. One of the most important soil borne pests is plant parasitic nematode. About three hundreds nematode species belonging to thirty five genera have been reported infesting rice. Among them, *Meloidogyne graminicola* (Golden and Birchfield) causing rice root knot disease has emerged as a major pest recently throughout the world due to its broad host range and ability of causing potential and yield loss. The losses caused by *M. graminicola* may vary from negligible to heavy depending on the severity of disease. This nematode reduced the rice yield by causing more than 10% yield loss in a greenhouse experiment and the yield losses might go as high as 80%¹. The main symptoms of root knot disease of rice are yellowing, dwarfing and gall formation on the roots of rice plants. The degree of symptom manifestation differs with time of infection, age of the plants and load of inoculums². To prevent yield losses and improve productivity, it is necessary to find out the effective sustainable management strategy. Indiscriminate use of chemicals for managing this disease, results in the development of pathogen resistance and risk to the environment which has favored the introduction of various eco-friendly approaches of management such as, removal of host weeds, flooding of fields, summer ploughing, organic amendments, and use of effective bio-control agents. Since each management approach has some advantage, an integrated approach can be a better option to management of the root knot nematode³. Fumigant or non fumigant nematicide can be included in integrated management of this Nematode, during heavy infestation conditions.

IMPACT OF BIOFERTILIZER AND BIOAGENTS ON LATE BLIGHT OF POTATO

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Late blight of potato caused by *Phytophthora infestans* is one of the most serious fungal diseases of potato that's attacks on leaves, stems, and tubers of potato plants. In the 1840s, *P. infestans* caused the Irish potato famine, when a million people starved and other million and a half emigrated out of Ireland. Several management practices have been adopted for 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%) was reported from treatment. where treatments were given as 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.

Keywords: *Phytophthora infestans*, *T. viride*, and mustard cake

EVALUATION OF TOMATO (*SOLANUM LYCOPERSICON* L.) HYBRIDS FOR FRUIT YIELD AND ITS CONTRIBUTING CHARACTERS IN HILL REGION OF UTTARAKHAND

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Tomato is a premier vegetable crop of round the year and one of the prominent eco-industrial crops of India. The present study which consist 22 F₁ including commercial 6 hybrids of tomato. The experiment was laid out in Randomized Block Design (RBD) with three replications during summer-rainy season, 2014 at Vegetable Block of VCSG Uttarakhand University of Horticulture and Forestry, Ranichauri, Tehri-Garhwal. Analysis of variance revealed significant differences among the hybrids for all the characters. The hybrid viz., Utkal Urwasi x Gujrat Tomato-3 proved the best with respect to fruit yield per plant (6935.08 g) whereas Utkal Urwasi x Palam Pink was promising for number of fruit per plant (79.82), number of flower cluster per plant (14.13), number of flower per cluster (8.0) and fruit set percentage (85.71 %). The hybrid Marglobe x Pusa Sadabahar was the best for earliest picking (43.0 DAT) and highest fruit weight (106.74 g). Therefore, Utkal Urwasi x Gujrat Tomato-3, Utkal Urwasi x Palam Pink, Marglobe x Pusa Sadabahar and Azad T-6 x NDT-7 are recommended for harnessing heterosis for fruit yield and its contributing characters in tomato under temperate hills of Uttarakhand.

ENHANCING VASE LIFE OF GLADIOLUS VAR. PETER PEARS THROUGH EXOGENOUS APPLICATION OF CARBOHYDRATE SOLUTION

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Gladiolus is economically most important flowering plants which has gained its popularity as a cut flower crop both in domestic as well as international market. This crop has attained immense importance among the flower lovers and occupies a prominent place in the garden due to its magnificent inflorescence and wide range of colours and shapes. However, its spikes are highly perishable and causes large amount of post harvest losses. A large number of the chemicals which can extend the vase life of these flowers are available but are not generally used by the farmers either due to their complex nature or difficult to handle. An On Farm experiment was conducted during 2015 to ascertain the effect of readily available and easy to handle vase solutions for reducing the post harvest losses incurred by the farmer. Three treatment regimes were selected which include farmer's practice (no treatment), pulsing/dipping of gladiolus spikes in sugar 5% and Pulsing of spikes with



sugar 5%+citric acid 2%. The results revealed that pulsing of spikes with sugar 5%+citric acid 2% recorded highest shelf life (8 days) as compared to farmer's practice (5 days). Highest number of spikes (120000 spikes/ha) were sold out to the market when treated with sugar 5%+citric acid 2% as compared to farmer's practice (65000 spikes/ha). The same treatment also improved the economic condition of the farmer by recording highest B:C ratio (2.98:1) as compared to farmer's practice (1.63:1). Pulsing of spikes with 5% sugar was observed to be the next best treatment.

EVALUATION OF POST HARVEST TECHNIQUES FOR MANAGEMENT OF GLADIOLUS CORMS

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Gladiolus (*Gladiolus grandiflorus* L.) is a tender herbaceous perennial and an important bulbous ornamental plant valued for its attractive spikes. It is commercially propagated by corms and cormels whose physiological dormancy usually lasts for about 4 to 5 months inside the storage. The corms become more susceptible to rotting due to prolonged storage. This has caused a decline in the commercial cultivation of gladiolus due to high economic losses. In order to control the rotting of corms, an On Farm Trial was conducted during 2015-16 at the farmers field comprising of three treatments viz., T₁ (Farmer's Practice: no treatment); T₂ (dipping of corms in Mencozeb@2g per litre of water for 30 minutes before storage) and T₃ (dipping of corms in *Trichoderma viridi* @ 2g per litre of water before storage). Highest percentage of healthy corms, recovered after storage, were recorded with T₃ (89%) followed by T₂ (81%) and lowest with T₁ (58%). Besides disease control, *Trichoderma* treatment was also found to enhance corm production and recorded highest production (87000 corms/ha) as compared to farmer's practice (61000 corms/ha). This Pre-storage treatment of corms increased the net returns of the farmer with highest BC ratio recorded in T₃ (2.95:1) followed by T₂ (2.73:1).

INTEGRATED NUTRIENT MANAGEMENT IN KHARIF SORGHUM (*Sorghum bicolor* L.)

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The field experiment was conducted at Sorghum Research Station, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Dist. Parbhani during *kharif* season of 2015 to study the "Integrated Nutrient Management in *Kharif* Sorghum (*Sorghum bicolor* L.)". The experiment was laid out in randomized block design with three replications and variety CSH -16 as test crop along with nine (09) treatment combinations. Gross and net plot size was 4.5 x 5.0 m and 3.6 x 4.4 m, respectively. Seeds were treated with insecticide (Emamectin benzoate) and biofertilizer like PSB and *Azospirillum*. Sowing was done on 21st June 2015 by seeds are dibbling and distance between 45cm x 15 cm. The study revealed that the application of 75% RDN through inorganic fertilizer + 25% RDN through vermicompost + seed treatment with PSB + *Azospirillum* (T₈) gave significantly higher grain yield (2356.89 Kg ha⁻¹), fodder yield (5450.31 Kg ha⁻¹) and biological yield (7807.20 Kg ha⁻¹) over rest of the treatments, however it was at par with application of 75 % RDN through inorganic fertilizer + 25% RDN through FYM + seed treatment with PSB + *Azospirillum* (T₇). Similar trend was observed with gross monetary returns, net monetary returns and B:C ratio.

Keywords: Integrated Nutrient Management, Organic Fertilizer, Inorganic Fertilizer.

BIOSURFACTANTS PRODUCED BY RHIZOSPHERIC MICROBES AND THEIR ROLE IN PLANT GROWTH PROMOTION

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Microbial surfactants or biosurfactants are the amphiphilic compounds that possess high surface activity and are potential substitute to their chemical counterparts because of their multifarious qualities like biodegradability, lower toxicity, stability under extreme temperature, salinity and pH and above all their ecofriendly nature. Biosurfactants have carved a niche in various fields such as food industries, cosmetic industries, pharmaceutical industries and in bioremediation techniques due to variety of surface activities like foaming, detergency, wettability, dispersion and emulsification. Apart from their wide range of roles and diverse capabilities in these areas, it has now gained attention in the field of agriculture as well. A large part of global economy is dependent on agriculture sector and due to intensive agronomic practices and increased use of chemicals, it is facing a setback. In recent times, biosurfactants have been recognized as potent tool for biocontrol of plant pathogens hence acting as growth promoter of plants and could be envisaged as a green alternative for sustainable agriculture practices. There are many rhizobacteria which are known to produce biosurfactants and promote biocontrol via induced systemic resistance, antibiosis, parasitism, antibiofilm activity, antiadhesive activity and improve the quality of soil by increasing the bioavailability of compounds and removing toxic metals. The genus *Pseudomonas* and *Bacillus* are the front runners among various other genera of bacteria and are ubiquitously present in soil. They specifically produce rhamnolipids and cyclic lipopeptides biosurfactant respectively. Other than that, some fungi and yeasts are also reported to produce biosurfactants i.e. sophorolipids. In the present study, roles of biosurfactants was checked in relation to plant growth promotion and biocontrol.

Keywords: Biosurfactants, Agriculture, RhizosphericMicrobe, Biocontrol



MANAGING DISEASES IN THE GREENHOUSE

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A greenhouse (also called a glasshouse, or, if with sufficient heating, a hothouse) is a structure with walls and roof made chiefly of transparent materials, such as glass, in which plants requiring regulated climatic conditions are grown. Many commercial glass / greenhouses or hothouses are high-tech production facilities for vegetables or flowers. The glass / green houses are fitted with equipment including screening installations, heating, cooling, lighting, and may be controlled by a computer to optimize conditions for plant growth. Different techniques are then used to evaluate optimality-degrees and comfort ratio of greenhouse micro-climate (i.e., air temperature, relative humidity and vapour pressure deficit) in order to reduce production risk prior to cultivation of a specific crop. Due to the favorable conditions for diseases, greenhouse is called as “factory of the plant diseases”. Two of three elements of the disease triangle are always present i.e. susceptible host and favorable environment. Disease management here must be considered primarily as exclusion or avoidance. Once diseases are introduced, it is difficult to manage. Disease management using exclusion nodules sanitation, physical approaches, host plant resistance, chemical nematicides, and biological control is discussed. If we can control one or more of the three points, then a pathogen can be controlled. For example, a disease can be controlled by removing the pathogen with hygiene or a pesticide, changing the environmental conditions to one that does not favour the pathogen or using of resistant/tolerant variety so that there is not a suitable host. So we can say conclusively that, every greenhouse manager should be aware of the sources of pathogens for each crop grown in their particular operation and should plan to eliminate those sources of disease. Money can be saved by not losing plants during production and by minimizing the expense of purchasing and applying disease control chemicals.

EFFECT OF FOLIAR SPRAY OF UREA AND ZINC SULPHATE ON GROWTH AND YIELD OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. LUCKNOW- 49”

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The experiment was conducted at University guava orchard, Department of Horticulture (Fruit Science), College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) during the session 2015 - 2016. The experiment was laid out in Randomized Block Design with ten treatment combinations consisting of one control, three concentrations of Urea, i.e. U_1 : Urea @ 1.0%, U_2 : Urea @ 1.5% and U_3 : Urea @ 2.0% and three concentrations of zinc sulphate, i.e. Zn_1 : Zinc sulphate 0.2%, Zn_2 : Zinc sulphate 0.4% and Zn_3 : Zinc sulphate 0.6% in factorial randomized block design with 3 replications. The observations were recorded on different aspects of vegetative characters, reproductive parameters, yield parameters, physical parameters and Chemical parameters of fruits. As regards urea levels, all parameters were found significantly superior under U_3 (Urea @ 2.0%) followed by U_2 (Urea @ 1.5%) and U_1 (Urea @ 1.0%) except specific gravity, it was nonsignificant. In case of foliar spray of Zinc sulphate it was found significantly superior under in Z_3 (Zinc sulphate @ 0.6%) which was significantly superior to Z_2 (Zinc sulphate @ 0.4%) and (Zinc sulphate @ 0.2%). The interaction of different treatment combinations showed significant for most of the parameters. Treatment combination of U_3Z_3 recorded maximum value for all the observations followed by U_3Z_2 and the minimum values were found in control. The interaction effect of urea and zinc sulphate markedly influenced the yield per tree. The highest yield per tree 42.92 kg was recorded in treatment U_3Z_3 (urea @ 2.0% & $ZnSO_4$ @ 0.6%) followed by 40.93 kg in U_3Z_2 (urea @ 2.0% & $ZnSO_4$ @ 0.4%). The minimum yield per tree was noted in U_0Z_0 .

Keywords: Foliar Spray, Urea, Zinc Sulphate, Growth, Yield, Quality, Guava.

EFFECT OF NITROGEN MANAGEMENT UNDER DIFFERENT LAND CONFIGURATION AND MOISTURE REGIMES ON HERB AND OIL YIELD OF MENTHA (*MENTHA ARVENSIS*.)

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The field experiment was conducted at Agronomy Research Farm of N.D. University of Agriculture & Technology, Kumarganj Faizabad (U.P.). during the summer season 2016-17 the effect of nitrogen management under different land configuration and moisture regimes on herb and oil yield of mentha This was laid out in split plot design keeping land configuration (flatbed, ridge bed, paired raised bed planting) moisture regimes (0.8, 1.0 and 1.2 IW/CPE) as main plot and nitrogen management in sub plot respectively. The 27 treatment combinations replicated three times. The soil of experimental site was slightly alkaline in natur, low in organic carbon deficient in available N and medium phosphorus and rich in potassium ($kg\ ha^{-1}$)

Plant growth parameters such as plant height, dry weight, leaf to stem ratio, herb yield were observed higher under raised bed (paired row) planting as compare to flatbed, and ridge planting. The moisture regime 1.2 IW/CPE ratio performed better in view of growth parameters as compared to rest of the other moisture regime.

Higher herb and oil yield were recorded under raised bed (paired row) planting. maximum plant height, number of branches, number of leaves recorded at moisture regime of 1.2 IW/CPE moisture regime and 125% ($200\ kg\ /\ ha^{-1}$) RDN nitrogen level the maximum net return (84103) and B-C ratio (2.02) was obtained under treatment combination of raised bed (paired row) planting at 1.0 IW/CPE and 125% ($200\ kg\ ha^{-1}$) RDN nitrogen level followed by treatment combination of raised bed (paired row) planting with irrigation at 1.0 IW/CPE and 125% ($200\ kg\ ha^{-1}$) RDN



nitrogen level. However, maximum water use efficiency 267.04kg /ha /cm was worked out under irrigation at 0.8IW/CPE while in planting method. Highest WUE recorded with raised bed (paired row) planting (265.98) method land configuration.

Keywords: IW/CPE, DAP, Moisture regime

EVALUATION OF DIFFERENT VARIETIES OF ONION COMPARSED WITH LOCAL VARIETY IN KHARIF SEASON

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On farm experiments were conducted at different villages comes under Krishi Vigyan Kendra, Burhanpur, M.P. during kharif season of 2014 to 2017. To evaluate the yield performance of two varieties Bhima Super and Agrifound Dark Red against local variety N-53 is commonly grown under field conditions of Burhanpur district. Obtained results showed that the Bhima super recorded the maximum height of plant (38.8 cm), leaf length per plant (44.6 cm), bulb diameter (6.08cm), bulb weight (59.24gm) followed by variety Agrifound dark red which was recorded maximum neck thickness (1.11 cm) and no. of leaves per plant (13.8). The variety Bhima super produced highest marketable yield (290 q ha⁻¹) which was at par with Agrifound dark red (160 q ha⁻¹). Bhima super variety recorded the zero bolting percentage and minimum splitting percentages (0.21%). The implication of this study showed that variety Bhima super performed best and could therefore be recommended as a potential replacement for the commonly grown variety N-53 in Burhanpur region.

INTEGRATED PEST MANAGEMENT AND INTEGRATED NUTRIENT MANAGEMENT IN HORTICULTURAL CROPS.

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The IPM approach used by organic growers should be nearly identical to the one employed by conventional growers. The difference is that the organic grower needs to monitor more closely and rely more heavily on cultural and physical techniques for preventing and managing problems and use only acceptable organic sprays. Keep in mind that organic pesticides are not generally as effective as chemical pesticides. And they still can negatively impact the pollinator population. To grow any type of fruit successfully, you must grow healthy plants and anticipate and prevent problems. The appearance and severity of pest problems varies between neighborhoods, areas of the state, and growing seasons. When symptoms of a problem are noticed, accurately identify the problem (weed, insect, disease, cultural/environmental), monitor for changes (increasing severity), and be prepared to act. Prevention and control measures at your disposal may be physical (e.g., handpicking Japanese beetles, removing diseased plants), cultural (e.g. pruning brambles to improve air circulation), or chemical (e.g. spraying horticultural oil to smother San Jose scale.) The continuous use or excess supply of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing economic inefficiency, damage to the environment and in certain situations, harm the plants themselves and also to human being who consume them. On the other hand, increase in productivity of horticultural produce removes large amounts of essential nutrients from the soil. Without proper management, continuous production of crops reduces nutrient reserves in the soil. The new approach to farming often referred to as sustainable agriculture, seeks to introduce agricultural practices that are ecofriendly and maintain the long term ecological balance of soil ecosystem. The judicious use of organic inputs with inorganic is considered as the alternative source to meet the nutrient requirement of the crops.

INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT IN BRINJAL (*SOLANUM MELONGENA* L.)

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An experiment was conducted at Research Field, Department of Horticulture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, College of Agriculture, Gwalior (M.P.) during rabi season (2016-2017) to see the effect of INM in Brinjal (*Solanum melongena* L.) cv. NDBH-6. Nine treatments of integrated nutrient management viz., 100% RDF (100:60:40 kg/ha) (T₁), 100% FYM (20 t/ha) (T₂), 100% VC (3 t/ha) (T₃), 50% FYM (10 t/ha) + 50 % VC (1.5 t/ha) (T₄), 50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha) (T₅), 25% RDF (25:15:10 NPK kg/ha) + 75% VC (2.25 t/ha) (T₆), 50% RDF (50:30:20 NPK kg/ha) + 50% FYM (10 t/ha) (T₇), 25% RDF (25:15:10 NPK kg/ha) + 50% FYM (10 t/ha) (T₈) and control (T₉) (no use of fertilizer) were evaluated in Randomized Block Design with three replications with plot sizes of 2 m × 3 m. Treatment T₇ [(50% RDF (50:30:20 NPK kg/ha) + 50% FYM (10 t/ha))] showed significantly higher Plant height, number of leaves/plant and length of leaves at 30, 60 and 90 DAT, fruit length, fruit diameter, fresh fruit weight, dry fruit weight at harvest were observed under (T₇) which remained statistically at par with 50% RDF (50:30:20 NPK kg/ha) + 50% VC (1.5 t/ha) (T₅) and 100% RDF (100:60:40 kg/ha) (T₁). However, significantly minimum values of growth and yield attributes were observed under control (T₉) (no use of fertilizer).

Keywords: Brinjal; INM, Organic and Chemical fertilizers

PHYLOGENY OF *STEINERNEMA ABBASI* (RHABDITIDA: STEINERNEMATIDAE) AND ITS VIRULENCE AGAINST *GALLERIA MELLONELLA*

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The investigations were conducted on soil samples collected from the sugarcane (*Saccharum officinarum* L.) agriculture fields of Baghpat district, the sub-humid region of Uttar Pradesh, India. The worms were diagnosed as member of bicornutum group due to the presence of two horns like cephalic structures in third stage infective juveniles. The newly isolated worms were not identical to pre-existing individuals of same group and can be differentiated from the *Steinernema abbasi* (Rhabditida: Steinernematidae) by the presence of mucronate processes in adults of second generations and relative proportion of oesophagus with body length in juveniles. In the present investigation the recovered populations of entomopathogenic nematodes (EPN) were identified, characterized and validated as an isolate of *S. abbasi* CS17 and CS18 with the application of advanced molecular tools. The phylogenetic analyses were based on the efficacy of conserved genes (ITS, D2-D3 and coxI) sequences in taxa validations. The nematodes were tested for their pathogenicity and reproductivity at different doses against wax moth larvae *Galleria mellonella*. *S. abbasi* isolates were found highly pathogenic and caused 100% mortality within 36 and 48 hours respectively in isolate CS17 and CS18. The lowest LC₅₀ value (12.47 IJs/ larva) with highest pathogenicity was recorded with *S. abbasi* isolate CS18 followed by *S. abbasi* isolate CS17. The study revealed that all the tested nematodes are able to propagate in the host cadaver and produced a varied number of 3rd stage infective juveniles at different doses applied. Further their tests on other insects in lab as well as green house and field conditions need to be evaluated to use them as biological control agents for controlling different target insect pests.

Keywords: *Steinernema abbasi*, conserved genes, ITS, D2-D3 and coxI, biocontrol agent.

ISOLATION OF BACTERIAL ENDOPHYTES FROM MEDICINAL PLANT ALOE VERA HAVING ANTIMICROBIAL AND PGPR ACTIVITY

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Endophytes are organisms that are intimately associated with various parts of plants without causing substantial harm to the host plant and forms association usually mutualistic. Endophytic bacteria may accompaniment certain metabolic properties, such as promoting plant growth, controlling soil-borne pathogens, or helping host plant to defeat stress responses to environmental abuse. They have been known to produce enormous variety of strange and wonderful secondary metabolites, some of which have profound biological activities that can be exploited for human health and welfare. Some of the endophytic microorganisms can produce the same secondary metabolites as that of the plant thus making them a promising source of novel compounds. In this study endophytic bacteria were isolated, characterize morphologically, biochemically (Urease, pectinase, cellulose, Casienase, gelatinase, chitinase, Catalase, Starch hydrolysis, lipolytic activity) and functionally. Plant growth promotion potential and phytochemicals producing ability of these endophytes were also assessed as it seems for them to be promising in increasing the yields of Green gram var. Pant Moong- 4, which can provide a better alternative for commercial fertilizers and pesticides. During functional characterization bacteria exhibited phosphate solubilization, IAA, siderophore production and ammonia production. Bacterial isolates were also evaluated for antibiotic sensitivity assay Penicillin, Ampicillin, Tetracyclin and Chlorempenicol. Therefore, these bacterial strains could be developed as potential PGP candidates for sustainable agriculture and might be utilized as bioinoculant for organic farming and sustainable agriculture.

RESPONSE OF URDBEAN [*VIGNA MUNGO* (L.) HEPPEL] TO PHOSPHORUS FERTILIZATION AND THIOUREA ON YIELD, QUALITY, NUTRIENT CONTENT AND UPTAKE

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A field experiment was conducted during *Kharif* season of 2015 on loamy sand soil to study the effect of phosphorus levels and bio-fertilizers on productivity, nutrient content and uptake of urdbean. Experiment consisted of four treatments of phosphorus levels (0, 20, 40 and 60 kg/ha) and five thiourea treatments of bio-fertilizers (control, thiourea 500 ppm at branching, thiourea 500 ppm at branching and flowering, thiourea 1000 ppm at branching and thiourea 1000 ppm at branching and flowering) there by making twenty treatment combinations tested in randomized block design with three replications. Result indicated that application of phosphorus up to 40 kg/ha significantly increased seed and straw yield, net returns, protein content in seed, nitrogen, phosphorus and potassium concentration in seed and straw and total uptake of nitrogen, phosphorus and potassium over preceding levels and remained at par with 60 kg/ha. Whereas, raising the level of phosphorus from 0 to 20 kg/ha registered the highest agronomic efficiency, apparent recovery and physiological efficiency of phosphorus after that, it showed significant decline upto 60 kg/ha. Application of thiourea 500 ppm at branching and flowering registered significantly higher concentration of N and P in seed and straw and total uptake of N, P and K as well as protein content in seed and available P₂O₅ in soil after crop harvest over thiourea (500 ppm) at branching and control. Whereas the highest agronomic efficiency and apparent recovery of P recorded under thiourea 500 ppm at branching and flowering and physiological efficiency under control.

A STUDY ON STATISTICAL MODELS FOR PRE-HARVEST FORECASTING OF WHEAT YIELD BASED ON WEATHER VARIABLES IN DISTRICT BARABANK

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The present investigation entitled “A study on statistical models for pre-harvest forecasting of wheat yield based on weather variables in district Barabanki” consists of five chapters including summary and conclusion. The purpose of the study is to develop different forecast models, some based on weather variables, agricultural inputs and few based on discriminant function analysis. The effects of individual as well as joint effect of weather variables have also been studied. Time series data on wheat yield and weekly data from 44th SMW to 52th SMW of the following year on eight weather variables viz., minimum temperature, maximum temperature, minimum relative humidity, maximum relative humidity,



minimum wind velocity, maximum wind velocity, rainfall and rainy day hour covering the period from 1990-1991 to 2011-2012 have been utilized for development of pre-harvest forecast model. Statistical methodology using discriminant function for pre-harvest forecast model has been described. In all seven procedures have been used to develop the pre-harvest forecast model. The procedure-I is based on weather indices and rest are based on discriminant functions. On the basis of Adjusted R^2 and RMSE, the model-III has turned out to be the best followed by the model-VI and model-VII. However, there has not been much difference in the values of adjusted R^2 corresponding to model- III, VI and VII (83.6, 80.8, 85.3 percent respectively) are easy to develop using discriminant functions. RMSE of model-VII is little less (3.34) as compared to model-III (11.69). Therefore, the model-VI and VII can be recommended for pre-harvest forecast of the wheat yield in practice. However, the model-III and VI are as good as model-VII.

GUAVA SOFTWOOD GRAFTING: A NOVEL APPROACH FOR PLANT MULTIPLICATION

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Softwood grafting technique is becoming popular for propagation of many fruit crops. Guava commonly known as “poor man’s apple” is one of the important fruit crop in which softwood grafting technique can be utilized for multiplication of plant propagules. Traditional and present commercial methods of guava propagation are still not commercially viable due to varying rate of success and cumbersome process. The shortage of quality planting material promote farmer to use plants from unreliable sources which later results in poor quality fruit and low production. Hence, a rapid and successful propagation technique is required as the area under crop is expanding and there is a demand for guava sapling throughout the year. For all these softwood grafting techniques may be a viable solution. Therefore, the study was undertaken on response of guava varieties to different time of softwood grafting under Akola (M.S.) condition. . The experiment was laid out in a Factorial Randomized Block Design. The treatment consisted of four different time of softwood grafting (T₁- 1st forth night of January, T₂- 2nd forth night of January, T₃ – 1st forth night of February, T₄- 2nd forth night of February) and three source of scion (S₁-L-49, S₂-Lalit, S₃-Shweta) with 12 treatment combination replicated three times. The result of present investigation indicated that the response of guava varieties varied with respect to different time of softwood grafting.

Key words : Guava, Softwood grafting, Propagation, HDP

STUDIES ON POWDERY MILDEW OF RAPESEED-"MUSTARD (BRASSICA JUNCEA L.) CAUSED BY Erysiphecruciferarum Opiz. Ex. Junell. AND ITS MANAGEMENT"

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Repeseed-mustard is the major rabi oilseed crops of the country. 1 hey occupies a prominent place being next in importance to groundnut, both in area and production. A number of diseases of different origins attack rapeseed-mustard in which, *Erysiphecruciferarum* Opiz. Ex. Junellis taking heavy toll every year by decreasing the quantity and quality of produced. In order to certain the severity and distribution of disease, a survey was conducted at different locations of Kanpur. The maximum disease intensity (70%) was recorded at Oilseed Research from, Kalyanpur, Kanpur and minimum disease intensity (24.4%) was recorded at farmer's field, Chaubepur, Kanpur. The symptoms of the disease was first appear on all the above ground parts of the plant are affected by the disease which appearances in form of dirty white circular, floury powdery patches on leaves, stem and pods with the increase in temperature white floury patches increase in size and coalesce to cover entire plant. Stem covered with mildew growth appear purplish and are bleached brown below the fungal growth. Severely disease plant appears to be dusted with white granular powdery mass. Such plant poor growth and produce fewer pods. The young green siliquae show white to dirty white circular mildew growth in the initial stage of infection. Later such pods are completely covered with white mass in size and produce few small sized shriveled seed. The pathogen is an obligate parasite. The mycelium of the fungus is amphigenous, whitsseptate spreading and persistent. Conidia are hyaline, borne singly or in short chain 25-45x12-16um in size and cylindrical in shape. perithecia are scattered, globose at first yellowish orange, becoming brown to dark brown and black with maturity, 90-130um in diameter. Cell of perithecia are irregular brown and 10-25um in diameter. Appendages are numerous myceloid present all over the surface of perithecia, Asci oval to pyriform 3-12 in number usually 6-8 with and indistinct stipe and 50-70x 30-45um in size. Ascospores are ovoid 2-7 in number and 16-22x11-14um in size. Conidia germinate only from one end the germ tube in normally branched having up to three branches. Out of tested 42 genotypes of *Brassica*, was found resistant and genotype viz. UDN-11-32, UDN-11-03, UDN-11-28 and UDN-11-26 were observed to be moderately resistant. Out of tested Ten treatment of fungicide, bioagent and nutrients seed treatments Iprodione +carbendazim (1:1)@ 2g/kg seed., was found to be most effective in reducing disease intensity with increasing yield and 1000 seed weight, followed by removal of three lower leaves. ZnSO₄+ Sulphur as per recommendation was the most effective fungicide for the management of Powdery mildew.

Keywords: Lowest disease intensity, highest yield and highest 1000 grain weight were recorded

ENHANCING THE PRODUCTIVITY OF RICE AND SOIL HEALTH THROUGH NUTRIENT MANAGEMENT IN RICE-WHEAT CROPPING SYSTEM

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A field experiment was conducted during *Kharif* season of 2015 at Crop Research Centre (CRC) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to enhancing the productivity of rice and soil health through nutrient management in rice-



wheat cropping system. The experimental field had an even topography with good drainage system. Which is situated at latitude of 29°40' North and longitude of 77°42' East and at an altitude of 237 meter above mean sea level. Meerut lies in the heart of Western Uttar Pradesh and has sub-tropical climate. The soil of the experimental field was loam in texture (51.9 % sand, 28.2 % silt and 19.9 % clay) and slightly alkaline in reaction (pH 7.68). The experimental soil was low in available nitrogen and medium in available phosphorus and available potassium with an electrical conductivity (1:2.5, soil: water extract) of 0.25 dS m⁻¹. Eleven different treatments viz; T₁ (Recommended NPK), T₂ (Recommended NP), T₃ (Recommended NK), T₄ (Recommended PK), T₅ (Recommended NPK+ wheat residue @ 5 ton ha⁻¹), T₆ (Recommended NPK + FYM @ 10 ton ha⁻¹), T₇ (SSNM 100 : 60 : 60: 25 : 30 : 5 i.e. N P K Zn S B), T₈ (SSNM-P), T₉ (SSNM-K), T₁₀ (SSNM-K+ wheat residue @ 5 ton ha⁻¹) and T₁₁ (SSNM + wheat residue @ 5 ton ha⁻¹) and were tested in Randomized Block Design with three replications. The rice variety Pusa basmati 1509 was grown and nutrient uptake, soil properties and nutrient use efficiency as influenced by different treatments were assessed. Results obtained from the study revealed that plant height, numbers of tillers per metre row length, leaf area index, canopy temperature depression and dry matter accumulation were enhanced in T₁₁, T₆ and T₇ as compared to rice crop grown in T₄ (recommended PK) which might be ascribed to increased availability of nutrients (N, P, K, S, Zn & B) and addition of wheat residue. Further, it was also observed that with the use of balanced inorganic fertilizer alone or in combination with organic fertilizer, physical properties of soil may improved due to improvement in OC g kg⁻¹ through more biomass addition in the soil. Significant reduction in BD was noticed where more biomass was added into the soil. Treatments having integration of sources/ nutrients (T₆, T₇ and T₁₁) distinctly showed the improvement in OC %, availability of N, P, K, S, Zn, B, Fe and led to better soil environment over T₄. Uptake of N, P, K, S, Zn, B and Fe by rice under different treatments was also found to be significantly higher than T₄. The grain yield of rice was significantly higher in combined use of organic & inorganic fertilizer treated plot than only inorganic one. However, no significant variation was observed in the grain yield where N, P, K + wheat residue, N, P, K + FYM and SSNM package + wheat residue treated plots. The balanced fertilizer either through traditionally available fertilizer or combined use of organic & inorganic fertilizer improved the grain yield of rice. All the treatments also improve the nutrient use efficiency than T₄. Inorganic fertilizer gave the highest net return and B: C ratio with minimum cost of production.

MICROBIAL EXOPOLYSACCHARIDES: APPLICATION FACETS IN PLANT GROWTH PROMOTION

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In the present scenario of ever increasing pollution and climate change agricultural lands are converting to marginal lands. To attain a secure future, the present has to be driven through sustainable approaches. Plant growth promoting rhizobacteria (PGPR) have emerged as a benchmark in attenuating the perplexities of agricultural lands and plant growth and yield. Among the various aspects involved in their action mechanisms, exopolysaccharides (EPS) production is one of the crucial traits determining the growth enhancing and stress curbing properties of PGPR. EPS are high molecular weight biopolymers which are either strongly adhered to the bacteria (capsular) or loosely attached (slime). The physio-chemical property of these biopolymers are much dependent on their monomeric units, therewith, deciding its fate and function in the rhizosphere. The gummy nature of EPS enables the microbial cells to attach to natural surfaces like roots even under unfavorable conditions ensuring the survivability of both bacteria and plants. EPS production by PGPRs has also been a strategy in elevating plant-microbe interactions, nodulation, NPK chelation, as carbon and nitrogen source, protection from phytopathogens, improving the quality of soil by forming hydrated soil aggregates supporting plant growth, ameliorating stresses such as drought, salinity, heavy metal toxicity by sequestering noxious ions and chemicals viz. Na⁺, Cl⁻, heavy metals (Pb, Cu, Hg, Cr, Zn etc.), providing nutrients and water to plants for their growth even under growth limiting scenario. Thus, these extracellular metabolites can be categorized as sustainable plant growth promoters and a better future can be designed by advancing the application strategies and understanding the mechanistic background.

Keywords: Plant growth promoting rhizobacteria, Nutrients, Phytopathogens, microbe interactions

VEGETABLE CROPS AS A NUTRACEUTICALS

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Vegetable has a vital role in the human health aspects not only providing the nutrition but also protecting against various forms of diseases, disorder etc. The changing trends in the lifestyle pattern leads to vast variety of health related issues. The recent advancement of the modern medicine has prominent role in the countering the health problems. Nutraceuticals is a form of food, portion of food or food itself which has an ability to fight against the disease and provide protection from future attack. Many vegetables such as Tomato has lycopene, alpha-carotene contains medicinal properties against health problems. Beta-carotene (Precursor for Vitamin A) in carrots has defense mechanism against oxidative damages to cells. Leafy vegetables like lettuce has antioxidants, vitamins, glycosides which are beneficial to health problems like insomnia, constipation, lactation disorder. The bulbous crop like onion has medicinal compounds such as polyphenolic flavonoids, thiosulfates, flavanol possess anti-carcinogenic, antithrombotic, antiasthmatic and anti-microbial properties. Apart from that various vegetables like potato, chilly, brinjal, cabbage, broccoli, beet root, radish, okra, coriander, garlic, ginger, cucumber, peas and many more have a great medicinal importance which has to be harnessed for the development of nutraceuticals product. From the recent reports it has been found that the nutraceuticals market in India estimated to be \$2.8 billion (nearly Rs 18,734.8 crore) at present over two-fold to \$6.1 billion (nearly Rs 40,815.1 crore) by 2020 as consumers preferences has increased towards health and fitness. Considering the above importance vegetables have a wide range to scope in the development of the nutraceuticals which will boost up the vegetable production sector. The introduction of modern biotechnological approaches helps to develop new varieties in vegetables crops containing good medicinal properties from which new form of human friendly medicines can be produced. Thus vegetables sector have ample amount of scope for nutraceuticals.

Keyword: Vegetables, Nutraceuticals, Medicinal properties.



EFFECT OF BIOREGULATORS ON GROWTH OF GREEN GRAM (*Vignaradiata*(L.) Wilczek.)**V. S. Shinde¹, V. M. Devgun², D. B. Deosarkar² S. S. Shinde²**¹Department of Plant Molecular Biology and Biotechnology, IGKV, Raipur, Chhattisgarh (India)²Department of Agril. Botany, Vasantnao Naik Marathwada Agricultural University, Parbhani 431402 (M.S.) India

An experiment was carried out to study the effect of bioregulators on growth of green gram (*Vignaradiata* (L.) Wilczek.). The treatments viz., control (water spray), Salicylic acid @ 25 ppm, Salicylic acid @ 50 ppm, Ethrel @ 100 ppm, Ethrel @ 200 ppm, Cycocel @ 250 ppm and Cycocel @ 500 ppm applied as foliar spray at flower-initiation stage. The study revealed that application of Ethrel @ 200 ppm at flower-initiation gave higher vegetative growth. The Cycocel @ 250 ppm, Cycocel @ 500 ppm and control and Significantly higher number of branches, dry weight and leaf area index was observed with bioregulators over the control.

Keywords: Bioregulators, Cycocel, Ethrel, Salicylic Acid, Green gram (*Vignaradiata* (L.) Wilczek.)

BALANCED USE OF NUTRIENTS FOR HIGH CROP YIELD AND QUALITY OF RICE (*ORYZA SATIVA* L.) IN CENTRAL ALLUVIAL SOIL OF UTTAR PRADESH**Vivek Kumar Trivedi, M. R. Pandey and Gautam Veer Chauhan***

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The field experiment on rice crop was conducted at Nawabganj Research farm in field No.-96, C.S.A. University of Agriculture & Technology Kanpur, during *Kharif* season 2013. The doses of experiment were 50% NPK, 50% NPK + S40, 50% NPK + S40 + Zn5, 50% NPK + Zn5, 100% NPK, 100% NPK + S40, 100% NPK + Zn5 and 100% NPK + S40 + Zn5. The results showed that the grain yield varied from 29.5 to 45.50 q ha⁻¹ and straw yield from 60.50 to 98.50 q ha⁻¹. The N content in grains ranged from 1.42 to 1.50%, P from 0.32 to 0.38%, K from 1.24 to 1.32%, S from 0.20 to 0.25% and Zn from 13.0 to 18.0 mg kg⁻¹. The N content in rice straw ranged from 0.22 to 0.28%, P from 0.17 to 0.24%, K from 0.35 to 0.44%, S from 0.10 to 0.14% and Zn from 27.0 to 40.0 mg kg⁻¹. It was noted the N uptake varied from 55.21 to 105.82 kg ha⁻¹, P from 19.72 to 40.92 kg ha⁻¹, K from 85.34 to 150.04 kg ha⁻¹, S from 11.95 to 25.16 kg ha⁻¹ and Zn from 201.65 to 473.15 g ha⁻¹. The starch content varied from 65 to 70%, amylase from 28 to 34% and amylopectin from 66 to 72%. The treatment T₉ (100% NPK + S40 + Zn5) gave the best results in terms of yields, nutrient content, uptake values and crop quality.

Keywords: NPK, grain yield, straw yield, nutrient content, uptake, Zn & S

WILT AND PYTHIUM DISEASE MANAGEMENT IN GREENHOUSE**Nisha Jangre¹, Anjit Jangre², Pappu Lal Bairwa¹, Bhanupratap Jangde¹.**¹Department of Vegetable Science, COA, IGKV, Raipur – 492012 (C.G.) India.²Department of Agronomy, COA, IGKV, Raipur – 492012 (C.G.) India

Greenhouse is a great asset to any vegetable plot, enabling gardeners to make the most of the sun. The disease management option under protected cultivation is often different than those recommended for the open field conditions. High host plant densities and the resulting microclimate are favorable to disease spread. Air exchange with the outside is restricted, so water vapour transpired by the plants and evaporated from warm soil tends to accumulate, creating a low vapour pressure deficit (high humidity). Therefore, the environment is generally warm, humid and wind-free inside the greenhouse. Such an environment promotes the fast growth of most crops, but it is also ideal for the development of bacterial and fungal diseases, of insects vectoring viruses and of herbivorous insects. Several cultural, chemical and biological methods have been adopted to control *Pythium* disease of vegetables. Various fungicides such as cuprous oxide, copper oxychloride, carbendazim, thiram, carbendazim + thiram, carboxin have been recommended for the seed treatment to control the disease in the vegetables. Control fungus gnats (*Bradysia impatiens*) and shore flies (*Scatellastagnalis*) which spread *Pythium*. Seed treatment with fungal antagonists like *Trichoderma harzianum* and *T. viride* formulations reduced the incidence of damping off and enhance the plant biomass under field conditions (Basharat et al., 2011).

Wilt diseases of vegetables can be controlled by several means like spraying, dusting, seed treatment and soil treatment. Fungicides against *F. oxysporum* Klotz indicated that prochloraz and carbendazim were found the most effective fungicides (Song et al., 2004). Several antibiotics against *R. solanacearum* in which streptomycin and streptopenicillin recorded less bacterial infection (Singh et al., 2000). *Pythium* and wilt diseases are very severe forms of soil borne diseases and management of these diseases and to increase the vegetable production under greenhouse conditions are possible only by integrating different control measures.

A REVIEW ON ECOLOGICAL IMPORTANCE OF INTEGRATED WEED MANAGEMENT**Yamini Raut**

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In most ecosystems, herbicides have become one of the most important components in weed control. There are two reasons to explain the increased use of herbicides, the first being the widespread adoption of high-yielding varieties which created economic incentives for farmers to reduce weed infestation; and the second is the availability of cheap herbicides, indicating that the cost of weed control by herbicides in wet-seeded rice is less than one-fifth of the cost of a single hand-weeding in Iloilo, Philippines and India. Similar situations exist in West Java, Indonesia and the Mekong Delta, Vietnam. It is expected that herbicide usage will continue to increase, both in developed countries, and



even in developing countries, where herbicides are currently used sparingly and farm wages are relatively low. However, this does not indicate a lack of importance for hand-weeding. Manual weeding is still the dominant weed control method in many parts of Asia, since management options for weed control are limited under diverse agro-ecological conditions. All the recommended herbicides commonly used are known to be very safe not only for humans and cattle, but also for the environment when they are used properly. However, intensive and repeated application of this type of herbicide has resulted in several negative effects that are, Evolving resistant weeds, Residual effects on many crops, Disappearance of some susceptible weeds such as *Brasenia schreberi* and *Sagittaria angustifolia*, which affects weed biodiversity. All these factors may well provide sufficient reason to attract public concern and anxiety regarding the negative effects of herbicides that might originate from intensive herbicide application in the environment. In this regard, an alternative to such a heavy dependence on herbicide is needed. Such an alternative might be found in the use of integrated weed management, which can reduce herbicide use in different cropping systems.

Key word: Weed management, Ecosystem, Herbicide, Biodiversity

EDIBLE OIL AND ITS EFFECT ON HUMAN HEALTH

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In India, the fats used as cooking media are generally vegetable oil, vanaspati and ghee. Edible oil stability is very important from the point of view in health of consumers as well as industrial application. Lipids are considered one of the most elemental nutrients for humans. Vegetable oil is derived from seeds of plants. Among the oilseeds cultivated in India, from which edible oil is obtained, are groundnut, rapeseed, mustard, safflower, sunflower, soyabean, linseed. The other sources of vegetable oil are palm, cottonseed, coconut and rice bran. They contain essential fatty acids which play an important role in nutrition and also carriers of fat soluble vitamins. It is estimated that about 90% of vegetable oils are used for edible purposes, while the remaining part finds industrial applications. Edible oils processing poses challenges due to its high content of polyunsaturated fatty acids and bioactive compounds. It may also lead to disruption of signaling networks and could be associated with some pathological states, such as cancer, cardiovascular, neurodegenerative, and metabolic diseases, and similarly with inflammatory complications. Vegetable oils are extremely damaging to the reproductive system and the developing bodies of unborn babies and children. Because the reproductive system in both men and women is constantly producing and dividing new cells, there is potential for mutation and problems when these cells are made of the wrong kind of fats and are oxidized. Because vegetable oils oxidize easily, they deplete the body of antioxidants since the body must use these to attempt to neutralize the oxidation.

Keyword: Natural antioxidant, Storage stability, Health importance, Edible oils

A REVIEW:-STUDIES ON *BRYOPHYLLUM PINNATUM* LEAVES POWDER AND ITS FORTIFICATION IN SNACK PRODUCT

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Bryophyllum pinnatum is a medicinal plant belongs to the family *Crassulaceae*. The native of plant is Madagascar. It is used in folk medicine in tropical Africa, tropical America, India, China, and Australia. *Bryophyllum Pinnatum* used in traditional medicine for the treatment of variety of ailments like anthelmintic, immunosuppressive, Hepatoprotective, anticeptive, anti-inflammatory and neprotective, antimicrobial activity, analgesic. *Bryophyllum Pinnatum* used for the treating Urinary Tract Infection (UTI) are the most widespread microbial diseases in India as per WHO. A number of bioactive compound groups including alkaloids, triterpenes, lipid, flavonoids, glycosides, bufadienolides, phenol, and organic acids has been covered. In this review studied on the *Bryophyllum Pinnatum* leaves powder by using two different drying methods (tray dryer and microwave oven) at five different temperatures for specific hours. Presented review studied on nutritional composition of *Bryophyllum Pinnatum* leaves powder like carbohydrate, fat, protein, mineral, crude fiber, ash content and its fortification into snack product.

Keywords: *Bryophyllum Pinnatum* leaves, Drying methods, Carbohydrate, Protein, Fat, Minerals, Snack Product.

EFFECT OF PLANTING METHODS, ORGANIC NUTRIENT SOURCES AND BIO-FERTILIZERS ON PHYSIOLOGICAL CHARACTERS AND ECONOMICS OF *KHARIF* ONION (*ALLIUM CEPA* L.)

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The present investigation entitled “Studies on the effect of planting methods, organic nutrient sources and bio-fertilizers on *kharif* onion (*Allium cepa* L.) in Gwalior area of Madhya Pradesh” was conducted in the field of farmer near, College of Agriculture, Gwalior during *kharif* season of the year 2013-14 and 2014-15. The field soil was sandy-loam having pH 7.9, electricity conductivity 0.13 dS/m, organic carbon 4.7 g/kg, available N, P₂O₅ and K₂O 213, 15.42 and 287 kg/ha, respectively. The rainfall received during the crop season was 666.8 and 581.8 mm in 2013-14 and 2014-15 respectively. The experiment consisted of thirty six treatment combinations laid in split-split-plot design replicated three times. The main plot treatments consisted three different planting methods viz., flat, furrow and ridge. The sub plot treatments were six organic nutrient sources viz., FYM 12.5 t/ha, FYM 25.0 t/ha, VC 2.1 t/ha, VC 4.2 t/ha, PM 2.1 t/ha and PM 4.2 t/ha. The sub-sub plot treatments were two bio-fertilizers viz., PSB 5 kg/ha and Azospirillum 5 kg/ha. The size of net plot was 1.5 m × 1.5 m. The 45 days old seedlings of onion variety Agrifound Dark Red were transplanted between 18-20 August in both the years keeping 30 cm × 15 cm planting geometry.



The physiological characters like Crop growth rate (CGR) and absolute growth rate (AGR) were continuously increased up to 100-120 DAT growth intervals under all treatments whereas relative growth rate (RGR) increase only up to 40-60 DAT crop growth interval. Seedlings transplanted on ridges resulted in significantly highest values of all these aforesaid growth characters 40, 60, 80, 100 and 120 DAT over those transplanted in furrow and flat soils. Furrow planting method was also found significantly superior to flat planting method for all the growth parameters. Ridge planting method resulted in significantly higher CGR and AGR at all crop growth intervals over rest two other planting methods. The minimum net income of Rs. 26080/ha calculated when the *Azospirillum* inoculated seedlings transplanted in flat soils with 4.2 t PM/ha (P1S6B2). On the other hand, seedlings inoculated with PSB transplanted on ridges with 25.0 t FYM/ha (P3S2B1) accrued the highest net monetary return amounting Rs. 97060/ha followed by P3S2B2 (Rs. 93790/ha) and P3S1B1 (Rs. 91260/ha). The highest B:C ratio of 2.65 was obtained with the treatment combination P3S1B1 closely followed by P3S1B2 (2.58), P3S2B1 (2.57) and P3S2B2 (2.52). On the other hand, minimum B:C ratio of 1.29 was obtained with P1S6B2.

EFFECTS OF SUB-LETHAL CONCENTRATIONS OF *ASPERGILLUS NIGER* ON THE MORTALITY AND IMMUNOLOGICAL CHARACTERISTICS OF *DYSDERCUS KOENIGII* (HETEROPTERA : PYRRHOCORIDAE)

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Dysdercus koenigii is a serious pest of cotton and other plants of economic importance. In recent decades, elevated awareness related to the impacts of pesticide on the environment and human health have resulted in efforts to reduce reliance on chemical controls of insect pests. Biological control has long been considered a potential alternative to pesticidal strategies for the pest management but its impact and level of use globally remain modest and inconsistent. The present work is aimed to evaluate the effects of *Aspergillus niger* on *Dysdercus koenigii* especially to find out their immune response. The effects of topically applied *A. niger* on adult of *D. koenigii* at concentrations of 10^4 , 10^5 , 10^6 spores / mL were analysed. Results showed differences in the mortality, THC and DHC. Our results indicate that the fungus *A. niger* could be used in the IPM of *D. koenigii* by presenting pathogenicity, which interferes with their development even when exposed to small concentrations. Protein content in haemolymph was also found to be markedly reduced following appearance of disease symptoms in treated adults compared to healthy adults. Further, lipid peroxidation analysis revealed that there was a gradual increase in lipid peroxidation activity in infected adults compared to control adults. The enzymatic activity of detoxifying enzymes like superoxide dismutase, catalase, cytochrome P450 and glutathione-S-transferase were found to be significantly changed in post inoculated insects compared to control. The findings of the present investigation would be discussed in the light of literature.

Keywords: Haemolymph, Lipid peroxidation, mortality, detoxifying enzymes

EFFICACY OF *TRICHODERMA HARZIANUM* CA-07 IN COMBINATION OF *PSEUDOMONAS FLUORESCENS* AND FUNGICIDE AGAINST ANTHRACNOSE OF CHILLI

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Biocontrol strategies have been mainly focused on proposing the use of biocontrol agents (BCAs) isolated from the rhizospheric region of the plant for protection against phytopathogens. The present study evaluates the effectiveness of *Trichoderma harzianum* CA-07 isolate in chilli against *Colletotrichum capsici* infection and comparing its efficiency in combination with fungicides (Topsin-M) and bacterial bioagent (*Pseudomonas fluorescens*). Pot trail was conducted in glass house compound of Department of Plant Pathology, CSAUA&T, Kanpur. The combined application of *Trichoderma harzianum* CA-07 + *Pseudomonas fluorescens* and *Trichoderma harzianum* CA-07 + Topsin-M through seed treatment and soil application resulted in a significantly lower incidence of anthracnose of 8.0 and 11.2%, respectively, and accounting for 88.0 and 79.0% of reduction over control. A combination of *Trichoderma harzianum* CA-07 and *Pseudomonas fluorescens* resulted in increased the plant growth (shoot length of 16 cm, root length of 4.0 cm, respectively) also increased the fruit yield (green fruit yield increased from 119 g/plant). This study suggests that the combination treatment of bioagents might have involved in the reduction of anthracnose incidence and increased the yield of chilli.

EFFECT OF ORGANIC MANURE AND BIO-FERTILIZER ON GROWTH, YIELD AND QUALITY OF TOMATO (*SOLANUM LYCOPERSICUM* L.) UNDER PROTECTED CONDITION

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An experiment was conducted to check the effect of different levels of organic manure and bio-fertilizers on growth, yield and quality of tomato (*Solanum lycopersicum* L.) cv. GS 600 at Department of Horticulture, Allahabad during Rabi season (November- March) in the year 2016-2017 under poly-house condition. Observations were recorded on growth, yield, and fruit quality. Among the treatments combination, Treatment T₄ (RDF + VC (50%) + VAM (50%) + AZ (50%) + PSB (50%)) proved better to improve the growth, yield and quality attributing traits than other treatment combinations. Maximum average plant height at 30, 60, 90 & 120 DAT was 43.53 cm, 74.87 cm, 171.63 cm & 215.41 cm respectively, number of branch per plant at 30, 60, 90 and 120 DAT was 7.13, 10.97, 16.83, 23.30 respectively, number of leaves per plant at 30, 60, 90 and 120 DAT was 66.00, 95.10, 263.20, 362.44 respectively, number of flower per plant at 120 DAT was 37.33, number of cluster per plant at 120 DAT was 7.9, number of flowers per cluster at 120 DAT was 8, number of fruits per plant at 120 DAT was 37.5, number of fruits per



cluster at 120 DAT was 7.8, fruit yield per plant 6.25kg, fruit diameter 125.12, fruit weight 160.01, Acidity (%) 0.98 were recorded in treatment T₀ and Ascorbic acid (mg/100g) 16.58 were recorded in treatment T₆ where as Treatment T₄ showed maximum Total soluble solid 4.02 (⁰Brix) and Shelf-life (days) 17.57 . Thus, application of optimum doses of organic manure and bio-fertilizers was found highly beneficial for growth, yield and quality of tomato.

Keywords: Vermicompost, Poutry manure, Azotobactor, VAM , PSB, Tomato, Growth ,Yield & Quality.

EFFECT OF MALATHION ON ESTERASE AND STRESS ENZYMES (SOD AND CATALASE) ACTIVITY IN A FRUIT FLY, *BACTROCERA CUCURBITAE*

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Bactrocera cucurbitae is a severe pest of horticulture that is distributed across a wide range of climatic regions including the Indian subcontinent. It infests nearly 125 plant species, preferentially cucurbits. This pest causes damages by puncturing the skin of cucurbits and laying its eggs inside the host. Eggs hatch into larvae within the fruits and develop by consuming them. Largely insecticides are the common tool to control *Bactrocera cucurbitae* population, which has resulted in insecticide resistance. This is a serious problem in agriculture, ending up with the tolerance to insecticides. The impact of Ld50 dose of Malathion on esterase, SOD and Catalase have been studied. Four types of esterase have been identified and their expression is reduced after 24hr of treatment. While in case of stress enzymes, their activity increase after 12 hr of treatment, which regains its basal level after 24 hr. Results of the above experiments reveal that malathion inhibits the esterase activity. Increased activity of stress enzymes revealed that after 12 hr of treatment, SOD and catalase comes in action and start detoxifying the ROS which is perhaps generated due to malathion treatment. After 24 hr of treatment, ROS is detoxified and stress enzymes come down to their basic level. The finding of the present investigation would be discussed in the light of available literature.

BIO-INSECTICIDAL PROPERTIES OF *HETERORHABDITIS INDICA* (DH₁₆) AGAINST LEPIDOPTERON INSECT PESTS

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Insects cause considerable damage to the agricultural crops. Several chemical pesticides were used to control these insects' pest which raised many environmental and health concerns in respect to soil and ground water contamination, residues on foods, resistant development and have resulted in prohibitive legislation. Entomopathogenic nematodes (EPNs) are the suitable biological agents. They do not cause any detrimental effect on environment. In the present investigation, nematodes were isolated from the sugarcane fields of Districts Meerut and designated as DH₁₆. To test the pathogenicity of *Heterorhabditis indica* isolate DH₁₆ against *Galleria mellonella* and *Helicoverpa armigera*, four different concentrations viz. 25, 50, 100, 200 IJ/larva were used on the insect larvae reared in Laboratory. Mortality was observed after 24h of the post infection period (PIP) in all concentrations against *G. mellonella* but in *H. armigera* bioassays mortality was initiated at 12h PIP in 200 IJ/Larvae. 100% mortality was initiated at 48h PIP against *H. armigera*, but against tested pests *G. mellonella* 100% mortality was recorded in all concentrations after 60h PIP. LC₅₀ was also calculated as 162.545; 25.864 and 13.219 at 24h, 36h and 48h after PIP against *G. mellonella* respectively while against *H. armigera* isolate, *H. indica* DH₁₆ showed 216.062; 162.516 and 14.043 IJ/Larvae at 12 h, 24 h and 36h PIP respectively. On the basis of LC₅₀ values *H. indica* was found highly efficacious isolate against both the pest i.e. *G. mellonella* and *H. armigera*. However, field trails are needed to be carried out so as to implement them as bio-pesticide in Integrated Pest Management (IPM).

Keywords: *Heterorhabditis indica*, *Galleria mellonella*, *Helicoverpa armigera*, PIP, IPM, Mortality and Efficacy

EFFECT OF TILLAGE AND NUTRIENT LEVELS ON GROWTH AND YIELD OF SOYBEAN BASED CROPPING SEQUENCE

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The field experiment was conducted during *kharif* and *rabi* season of 2014-15 and 2015-16 on clayey soil at the farm of AICRP on Integrated Farming Systems, VNMKV, Parbhani, to study the effect of tillage and nutrient levels on soybean, *rabi* sorghum and wheat in cropping sequence. Treatment consists of twelve treatment combinations comprising two tillage practices (minimum tillage, conventional tillage) and two cropping systems (soybean-*rabi* sorghum, soybean-wheat) in main plot, three levels of nutrients (75, 100 and 125 per cent RDF) in sub plot for soybean in *kharif* and after that for *rabi* sorghum and wheat in *rabi* season were assigned in a split-split plot design. Application of conventional tillage increased the growth, yield attributes and yield of soybean, *rabi* sorghum and wheat. Cropping systems treatment to soybean was found to be non significant enhanced the growth, yield attributes, yield of soybean. Use of 125 per cent RDF to soybean, *rabi* sorghum and wheat enhanced the growth, yield attributes, yield of soybean, *rabi* sorghum and wheat followed by 100 per cent RDF.

Keywords: conventional tillage, minimum tillage, nutrient levels, *rabi* sorghum, soybean, wheat, yield etc.

EFFECT OF VARIOUS PLANT SPACING AND NUTRIENT LEVEL ON GROWTH AND YIELD OF *KHARIF* SOYBEAN [*GLYCINE MAX* (L.) MERRILL]"

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The field experiment was conducted during the kharif season of year 2015 at the experimental farm of AICRP on Soybean, VNMKV, Parbhani (MS). To find out the effect of plant spacing's and different fertilizer levels on soybean. The experiment was laid out in Split Plot Design with five plant spacing's viz., S₁ 30 x 7.5 cm, S₂ 45 x 05 cm, S₃ 30 x 10 cm, S₄ 30 x 15 cm and S₅ 30 x 30 cm in main plot and three fertilizer levels viz., F₁ – 100% of RDF, F₂ – 125 % of RDF and F₃ – 150 % RDF in sub plot along with three replication. The result of experiment shown that, among the different plant spacing's tested, 45 cm x 5 cm recorded more of growth, yield attributes and yield of soybean than other plant spacing's. In case of application of fertilizer level 150% RDF recorded higher value of growth attributes, yield attributes and yield of soybean.

Keywords: Fertilizer, spacing's, soybean, recommended dose of fertilizer.

EFFECT OF PLANT SPACING ON DIFFERENT GENOTYPE OF PIGEON PEA (*Cajanus cajan* (L.) Millisp)

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A field investigation entitled “Effect of plant spacing on different genotype of pigeon pea (*Cajanus cajan* (L.) Millisp)” was conducted during kharif 2013-14 at experimental farm Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, to study effect of spacing on the growth and yield of pigeon pea, to evaluate performance of genotype of pigeon pea on different spacings. The experiment was conducted in split plot design with four spacings i.e. S₁ – 60 x 30 cm, S₂ – 90 x 20 cm, S₃ – 120 x 15 cm, and S₄ – 60 x 60 – 120 cm in main plot and three genotypes G₁–BSMR-853, G₂–MUTANT(M)-853 and G₃–BDN-711 in sub plots with twelve treatment combinations. It can be concluded that, the spacing of 120 x 15 cm (2341 kg ha⁻¹) and 60 X 60 – 120 cm (2237 kg ha⁻¹) were found highly productive as compared to 90 x 20 cm, 60 x 30 cm. Among the genotypes of pigeon pea BDN-711 (2119 kg ha⁻¹), found significantly higher over BSMR-853, however it was at par with MUTANT (M)-853 (2000 kg ha⁻¹).

Keywords: Genotype, spacing, pigeon pea, yield etc.

INFLUENCE OF NITROGEN, PHOSPHORUS AND ZINC ON GROWTH, YIELD ATTRIBUTES, YIELD AND NUTRIENT UPTAKE BY MAIZE CROP (*ZEAMAYS* L.)

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The field investigation entitled “Influence of Nitrogen, Phosphorus, and Zinc on yield attributes, yield and nutrient uptake by Maize crop (*Zeamays* L.)” was conducted during kharif season of 2012 on AICRP on Integrated Farming Systems, VNMKV, Parbhani with objectives to know the nitrogen, phosphorus and zinc requirement of maize crop and to know the uptake of nutrient by maize crop. The experiment was laid out in split plot design with eighteen treatments consisting of six combinations of nitrogen and zinc as main plot and three combinations of phosphorus as sub plot treatments replicated thrice. Application of 150 kgN/ha, 100 kg P/ha and 25 kg Zn/ha recorded significantly highest growth parameters like plant height (cm), number of leaves, and dry matter production (g), yield parameter like number of grains cob⁻¹, cob weight plant⁻¹, grain weight plant⁻¹, number of grain row cob⁻¹ and uptake of N, P and Zn over 125 and 100 kgN/ha, 75 and 50 kgP/ha. And 15 kgZn/ha respectively.

Keywords: maize nitrogen nutrient uptake phosphorus zinc etc

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD, ECONOMICS AND NUTRIENT UPTAKE OF WHEAT

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A field experiment was conducted during Rabi season of 2009-10 at Experimental Farm, at AICRP on Integrated Farming System, Marathwada Krishi Vidyapeeth, Parbhani with the objective to evaluate effect of integrated nutrient management on growth and yield attributes of wheat and to find out suitable integrated nutrient management practice for wheat, to workout economics of different treatments. The experiment was laid out in the Randomized Block Design (RBD) with 9 treatments replicated thrice from the result it can be concluded that The highest grain yield (26.87 q ha⁻¹), straw yield (41.47 q ha⁻¹) and biological yield (68.14 q ha⁻¹) was recorded in treatment T₅- RDF + 5 t FYM ha⁻¹ + 10 kg ZnSO₄ ha⁻¹ + 5 kg boron ha⁻¹, also regarding the uptake of NPK and economics treatment T₅- RDF + 5 t FYM ha⁻¹ + 10 kg ZnSO₄ ha⁻¹ + 5 kg boron ha⁻¹ superior over rest of treatment.

Keywords: Wheat, Yield, Nutrient, Fym etc.

EFFECT OF MICRONUTRIENTS ON YIELD, QUALITY AND STORAGE OF ONION (*ALLIUM CEPA* L.) IN NORTH BIHAR

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A field experiment was conducted in 2014-15 and 2015-16 (Rabi) at Tirhut College of Agriculture, Dholi, Experimental Farm of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur) Bihar to evaluate the effect of micronutrients on yield, quality and storage of onion (*Allium cepa* L.) var. Agrifound Light Red in north Bihar. The experiment comprises of six treatments (T₁-Soil application of Zinc Sulphate @ 10.0 kg/ha (Zinc Sulphate), T₂-Foliar application of Zinc Sulphate @ 0.5% @ 30 and 45 DAP (Zinc Sulphate), T₃-Soil application of



Boron @ 10.0 kg/ha (Borax), T₄-Foliar application of Boron @ 0.25% @ 30 and 45 DAP (Borax), T₅-Foliar application of micronutrient mixture @ 0.5% (Composition: Fe-2.5%, B-0.50%, Zn-3.0%, Cu-1.0 %, Mn-1.0 %) 30 and 45 DAP and T₆-Control replicated thrice in RBD. 15cm x 10cm spacing was maintained with standard package of practices. Fertilizer dose of N: P₂O₅: K₂O: S:: 120:80:100:40 were applied. Highest total bulb yield (29.12 t/ha), marketable bulb yield (26.88 t/ha), minimum double per cent (0.94 %), highest leave dry matter content (1.48 t/ha), total dry matter yield (28.16 t/ha), dry matter yield of bulbs (26.68 t/ha) and minimum storage loss (65.28 %) was recorded with T₅ followed by T₃ with total bulb yield (27.96 t/ha), marketable bulb yield (25.64 t/ha), total dry matter yield (26.54 t/ha), dry matter yield of bulbs (25.21 t/ha), and minimum storage loss (74.47 %). Overall impact of T₅ was superior one.

SIGNIFICANCE OF CARBOHYDRATES FOR THE DEVELOPMENT OF BISCUITS

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Foods high in carbohydrates are an important part of a healthy diet. Carbohydrates provide the body with glucose, which is converted to energy used to support bodily functions and physical activity. But carbohydrate quality is important; some types of carbohydrate rich foods are better than others: Carbohydrates are found in a wide array of both healthy and unhealthy foods bread, beans, milk, popcorn, potatoes, cookies, spaghetti, soft drinks, corn, and cherry pie. They also come in a variety of forms. The most common and abundant forms are sugars, fibres, and starches. Common sugar (sucrose) is a carbohydrate derived from sugar cane or sugar beet. It is a disaccharide composed of two monosaccharides, a molecule of glucose joined to a molecule of fructose. Sugar is used in biscuit formulations in a granulated or powder form. Sugar gives sweetness, but it is also important in developing the texture of the biscuit. Dissolved sugar tends to inhibit starch gelatinisation and gluten formation and creates a biscuit with a more tender texture. Undissolved sugar crystals give a crunchy, crisp texture. Sugar crystals, which melt during baking, cool to a non-crystalline glass-like state which gives a crispy, crunchy texture, particularly on sugar topped biscuits. Starch is the main component of wheat flour. It represents almost all of the carbohydrate content and around 80% of the total energy content of wheat flour. Starch is a polysaccharide (many sugars) made up of glucose units linked together to form long chains. The principle starch molecules in wheat flour are amylose, which typically comprises 28% of the total amount of starch. Amylose molecules contribute to gel formation. Their linear chains of molecules line up together and are able to bond to make a viscous gel. Starch is insoluble in water, however the starch granules do absorb a limited amount of water in the dough and swell. Above temperatures of 60o-70o C the swelling is irreversible and gelatinisation begins. The gelatinisation may continue until the starch granules are fully swollen, but it is normal in baked products that only partial gelatinisation occurs. The gelatinisation of the starch contributes to the rigidity and texture of the biscuit. As the starch gel is heated further, dextrinisation occurs. This contributes to the colouring of the biscuit.

RESPONSE OF GCA AND SCA ON GROWTH, YIELD AND ITS CONTRIBUTING TRAITS IN SPONGE GOURD [*LUFFA CYLINDRICA* (ROEM) L.]

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The present investigations were carried out in two years with aims to determine combining ability in per cent of mean involving 14 parental lines and their 40 F₁ hybrids. The experiments were laid out in RBD with three replications. Analysis of variances for combining ability revealed that the partitioning of variances due to lines × testers showed highly significant differences for all the characters except fruit circumference (cm) in both the years and number of primary branches per plant in Y₁. Variances due to lines showed highly significant differences for all the traits except vine length (m) in both the years and days to anthesis of first pistillate flower in Y₂. The variances due to testers were also highly significant for all the characters except node number to anthesis of first staminate flower, node number to anthesis of first pistillate flower, node number of first fruit harvest, average fruit weight (g), number of fruits per plant and average fruits yield per plant (kg) in both the years. Lines NDSG-55, NDSG-18, NDSG-1 and NDSG-21 and testers Pusa Chikni showed desirable and significant gca effects for average fruit yield per plant and Lines NDSG-1 and NDSG-18 were found good general combiners for average fruit yield per plant and were also found good general combiners for node number to anthesis of first staminate flower, node number to anthesis of first pistillate flower, days to anthesis of first staminate flower, days to first fruit harvest, node number of first fruit harvest, number of fruits per plant, fruit circumference (cm) and number of primary branches per plant in both the years. Among forty crosses the best seven crosses viz., NDSG-63 X Pusa Chikni, NDSG-24 X Pusa Chikni, NDSG-2 X NDSG-12, NDSG-18 X NDSG-11, NDSG-2 X NDSG-11, NDSG-10 X NDSG-15 and NDSG-10 X NDSG-12 showed significant and positive sca effects for average fruit yield per plant as well as some other yield components were found common over both the years. Combining ability analysis elucidated higher magnitude of variances due to sca (σ^2_s) than variance due to gca (σ^2_g) indicating preponderance of non-additive gene action for almost characters.

EFFECT OF DIFFERENT PHYTOEXTRACTS AGAINST BLAST OF RICE CAUSED BY *PYRICULARIAORYZAE*

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Rice (*Oryzasativa*L.) is an important staple food provides diet more than 50% of world population. Blast of rice, caused by *Pyriculariaoryzae* contributes a major reduction in rice yield. The excessive use of fungicides causes harmful effect on the environment.



To reduce the side effects of fungicides alternative means are opted. Application of phytoextracts promote as an innovative agents in plant protection. In present study different type of plant extracts were used to check the growth of the pathogen. The successive trails of four days intervals were evaluated using different plant extracts in vitro of different concentration. After four days of inoculation of pathogen at 15% concentration of phytoextract, *Allium sativum* (Garlic) inhibited 62% mycelium growth of pathogen meanwhile *Allium cepa* (Onion) and *Zingiber officinale* (Ginger) show almost equal effect around 54%. After eight days of inoculation, garlic remains effective meanwhile ginger and onion inhibited 42% and 44% respectively against pathogen *Pyricularia oryzae*, whereas *Azadirachta indica* (Neem) and *Curcuma longa* (Turmeric) show least effective against blast diseases of rice.

Keywords: Rice, *Pyricularia oryzae*, phytoextracts, fungicides, environment

CULTURAL AND MORPHOLOGICAL VARIATIONS AMONG THE ISOLATES OF *SCLEROTINIA SCLEROTIORUM* (LIB.) DE BARY CAUSING STEM ROT OF MUSTARD IN INDIA

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In the current study all the isolates of *S. Sclerotiorum* collected from mustard fields in different districts of Uttar Pradesh and Rajasthan (India) showed variations in cultural and morphological characteristics i.e., colony colour and texture, and sclerotial formation, number, pattern, size and weight when grown on PDA. Among all isolates SsM and SsH were found significantly fast growing followed by SsB, SsAL and SsA. All isolates produced sclerotia in 5-8 days. Maximum number of sclerotia (49) was formed in isolate SsM, While minimum (21) in SsA. Larger size of sclerotia (6.9×3.2 mm) was found in SsH, while smallest (3.6×3.1 mm) in SsA. Maximum weight of sclerotia was recorded in isolate SsB (1.2 mg) however other isolates varied in their ranging (0.2-0.9 mg). Wherefore the present observation proved the variability among the different geographical isolates from India.

EFFECT OF SODIUM NITROPRUSSIDE (SNP) ON MORPHO –PHYSIOLOGICAL AND BIOCHEMICAL CHANGES IN DIFFERENT CROP PLANT INDUCED BY DIFFERENT ABIOTIC STRESS

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Effect of SNP (sodium nitroprusside), a nitric oxide donor. It has been seen that nitric oxide (NO) is a substance which plays an important role to reduce the effect of different abiotic stresses between particular concentration range exogenous nitric oxide (0.25 mM sodium nitroprusside, SNP) in mitigating oxidative stress in wheat seedlings exposed to arsenic (As). The effects of sodium nitroprusside (SNP) on the multiplication, regeneration and rooting of *Malushopehensis* Rehd. var. *pinyensis* Jiang in tissue culture by applying 20 µM SNP to the Murashige and Skoog (MS) medium containing 2.0 µM 6-benzylaminopurine (BA) and 1.0 µM zeatin (ZT). Multiplication of plantlets from the 1st subculture was more sensitive to SNP than that from the 4th or 7th subculture. The role of exogenous nitric oxide (NO) in amelioration of As-induced inhibitory effect was also evaluated using sodium nitroprusside (100 µM SNP) as NO donor and 2-(4-carboxy-2-phenyl)-4,4,5,5-tetramethylimidazoline-1-oxyl-3-oxide (200 µM PTIO). The role of NO in the process of amelioration has ultimately been manifested by significant reduction of membrane damage and improvement of growth performance in plants grown on As + SNP. Application of sodium nitroprusside (SNP), as a nitric oxide (NO) donor, revealed that NO affected element ratios in both DR and SR calluses in a concentration-dependent manner. In chick pea sodium nitroprusside and putrescine could completely ameliorate the toxic effects of salt stress on electrolyte leakage and lipid peroxidation and partially on RWC. No significant decline in chlorophyll content under salt stress as well as with other treatments was observed. Sodium chloride stress activated the antioxidant defence system by increasing the activities of peroxidase (POX), catalase (CAT), superoxide dismutase (SOD) and ascorbate peroxidase (APX). However no significant effect was observed on glutathione reductase (GR) and dehydro ascorbate reductase (DHAR) activities. Both putrescine and NO had a positive effect on antioxidant enzymes under salt stress. So SNP (sodium nitroprusside) reduces the effect of different abiotic stress in crop under certain concentration range.

Key word: SNP (sodium nitroprusside), biochemical, morpho-physiological changes, abiotic stress.

CORRELATION AND PATH COEFFICIENT ANALYSIS IN BRINJAL (*SOLANUM MELONGENA* L.)

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The study was carried out with eight parents and 28 F₁ hybrids of brinjal at SVP UA&T Meerut during Kharif 2010 to find out correlation and path coefficient analysis among the different yield attributing traits and direct and indirect effect of traits on yield. Data recorded for twelve characters viz. "plant height, primary branches per plant, plant spread, days to first flowering, days to first fruit set, days to first harvest, average fruits weight, fruit length, fruit diameter, fruit index, fruits per plant and yield per plant. Highly significant and positive association of fruit yield per plant was recorded with fruit length, fruit index, plant height and average fruit weight while non significant and positive correlation were found between fruits per plant and fruit diameter. Fruit yield per plant showed negative and significant correlation between days to first harvest, days to first fruit set and days to first flowering. Fruits per plant showed negative and significant correlation between average fruit weight, fruit index, fruit diameter, days to first harvest, plant spread, fruit length and days to first fruit set. Path coefficient analysis for fruit yield involving 11 independent variables revealed that fruit diameter gave maximum positive and direct effect on yield per plant followed by fruit length, fruits per plant, average fruit weight and days to first fruit set. Fruit Index showed maximum indirect effect via fruits per plant at genotypic level. At phenotypic level, fruit diameter showed maximum direct effect on fruit yield per plant followed by fruit length, fruits per plant, average fruit



weight and days to first fruit set, while fruit index showed maximum indirect effect on yield per plant via fruits per plant and plant height via fruits per plant.

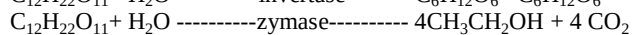
BIOFUEL (ETHANOL) FROM SUGARCANE- NEED OF THE FUTURE FOR SUSTAINING CANE PRODUCTIVITY

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Sugarcane is one the most important cash crops of India. It is the second largest agro-based industry and also the main drivers of the rural economy, supports the livelihood of about 6.0 million farmers besides about half a dozen skilled and unskilled workers also directly or indirectly associated with this crop. It also contributes about 1.1% of the National GDP with a share of about 10.0% in the agriculture GDP of the country. India ranks second in cane area and sugar production after Brazil with about 350 MT of annual sugarcane production and 25 MT of sugar. In recent years, because of increasing demand of bio-energy from today society, this crop has become more important. The demand of sugar is expected to be increased from around 25.0 MT to 36.0 MT and that of ethanol from 2170 ML to 8800 ML by the year 2030. This paradigm shift of recognizing sugarcane as important feed stocks for second generation ethanol production using bagasse and other cellulosic materials, like trash invites the attention of the scientists to look into new avenues associated with it. Hence, there is an urgent need to increase sugarcane production from 341 to 500 MT, cane productivity from 70 t/ha to 100 t/ha and sugar recovery from 10.0% to about 11.0%, respectively in order to meet the above demand.

There are two types of fuels i.e. (i) fossil fuel (Natural capitals) i.e. coal, crude oil, gases etc. and (ii) Income fuels i.e. solar, hydro and wind energies/power, fuel ethanol and power from co-generation contributes hardly 30% of the total fuel and energy requirement of the world. Fossil fuels are not made by men; neither they are renewable, nor they can be recycled. Hence, once they are exhausted, they are exhausted forever. They may extinct latest by the end of this century or even earlier. If we misuse fossil fuels i.e. natural capitals around us by emitting CO₂ and other green house gases, CO, toxic gases etc., from our industry and vehicles will result in pollution, global warming, ozone depletion, etc., and thereby challenge the tolerance limit of nature. Because of high level of pollution, global warming and depletion of ozone layer UV rays had started penetrating to the earth due to which 40% new borne infants either do not survive or become sick. This indicates that we are advancing towards disaster and the day is not far off for the downfall of the civilization, if remedial measures are taken timely to minimize the use of fossil fuel. Ethanol is an alcohol (ethyl and grain alcohol ETOH), a group of chemical compounds whose molecules CH₃CH₂OH or empirically (C₂H₆O) contain a hydroxyl group-OH, bonded to carbon atom. The word alcohol is originally derived from the Arabic word al kuhul-, a fine powder used as an eye makeup produced by distillation of antimony. Later the term was applied to the distilled and refined products by medieval alchemists. Since ancient times simple sugars are used as raw material for producing ethanol. Entire beverage ethanol and more than 50% of industrial ethanol is still made by fermentation of sugars. The fermentation process of sugars into ethanol takes place in two stages under the influence of two enzymes i.e. invertase and zymase from yeast. The reactions are represented by the following simple equations:



Ethanol can be used as an automobile fuel by itself (100%) and in blends of 85:15 with gasoline, or of course in multi flex vehicles only having E 85 engines made by Canada and Brazil. As the ethanol molecule contains oxygen, it allows engines to combust the fuel more completely, resulting in fewer emissions and thus helps in curbing pollution to a great extent. Fuel (ethanol) is cheaper as compared to gasoline and is one of the cleanest, safest and harmless automobile fuels. It reduces emissions of CO₂ and other green house gases responsible for global warming by over 35%, tail pipe CO emission by 30%, exhaust volatile organic compound (VOC) by 12%, toxic gases emissions by 30%; particulates, especially fine particulates emissions that pose health threats to those having respiratory ailments, senior citizens and children, considerably, as compared to gasoline.

The National Biofuel Policy released in December, 2009 by the Ministry of New and Renewable Energy (MoNRE) envisages a target of complete blending of 5.0% ethanol by 2011-12 and then gradual increase it to 10.0% by 2016-17 and to 20.0% thereafter. To attain this task, the final demand would be 1.93MT and total alcohol demand would be as high as 3.52 MT which includes Industrial and potable alcohol.

In the current scenario of glut in sugar production and very large carry-over stocks, at times exceeding 10 million tonnes of sugar, forcing the markets to bring down the prices to abnormally low level, it is advisable to divert major part of sugarcane for ethanol production, after meeting the sweetener's and other demands. Flexible approach to change the ratio of sugar and ethanol production, as and when required, will help in a big way to stabilize the markets by taking care of the supply-demand distortions in sugar, presently caused.

At present, final molasses of cane sugar is the only feedstock for ethanol production, except for hardly a few distilleries producing from grains and alternate feedstock's. To meet the requirement of fuel-ethanol from 10 to 20% blending, its production has to be supplemented from other available sources such as alternate sugar processing intermediates, *khandsari* molasses and other alternative feed stocks. In order to meet the demand for increased blending in near future, it is essential that new avenues like entire secondary filtered juice + filtered juice (SJ+FJ) along with B-Hy. or A-Hy. molasses and even part of primary juice should be explored for augmenting fuel ethanol production. Thus, augmented production and use of fuel ethanol along with co-generation of power will give a boost to socio economic stability of not only sugarcane growers but also of the entire farmer's fraternity. It will also provide lot of employment opportunities in rural areas.

In addition, ethanol (biofuel) can also be produced from perennial crops containing sugars (sugar beet, sweet sorghum), starch (maize, wheat, potato, cassava, sweet potato etc.) and cellulosic materials like bagasse, agricultural wastes/crop residues such as husks of rice, mustard, soya, gram, coconut etc., wild grasses, waste wood chips, waste paper etc, which are available in large quantities in the vicinity of sugar factories.

Thus, by producing our own indigenous income fuel ethanol from sugarcane, we will be able to solve our oil problem besides savings to public exchequer in the form of reduced oil import bill and pruned diesel, gas and kerosene subsidies besides sustaining cane productivity.

MALE MEIOTIC STUDIES IN SOME MEMBERS OF GENUS *LACTUCA* FROM THE COLD DESERTS OF LADAKH DIVISION OF JAMMU AND KASHMIR.

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The present investigation includes detailed male meiotic study and pollen fertility on species (10 accessions) of genus *Lactuca* for the first time from the unexplored cold desert regions of Ladakh division of Jammu & Kashmir. All the presently investigated wild populations of the species exist at 2x level. All the species have been worked out for the first time from the studied area. The meiotic course including chromosomal pairing, segregation and sporad formation was perfectly normal in majority of the species leading to high pollen fertility (95-100%). However, the studied accessions of *Lactuca dolichophylla* ($n=8$), and *Lactuca macrorhiza* ($n=8$) exhibit the phenomenon of cytotoxicity involving chromatin transfer among neighbouring PMCs. As a result of these meiotic abnormalities, the pollen fertility gets reduced.

Keywords: Ladakh, cold deserts, male meiosis, pollen fertility.

EFFECT OF DIFFERENT PRUNING INTENSITIES ON WOOD PRODUCTION AND YIELD OF LATE SOWN WHEAT VARIETIES UNDER DALBARGIA SISSOO BASED AGRISILVICULTURE SYSTEM

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Field experiment was conducted during rabi season of 2010-2011 under AICRP on Agroforestry, Department Forestry, JNKVV, Jabalpur (M.P.). Dalbargia sissoo was planted in 5x5 m spacing in the year 1988. The treatment combination involved in main plot were four pruning treatments (viz. no pruning, 25% pruning, 50% pruning and 75% pruning) and one open (without tree) in main plot and three late sown wheat varieties (viz. M.P.-3020; GW 273 and GW 366) 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 inter cropping with D. sissoo three late sown wheat varieties were sown in 20 cm row spacing fertilized with recommended dose of fertilizer i.e. 100:60:40 N:P:K kg ha⁻¹. The result revealed that crop under open condition recorded significantly higher plant height (77.26 cm), number of effective tiller/MRL (50.53), length of ear head (9.04 cm), number of grains/ear head (41.46) and 1000 grains weight as compared to no pruning which recorded significantly lowest plant height (72.2 cm), number of tillers/MRL (39.86), length of ear head (8.22 cm), number of grains/ear head and 1000 grain weight (27.68gm). Grain yield open under condition (without tree) recorded significantly higher grain yield (1892 kg ha⁻¹) at par with 75% pruning (1700 kg ha⁻¹), 50% pruning (1658 kg ha⁻¹) and 25% pruning (1633 kg ha⁻¹) but significantly superior to no pruning (Rs. 1209 ha⁻¹). The percent reduction in grain yield under no pruning 25% pruning, 50% pruning and 75% pruning over open condition was 36.1, 13.7, 10.9 and 10.1% respectively. Grain yield of wheat was significantly influenced by different varieties. Wheat variety GW-273 recorded significantly higher grain yield (1778 kg ha⁻¹) closely followed by MP-3020 (1617 kg ha⁻¹) but superior to variety GW-366 which recorded significantly lowest grain yield of 1483 kg ha⁻¹. Variety MP-3020 was at par with GW-273. The percent reduction in grain yield in GW-266 and MP-3020 over GW-273 was 16.7 and 9.0 percent respectively. Agrisilviculture system gave significantly higher monetary return (Rs. 29003 ha⁻¹) than growing of crop alone (Rs. 14317 ha⁻¹) or tree alone (Rs. 14531). Managed agroforestry system, wheat+D.sissoo in 25% pruning gave higher monetary returns (Rs. 33,580 ha⁻¹) at par with 50% and no pruning but significantly superior to 75% pruning (Rs. 23332 ha⁻¹) crop alone and tree alone. Among varieties GW-273 recorded high monetary return (Rs. 27,927 ha⁻¹) at-par with MP 3020 (Rs. 26,870 ha⁻¹) but significantly superior to GW-366 (Rs. 23,400 ha⁻¹).

Keyword:- Agroforestry, Agrisilviculture system, Dalbargia sissoo, Monetary return, Pruning.

EFFECT OF DIFFERENT DOSES OF FERTILIZERS AND CROP GEOMETRY ON NUTRIENT UPTAKE OF INDIAN MUSTARD (*BRASSICA JUNCEA* L.)

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Indian mustard (*Brassica juncea* L.) is an important rabi oilseed crop of Haryana. Indian mustard (*Brassica juncea* L. Czern) belongs to family Cruciferae, genus *Brassica* and species *juncea* popularly known as rai. A field trial was conducted at the Regional Research Station of Chaudhary Charan Singh Haryana Agricultural University, Bawal during rabi (winter) season of 2015-16 to study the effect of different doses of fertilizers and crop geometry on nutrient uptake of late sown Indian mustard (*Brassica juncea* L.). The experiment was laid out in split plot design with combination of 4 dose of Fertilizers (70 % RDF, 85 % RDF, Recommended dose of fertilizer i.e. 80 kg N + 30 kg P₂O₅ + 20 kg K₂O + 40 kg S per hectare and 115 % RDF) and 6 Crop geometry (30 cm x 10 cm, 25 cm x 15 cm, 30 cm x 15 cm, 25 cm x 20 cm, 30 cm x 20 cm and 25 cm x 25 cm). The results reveal that the nutrient uptake (N, P, K and S) were increased with successive increase in fertilizer doses. However, application of 85% RDF showed higher values of nutrient uptake over 70% RDF. Crop geometry (25 cm x 15 cm i.e. 2.66 lakh plants/ha) showed higher nutrient uptake (N, P, K and S) 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). The findings of the study concluded that 85% RDF and crop geometry of 25 cm x 15 cm i.e., 2.66 lakh plants/ha showed better performance of crop in terms of nutrient uptake.

ATTITUDE OF FARMERS TOWARDS MAIZE FARMING

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Study undertaken in three village of Dankhora block of Katihar District(Bihar) revealed that majority of the respondents had shown their positive attitude towards usefulness of maize crop. The respondents had the view that cultivation of the crop is of expensive enterprise and not profitable for small farmers. They also realized that recent maize production technologies are lacking.

Bihar is one of the largest maize growing State and other crop was grown primarily as a subsistence crop to meet food needs for long time till recently. But now like in non traditional Area(Karnataka and Andhra Pradesh) is also grown for commercial purpose (i.e mainly to meet the raw material requirement of the animal feed sector). It is third largest maize producing state Contributing around 10 percent to national production. Maize can be utilized in many different form by converting it into a variety of products through grinding, alkali processing, boiling, cooking and fermenting such as corn, starch, corn flakes and cereal etc. It also has many industrial application, which can make it a profitable crop in the state. Maize processing and utilization pattern shows that in India. Around 60 percent of the total produce is for animal feed, 28 percent for human consumption and 12 percent is used by the industry (starch, brewery etc). In Bihar only 8-10 percent of maize (5% directly by the processor and another 3-5% is being used by road side snacks, joints etc) is processed within the state despite the fact that the state has huge and rising marketable surplus. Hence the socio economic and Psychological attributes of farmers involved in maize farming has been recognized as an important segment of human resource management. In order to formulate a suitable strategy for increasing production potential capacities of maize crop through effective farmers involvement in maize farming. It has been decided to assess the attitude of farmers engaged in maize cultivation.

MATERIALS AND METHOD The Present study was under taken Dankhora block of Katihar district (Bihar) which has been identified as a potential area of maize cultivation. These village namely Nawada, Thapkol and Vellai were selected randomly in the block which had maximum number of farmers involved in the maize farming. Further a comprehensive list of farmers from each village were prepared and 20 farmers from each villages were selected as a sample by using proportionate probability principle. Thus the total respondent participated in the study were 60. The data were collected from the respondents with the help of structural interview schedule prepared for the purpose followed by extensive personal interview in order to supplement their responses.

DEVELOPMENT OF TRICHODERMA BASED NOVEL BIO-FORMULATIONS WITH INCREASED SHELF LIFE FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS

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Insect, pest and diseases are the major constraints for achieving higher production in agriculture. The use of microorganisms to control plant pathogens, known as biological control is now in practice. It is accepted as a suitable and environmentally friendly alternative or a supplemental way of reducing the use of chemicals in agriculture against plant disease management. Therefore, the present studies have been proposed with the main focus on the identification of *Trichoderma* based novel bio-formulations to replace chemicals in fertilizing soils and improving plant resistance against phytopathogens. A total of 8 *Trichoderma* species viz; *T. harzianum*, *T. asperellum*, *T. koningiopsis*, *T. virens*, *T. reesei*, *T. koningii*, *T. atroviride* and *T. longibrachiatum* were isolated from soil samples collected from 12 districts of Uttar Pradesh and sent to Indian Type Culture Collection (ITCC), New Delhi for confirmation. The isolated and identified strains of the *Trichoderma* sp. were characterized based on cultural, morphological, physiological, biochemical and molecular analysis to study the growth pattern, characteristics of the mycelium / spores, nutritional behavior, physiological and phylogenetic analysis and were evaluated for their antagonistic potential against *Fusarium oxysporum* f.sp. *ciceri*, *Fusarium udum*, *Rhizoctonia bataticola*, *Rhizoctonia solani*, *Sclerotinia sclerotiorum*, and *Sclerotium rolfsii* using dual inoculation method. Effect of volatile and non-volatile compounds of *Trichoderma* sp. on the growth and sporulation of the phytopathogens was also studied. Based on these studies *T. harzianum* (ITCC 9864) was found best in reducing growth & sporulation of the test pathogen. Pure *Trichoderma* spores (PTS) were harvested from *T. harzianum* (ITCC 9864) and compared with commercially available talc based formulations. Different dosage of pure spore mass of *T. harzianum* @ 0.004g/kg, 0.04g/kg, 0.4g/kg and 0.2g/kg and commercially available talc based formulation (*Trichoderma harzianum*) @ 4g/Kg were mixed in FYM with 2×10^8 cfu/g for substrate colonization and mass multiplication and studied periodically upto 18 months. Pure *Trichoderma* spore in FYM @ 0.04g/kg maintained 1×10^8 cfu/ml even upto 18 months while commercially available talc formulation showed no cfu after 10 months of storage. Shelf life of pure *Trichoderma* spores (PTS) alone and in combination with Chitin and Carboxymethyl Cellulose (CMC @ 5%) was studied to find out the efficacy of these adjuvants to increase shelf life. Shelf life of pure *Trichoderma* spores mixed with chitin proved to be more effective as compared with pure *Trichoderma* spores (PTS) alone and with Carboxymethyl Cellulose, thereby indicating that chitin helps in maintaining cfu for long duration (even up to 18 months). Therefore, it may conclude that formulation prepared by these two methods has given better shelf life as 2×10^{12} cfu/ml even after 18 months of storage and is cost-effective, which is a new finding. These findings clearly indicated that pure *Trichoderma* spores (PTS) even in a very small quantity are very potent and effective for longer survival as compared to commercially available talc based formulations and can effectively be used for the management of soil borne pathogens.

STUDIES ON CANOPY MANAGEMENT PRACTICES ON NPK STATUS OF LEAVES IN HIGH DENSITY PLANTING OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR

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Investigation was carried out during 2014-15 at experimental orchard and the chemical analysis was undertaken in the laboratory of the Department of Horticulture and Soil Science, Chaudhary Charan Singh Haryana Agriculture University, Hisar during winter season to standardize level of pruning and pinching of guava plants planted under high-density orcharding. A significant difference was observed in N, P and K content due to different pruning levels and pinching numbers at different planting density of guava during winter season. The highest N, P and K content was recorded in leaves taken from plants subjected to severe pruning up to 60% removal of shoot followed by 40 and 20% removal of shoot as compared to leaves taken from unpruned plants irrespective to pinching and spacing. Regarding pinching, the maximum N, P and K content was recorded in leaves taken from plants pinched twice, which was followed by leaves taken from plants pinched one time and the minimum in leaves taken from control plants with no pinching irrespective to pruning and spacing, while irrespective of pruning and pinching spacing also significantly affected the leaves nutrient composition as highest N, P and K content was registered in leaves taken from plants at 5x5 m spacing, which was followed by leaves taken from plants at 5x4 and 5x3 m spacing and the minimum in leaves taken from plants at closer spacing (5x2 m). The interaction between pruning and spacing was significant in respect to nitrogen content of leaves during winter season, while other interactions were non-significant. However, the interaction effect due to pruning levels, pinching numbers and spacing was non significant in respect to P and K content of leaves during winter season.

Keywords: Pruning, pinching, spacing, leaf analysis and guava

STUDIES ON THE EFFECT OF GROWTH REGULATORS ON *IN-VITRO* CLONING OF *CARICA PAPAYA* L. THROUGH SHOOT TIP AND INFLORESCENCE

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Papaya is the most important fruit crop of tropical and sub-tropical countries of the world. It is valued for its nutritional as well as pharmaceutical importance as it is rich source of provitamin A, Calcium and Papain, a photolytic enzyme. Since Papaya is highly heterozygous fruit crop. There is need of multiplication of plant through Tissue Culture for bearing fruits in almost all the plants. Keeping these facts in view the multiplication of Papaya *Carica papaya* L. cv. Pusa Delicious through Tissue Culture is needed for the production of numerous plants with in short period of time that is why the present experiment was carried out in the Tissue Culture Lab of the Department of Horticulture, Sardar Vallabhbhai University of Agriculture & Technology, Meerut, (U.P.) during the year 2016-2017. The experiment was conducted in two way factorial design with 33 treatments comprising of 3 level of BAP (1, 2 and 3 ppm), 3 levels of Kinetin (1, 1.5 and 2 ppm), 6 level of NAA (0.01, 0.1, 0.5, 1, 2 and 3 ppm) and 5 levels of IBA (0.1, 0.5, 1, 2 and 3 ppm) replicated thrice. The different concentrations of Auxins and Cytokinins alone and in various combination are applied. The effect of these combinations was clearly observed among the different concentration of the bio-regulators, BAP 1 ppm + NAA 0.5 ppm was found to be the best for shoot development and as well as for maximum number of shoot. In case of rooting of explants the effect of IBA and NAA was studied with the half dose of CHU (N6) media, NAA 3 ppm was most effective in terms of root induction in explant which induced the root just in 11.66 days. IBA 1 ppm was best in inducing maximum number of roots. Hence on the basis of result obtained from the present investigation it can be concluded that the combination of BAP 1 ppm and NAA 0.5 ppm is the best for shoot development and NAA 3 ppm and IBA 1 ppm is the best for early rooting and maximum rooting respectively in CHU (N6) media for Papaya (*Carica papaya* L.) tissue culture and can be recommended to the commercial tissue culture laboratories and to the researchers.

EFFECTS OF SUB-LETHAL CONCENTRATIONS OF *ASPERGILLUS NIGER* ON THE MORTALITY AND IMMUNOLOGICAL CHARACTERISTICS OF *DYSDERCUS KOENIGII* (HETEROPTERA : PYRRHOCORIDAE)

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Dysdercus koenigii is a serious pest of cotton and other plants of economic importance. In recent decades, elevated awareness related to the impacts of pesticide on the environment and human health have resulted in efforts to reduce reliance on chemical controls of insect pests. Biological control has long been considered a potential alternative to pesticidal strategies for the pest management but its impact and level of use globally remain modest and inconsistent. The present work is aimed to evaluate the effects of *Aspergillus niger* on *Dysdercus koenigii* especially to find out their immune response. The effects of topically applied *A. niger* on adult of *D. koenigii* at concentrations of 10^4 , 10^5 , 10^6 spores / mL were analysed. Results showed differences in the mortality, THC and DHC. Our results indicate that the fungus *A. niger* could be used in the IPM of *D. koenigii* by presenting pathogenicity, which interferes with their development even when exposed to small concentrations. Protein content in haemolymph was also found to be markedly reduced following appearance of disease symptoms in treated adults compared to healthy adults. Further, lipid peroxidation analysis revealed that there was a gradual increase in lipid peroxidation activity in infected adults compared to control adults. The enzymatic activity of detoxifying enzymes like superoxide dismutase, catalase, cytochrome P450 and glutathione-S-transferase were found to be significantly changed in post inoculated insects compared to control. The findings of the present investigation would be discussed in the light of literature.

Keywords: Haemolymph, Lipid peroxidation, mortality, detoxifying enzymes

ROLE OF BOTANICAL INSECTICIDES IN IPM

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The strategy of exclusive reliance on synthetic insecticides for managing all insect pests has created a number of ecological and environmental problems in addition to aggravation of the pest attacks on agricultural crops. This has once again focussed our attention on botanical insecticides as other alternative means of insect control. The insecticide of plant origin extracted from seeds, flowers, leaves, stem and roots are



termed as botanical insecticides. Nicotine, rotenone, sabadilla, ryania, pyrethrum are more important botanical insecticides. These plant derived products are known to have been utilized by man since ancient times. Botanical pesticides exert a range of behavioural and physiological effects on the colonization, development, growth, survival and multiplication of insects. The toxic principles in botanicals are mostly alkaloids, heterocyclic nitrogenous compounds 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. But in addition to high insecticidal activity, botanical insecticides are safer to plant and animal life, biodegradability with sufficient residual action, ready availability of the plant or capability for cultivation with a reasonably short gestation period, yield products of consistent quality, naturally occurring phytochemicals exert a wide range of behavioural and physiological effects on the insects and therefore it is difficult for insects to develop resistance to these pesticides. The use of botanical pesticides for plant protection has assumed greater importance in recent years all over the world due to environmental deterioration and health hazards associated with the use of synthetic pesticides. It is hoped that extensive use of plant based pesticides in integrated pest management will help in conserving environmental quality.

BIOLOGICAL CONTROL OF LEAF SPOT DISEASE OF GROUNDNUT

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The leaf spot or tikka disease is caused by two species of fungus *Cercospora arachidicola* and *Cercospora personata* on groundnut (*Arachis hypogaea* L.) is the predominant, devastating, common constraints and economically important foliar fungal disease and major yield reducing factor of groundnut. The yield loss was calculated in the groundnut due to early and late leaf spot (Tikka) by over 30-48%. The efficacy of three botanicals viz. neem leaf (*Azadirachta indica*), debdaru leaf (*Polyalthia longifolia*), and datura leaf (*Datura metel*), NAU-Bio-fungicide along with a check (Bavistin) and untreated control were evaluated as foliar spray in the field. Among the treatments, NAU-Biofungicide (53.61%), extracts of neem leaf (51.91%), datura leaf (40.85%) and debdaru leaf (38.72%) showed excellent performance in controlling leaf spot and increasing pod yield respectively as compared to control in the field. The yield increase due to the application of NAU-Biofungicide as spray + seed treatment gave the highest net profit of Tk. 176768.00/ha that was following by extracts of neem leaf Tk. 172275.00/ha, NAU-Bio-fungicide spray Tk. 168818.00/ha, NAU-Bio-fungicide as seed treatment Tk. 159725.00/ha, datura leaf Tk. 155043.00/ha, Bavistin spray Tk. 153525.00/ha and debdaru leaf Tk. 153307.00/ha. The percentage of return over control ranged 58.96 to 83.28%. Maximum of 83.28% return over control was obtained from NAU-Bio-fungicide as seed treatment + spray followed by extract of neem leaf (78.62%), NAU-Bio-fungicide spray (75.04%), NAU-Bio-fungicide as seed treatment (65.61%), extract of datura leaf (60.76%) and Bavistin (59.18%).

Keywords: Biological, Leaf spot, Groundnut, Tikka, Bio-fungicides, Botanical and Yield

DEEP FAT FRYING

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Deep-fat frying, also known as immersion frying, is one of the oldest and most common unit operations used in the preparation of food. The process was first developed around the Mediterranean area due to the influence of olive oil. Deep fat frying is a cooking method where oil is used as the heat transfer medium, in direct contact with food at a temperature above boiling point of water and therefore, may be classified as a dehydration process. Frying temperatures usually range between 130 and 190°C, but most common frying temperatures are in the 170–190°C range. The high temperatures of the frying oil lead to the evaporation of water at the surface of the food. Due to evaporation, water in the external layers of the product moves to the surrounding oil and surface drying occurs, inducing crust formation. Additionally, oil is absorbed by the food, replacing part of the water. The aim of this process is to combine short cooking times with unique characteristics. It also involves heat and mass transfer simultaneously. During frying time, the mass transfer is characterized by the dynamics moisture loss from the food and the fat uptake into the food. Oil uptake of product is an important issue, affecting the nutritional and organoleptic qualities of fried foods. It is affected by oil temperature, frying time, initial water content of food ingredients, product surface area, the ratios of product weight to frying oil volume, pretreatments and many other factors.

EFFECT OF SUBSTRATES ON *TRICHODERMA VIRIDE* CONIDIA PRODUCTION ON DIFFERENT GRAINS UNDER SOLID STATE FERMENTATION CONDITION

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Trichoderma viride antagonistic fungus was evaluated for production of conidial mass on different grain of wheat, corn, sorghum, rice and bajra. Out of five grain the highest conidial sporulation was observed on rice grain. However, it was difficult to produce the conidia at mass level due to boiling of rice grain and conversion into compact mass during sterilization resulting in difficulty for harvesting the conidial mass from conidial flask in solid state fermentation conditions. So, sorghum grain was found better than rice grain for mass production of conidial by *Trichoderma viride*.

Keywords: *Trichoderma viride*, substrates, conidia, sporulation.

ECONOMICS ANALYSIS OF RED WAL (*DOLICHUS SPP.*) IN RAIGAD DISTRICT OF MAHARASHTRA



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The present study was conducted at Department of Agricultural Economics, Dr. B.S. Konkan Krishi Vidyapeeth (Agricultural University), Dapoli, Maharashtra to analysis economics of RedWal (*Dolichus spp.*) in Raigad district of Maharashtra. The main purpose of present study to workout cost, returns and profitability in cultivation of wal. In this study, 120 wal cultivators were selected randomly. At the overall level, out of the total cost of cultivation of red wal, share of cost-A, cost-B and cost-C were as 26.11 per cent (Rs.9955), 50.26 per cent (Rs. 19736) and 23.63 per cent (Rs. 39270), respectively. The maximum cost was for total human labour 47.21 per cent followed by manures, seed and fertilizers, cost on bullock labour, irrigation charges, depreciation of implements and machinery, interest on working capital and interest on fixed capital. Rental value of owned land was 24.02 per cent. Supervision charges were 2.53 per cent. The cost per quintal was worked out to be Rs.5667. The net returns at cost-A, cost-B and cost – C were as Rs. 38942, Rs. 29161 and Rs. 9627, respectively at overall level. The benefit cost ratio was achieved as 1.24 on overall level. From the present study, it can be concluded that cultivation of Red Wal in Raigad district of Maharashtra found profitable and economical.

EFFECT OF SOWING TIMES ON YIELD AND ECONOMICS OF DIFFERENT RICE GENOTYPES UNDER KONKAN CLIMATIC CONDITION OF MAHARASHTRA

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A field experiment was conducted to assess the effect of sowing time on yield and economics of different rice genotypes under Konkan climatic condition on lateritic soil having low to moderate soil fertility status during 2013 and 2014 in *Kharif* season. The experiment was laid out in split plot design with three main plots viz., sowing times and nine sub plot treatments viz., varieties. Thus, there were 27 treatment combinations, replicated three times. The pooled mean of data showed that the significantly higher grain yield was recorded by short duration hybrid Sahyadri-4 sown during 23rd meteorological week followed by same hybrid sown during 24th meteorological week and medium duration variety Jaya sown during 23rd meteorological week. However, in case of straw yield in the pooled data, the significantly higher value was recorded by medium duration variety Karjat-5 sown during 23rd meteorological week followed by same variety sown during 24th meteorological week. In respect of economics of treatment combinations, the highest net returns and B:C ratio were obtained when rice crop was sown during 23rd meteorological week with short duration hybrid Sahyadri-4 which was closely followed by the medium duration variety Jaya sown during 23rd meteorological week.

EFFECT OF SUPPLEMENTATION OF ASHWAGANDHA (*WITHANIA SOMNIFERA*) AND SELENIUM ON GROWTH, MEAT QUALITY AND HAEMATO-IMMUNOLOGICAL RESPONSES OF BROILER CHICKENS

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An experiment was conducted at Poultry Research and Training Centre of the College of Veterinary and Animal Sciences, SVBPUAT, Meerut to monitor effect of supplementation of Ashwagandha and Selenium on growth traits, dressing quality and Haemato-immunological responses of broiler chicks during June and July, 2015. For this experiment 360 day old chicks were wing banded, weighed and randomly distributed into six dietary treatments viz. T₀: Control group, T₁: Ashwagandha (0.025%), T₂: Selenium (0.015%), T₃: Selenium (0.020%), T₄: Ashwagandha + Selenium (0.025+ 0.015%) and T₅: Ashwagandha + Selenium (0.025+0.020%) consisting of three replicates and each replication have 20 broiler chicks. The results showed that overall body weight gain (1030.37±332.47 g), weekly body weight gain (328.32±74.12 g) and feed consumption ratio (1.66±0.20) were significantly (P<0.05) higher in T₅ as compared to control group. Haemoglobin, packed cell volume, total erythrocyte count, higher in T₅ as 12.28±0.07 g/dl, 31.59±0.02%, 2.88±0.01 million cell/mm³ and as well as lower mean corpuscular volume, mean corpuscular haemoglobin also found in T₅ as compared to other treatment and control group. The maximum live body wt. (2286.67±20.46g), cooking yield (63.74±0.02%), giblet (5.33±0.00%), drumstick weight (33.53±0.03%), dressing percentage (73.68±0.02 %) and meat pH (5.67±0.05) were found in T₅ combination (Ashwagandha (0.025%) + Selenium (0.020%)) as compared to control group. Results of present investigation showed that Ashwagandha (0.025%) and Selenium (0.020%) combination group significantly increased body weight gain, feed conversion ratio, blood biochemistry and meat quality. Therefore it can be concluded that Ashwagandha and Selenium combination used @ 0.025% and 0.020% of basal diet of broilers is more optimum and economical for broiler production.

ENHANCING VASE LIFE OF GLADIOLUS VAR. PETER PEARS THROUGH EXOGENOUS APPLICATION OF CARBOHYDRATE SOLUTION

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Gladiolus is economically most important flowering plants which has gained its popularity as a cut flower crop both in domestic as well as international market. This crop has attained immense importance among the flower lovers and occupies a prominent place in the garden



due to its magnificent inflorescence and wide range of colours and shapes. However, its spikes are highly perishable and causes large amount of post harvest losses. A large number of the chemicals which can extend the vase life of these flowers are available but are not generally used by the farmers either due to their complex nature or difficult to handle. An On Farm experiment was conducted during 2015 to ascertain the effect of readily available and easy to handle vase solutions for reducing the post harvest losses incurred by the farmer. Three treatment regimes were selected which include farmer's practice (no treatment), pulsing/dipping of gladiolus spikes in sugar 5% and Pulsing of spikes with sugar 5%+citric acid 2%. The results revealed that pulsing of spikes with sugar 5%+citric acid 2% recorded highest shelf life (8 days) as compared to farmer's practice (5 days). Highest number of spikes (120000 spikes/ha) were sold out to the market when treated with sugar 5%+citric acid 2% as compared to farmer's practice (65000 spikes/ha). The same treatment also improved the economic condition of the farmer by recording highest B:C ratio (2.98:1) as compared to farmer's practice (1.63:1). Pulsing of spikes with 5% sugar was observed to be the next best treatment.

EVALUATION OF POST HARVEST TECHNIQUES FOR MANAGEMENT OF GLADIOLUS CORMS

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Gladiolus (*Gladiolus grandiflorus* L.) is a tender herbaceous perennial and an important bulbous ornamental plant valued for its attractive spikes. It is commercially propagated by corms and cormels whose physiological dormancy usually lasts for about 4 to 5 months inside the storage. The corms become more susceptible to rotting due to prolonged storage. This has caused a decline in the commercial cultivation of gladiolus due to high economic losses. In order to control the rotting of corms, an On Farm Trial was conducted during 2015-16 at the farmers field comprising of three treatments viz., T₁ (Farmer's Practice: no treatment); T₂ (dipping of corms in Mencozeb@2g per litre of water for 30 minutes before storage) and T₃ (dipping of corms in *Trichoderma viridi* @ 2g per litre of water before storage). Highest percentage of healthy corms, recovered after storage, were recorded with T₃ (89%) followed by T₂ (81%) and lowest with T₁ (58%). Besides disease control, *Trichoderma* treatment was also found to enhance corm production and recorded highest production (87000 corms/ha) as compared to farmer's practice (61000 corms/ha). This Pre-storage treatment of corms increased the net returns of the farmer with highest BC ratio recorded in T₃ (2.95:1) followed by T₂ (2.73:1).

GROWTH AND FLOWERING OF JASMINUM SAMBAC (L.) AS INFLUENCED BY TIME AND DIFFERENT LEVELS OF PRUNING

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An experiment entitled "Growth and flowering of *Jasminum sambac* (L.) as influenced by time and different levels of pruning" was conducted at Satpuda Botanic Garden, College of Agriculture, Nagpur (M. S.) during 2013-14 and 2014-15 in factorial randomized block design with 16 treatment combinations. The treatments comprised four timings of pruning viz., 2nd week of December, 4th week of December, 2nd week of January and 4th week of January and four levels of pruning viz., light pruning (45 cm above ground level), medium pruning (30 cm above ground level), hard pruning (15 cm above ground level) and no pruning (control). The treatments were imposed on already existing three year's old plants of *Jasminum sambac* (L.). The results revealed that significantly maximum length of primary shoot, leaves/primary shoot and productive shoots/plant were recorded when the jasmine plants were pruned at 4th week of December, whereas, sprouts/plant, weight of 100 flower buds and shelf life of flower were non-significantly influenced by time of pruning during both the years of experimentation. In respect of level of pruning, sprouts/plant, length of primary shoot, leaves/primary shoot, productive shoots/plant, weight of 100 flower buds and shelf life of flower were noted significantly maximum with medium pruning. Interaction effect of time and severity of pruning was found significant in respect of flower yield in jasmine. Significantly the highest flower yield in terms of flower buds/plant, flower yield/plant and flower yield/ha were noted when the plants were pruned during 4th week of December at 30 cm above ground level (medium pruning).

Key words : Flowering, growth, jasmine, *Jasminum sambac* (L.), pruning

IMPORTANCE OF STRAWBERRY CULTIVATION IN TARAI REGIONS OF UTTAR PRADESH AND UTTARAKHAND

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Strawberry (*Fragaria* × *ananassa* Duch.) is a natural hybrid of *Fragaria chiloensis* L. P.Mill. and *Fragaria virginiana* Duch and belongs to the Rosaceae family, originated in Europe in the 18th century. All the cultivated varieties of strawberry are octaploid (2n = 8x = 56) in nature. The strawberry is one of the most popular fruits in the world. Strawberry is a nutritious fruit with high flavour and the fruit is widely appreciated for its characteristic aroma, bright red colour, juicy texture and sweetness. Strawberry is very rich source of antioxidants. It is eaten raw or used in making juice, desserts, jam, syrup, and wine. The leaves are used in blended herbal tea. Leaves and roots are believed to have medicinal properties. The strawberry is called 'the queen of fruits' in Asian countries because it's packed with health benefits. Strawberries are considered one of the healthiest fruits. Packed with essential vitamins and minerals, they are also sodium, cholesterol and fat free. This fruit crop is grown in subtropical as well as temperate regions in India particularly in Punjab, Himachal Pradesh, Uttarakhand and Karnataka. However, the foot hills and tarai regions are very much suited for its growth and development. So, Western Uttar Pradesh may be well suited for its commercial cultivation. Important strawberry varieties cultivated in India are Chandler, Tioga, Torrey, Selva, Belrubi, Fern and Pajaro. Strawberry is



vegetatively propagated through runners which often get infected by different viruses such as strawberry mottle virus and mycoplasma diseases that makes its cultivation quite difficult and labour intensive. Therefore, adaptation of *in vitro* propagation techniques for mass propagation of this crop is considered as an alternative to traditional runner production. For large scale propagation of virus free plants, tissue culture is most widely used. High multiplication achieved via micropropagation allows the grower to meet an unexpected demand for a particular cultivar. Another advantage of tissue culture, starting with apical meristems as explants, is the elimination of virus and virus-like diseases.

INVESTIGATION OF DIFFERENT LEVELS OF AZOLLA (*AZOLLA PINNATA*) ON PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKS

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The investigation was conducted at Poultry unit, Deptt. of Animal Husbandry and Dairy Science, Dr. B.S. Konkan Krishi Vidyapeeth Dapoli, Maharashtra to assess the different levels of Azolla (*Azolla pinnata*) on performance and carcass characteristics of broiler chicks. A total 120 chicks (144) were reared together until 9 days of age for brooding. On 10th day, the chicks were weighed individually and distributed randomly into four dietary treatments with five replications and each replication have six chicks. A control diet (T₀) containing 0.0 % Azolla and three experimental diets in which Azolla was partially (5%; T₁), (10%; T₂) and T₃ replaced (15%) by fresh Azolla (*Azolla pinnata*). An average body weight of 2344.20, 2507.37, 2285.50 and 2244.03 g was found in treatments T₀, T₁, T₂ and T₃ respectively at the end of 6th week. The feed conversion ratio found significantly superior T₁ (1.70) followed by T₀ (1.81), T₂ (1.82) and T₃ (1.84), respectively. Supplementation of Azolla at the rate of 5 % for 42 days showed the significant improved carcass weight (1932.20 g) and dressing percentage (72.47 %). There was no adverse effect on the performance of broiler chicken when 5 per cent of broiler diet was replaced with Azolla. Hence, net profit per bird was maximum achieved in T₁ (Rs.61.91) followed by T₃ (Rs. 51.54), T₂ (Rs. 49.58) and T₀ (Rs. 47.09), respectively. The study concluded that supplementation of Azolla meal at the rate of 5 per cent in broiler diet for 42 days increased body weight gain and meat quality. Therefore, it can be used as a poultry feed to reduce feed cost and profitable broiler farming.

STUDIES ON VALUE ADDITION OF PINEAPPLE CHEESE

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The present investigation entitled "Studies on value addition of Pineapple cheese" was carried out in Post-Harvest Lab, Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology and Sciences, (Deemed to be University) during the winter season of the year 2016-2017. The experiment was laid out in CRD with 10 treatments and 3 replications for preparation of pineapple cheese. Physico-chemical parameters viz., TSS, acidity, ascorbic acid, non-reducing sugars, and total sugars as well as organoleptic attributes viz., colour, flavour, taste and overall acceptability of pineapple cheese were evaluated at an interval of 0 days up to 90 days of storage. An overall result of pineapple cheese was found better in the treatment T₃ (Pineapple 70% + Apple 30%) proved to be the best in terms of quality whereas T₆ (Pineapple 40 + Apple 60%) proved to be best in terms of sensory score economic return on value addition of pineapple cheese at room temperature.

Keywords : pineapple, apple ; Pulp; TSS; Bio-chemical parameters; Storage

EFFECT OF ORGANIC TREATMENTS ON GROWTH AND YIELD OF FENUGREEK

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A field experiment was conducted at Kumarganj, Faizabad (Uttar Pradesh), India. Fresh cow urine and cow dung were collected in a sterile container from a local variety of cow, college of veterinary & Animal husbandry at Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad during (2016-17). Panchagavya is an organic formulation which in Sanskrit means the blend of five products obtained from cow i.e. milk, ghee, curd, dung and urine. These entire individual called gavya and collectively named panchagavya. These components enhance the fungicidal and insecticidal activities of Panchagavya. It has potential to play the role for promoting growth and providing resistance to plant system. Panchagavya is used as a seed treatment, foliar spray as well as soil application alone or with irrigation. Which promote the growth of plants and provide resistance against pest and disease. It has an excellent germicidal power, antibiotic and antimicrobial activity. The organic farming is gaining impetus due to realization of inherent advantage because it increased the sustaining crop production and maintaining dynamic soil nutrient with safe environment. The inhibitory capacity of fresh cow products have reported on seed borne fungi viz., *Cercospora*, *Alternaria*, *Bipolaris*, *Fusarium* and *Colletotrichum*. Cow urine has been applied as bio pesticide in organic farming along with cow dung, Cow milk and other herbal ingredient because cow urine is not only toxic material but it contain 95% water, 2.5% urea and remaining 2.5% is a mixture of minerals salts, hormones and enzymes. The effect of treatment on plant height was maximum in seed treatment with cow urine (73.33 cm) followed by seed treatment with panchagavya (72.87 cm), foliar spray of panchagavya (72.59) and foliar spray of cow dung slurry



(72.42). The yield was found highest in seed treatment with Vanaspativash (17.34q/ha.) followed by seed treatment with cow urine (17.30q/ha.), seed treatment with panchagavya (17.12q/ha.).

Keyword: Organic treatment, Fenugreek, Panchagavya, Fungicidal, Insecticidal, Resistance, Antibiotic and Antimicrobial

MODIFIED ATMOSPHERE PACKAGING OF FRESH PRODUCE

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MAP is a Food packaging technique in which the proportion of CO₂, O₂ and N₂ in a sealed container are different from those in the normal air to enhance the food shelf-life with preserving the natural quality. MAP is the modification or replacement of air (N₂ content 78%, O₂ content 21%, CO₂ content 0.035%, together with water vapor and traces of inert gases) in a pack with a mixture of gases achieved by the natural interplay between two process, the respiration of the product and the transfer of gases through the packaging that leads to a atmosphere richer in CO₂ and poorer in O₂ or introduction of fixed proportion of gas mixture in to the package before being sealed. That leads to an atmosphere richer in CO₂ and poorer in O₂; and it depends on the characteristics of the commodity and the packaging film. This atmosphere can potentially reduce respiration rate, ethylene sensitivity and production, ripening, softening and compositional changes, decay and physiological changes, namely, oxidation. MAP involves the exposure of produce to the atmosphere generated in a package by the interaction of the produce, the package and the external atmosphere. The initial atmosphere may be either air or a gas mixture. The objective of MAP design is to define conditions that will create the atmosphere best suited for the extended storage of a given produce while minimizing the time required achieving this atmosphere. Matching the film permeation rate for O₂ and CO₂ with the respiration rate of the packaged produce can do this.

TO STUDY OF THE MIXED FRUIT JUICE RTS BEVERAGE AND STORAGE STUDY AT ROOM TEMPERATURE STORAGE CONDITIONS

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A variety of soft drinks are being presently produced in the country such as sweetened carbonated (aerated) soft drinks, still beverages containing fruit juice/pulp and soda water falling under the category of RTS (ready-to-serve) beverages. Among these the share of fruit juice based beverages are very small compared to synthetic carbonated drinks/soda waters. However, the trend is slowly changing for the obvious advantages of nutritious beverages over the synthetic aerated waters. The RTS beverage was prepared by different fruit (Apple, Guava, Carrot and banana) juice according to different sample based on the ratio and the samples was stored at room temperature for 90 days. The physico-chemical and quality parameters analysis pH acidity, TSS, Ascorbic acid, optical density. we were see that no changing in the samples at 24 hours but after 30 days some changing in RTS beverage samples during storage conditions. The TSS of mix fruit RTS beverage increased with increasing during storage. the highest value were found in TSS, Acidity, pH, Optical density and Ascorbic acid (21.90, 2.32, 3.91, 2.38, 5.00) at room temperature after 90 days. TSS value of RTS beverage during storage were probably due to conversion of polysaccharides into soluble sugars. Vitamin C is an antioxidant and, in water, it readily oxidizes first to dehydrate ascorbic acid, then to dike to gulonic, oxalic, and threonic acids. The first reaction is reversible, but the subsequent ones are not. Hence, its content in food can decrease during food preparation and storage. Optical density slightly decreased with decrease in storage period. This decrease in optical density may be attributed to no-enzymatic mallard browning reaction may take place between nitrogenous compound and sugar, nitrogenous compound and organic acid. The RTS beverage samples were superior of refrigerator than comparison to the room temperature.

DEHYRRATION OF MORINGA OLEIFERA LEAVES BY USING DIFFERENT METHOD & ITS UTILIZATION IN PARATHA

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Moringaoleifera is a multipurpose and exceptionally nutritious vegetable tree with a variety of potential uses& its leaf is most nutritious &drying of moringa leaf powder not only increases the micronutrients & also it increases the shelf life of its powder. The nutritional potential & antioxidant component present in moringa make it suitable for preparation of various traditional products i.e.paratha. the main ingredients in paratha is wheat flour &refined wheat flour is deficient in protein , vitamins &minerals.Use of moringa leaves powder in paratha not only increases the nutritional value but also help to resolve problem of malnutrition.

Keywords:Mornigaleaves, micronutrients, health benefits,paratha,antioxidentcompnent.

PHYLOGENY OF *STEINERNEMA ABBASI* (RHABDITIDA: STEINERNEMATIDAE) AND ITS VIRULENCE AGAINST *GALLERIA MELLONELLA*

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The investigations were conducted on soil samples collected from the sugarcane (*Saccharum officinarum* L.) agriculture fields of Baghpat district, the sub-humid region of Uttar Pradesh, India. The worms were diagnosed as member of bicornutum group due to the presence of two horns like cephalic structures in third stage infective juveniles. The newly isolated worms were not identical to pre-existing individuals



of same group and can be differentiated from the *Steinernema abbasi* (Rhabditida: Steinernematidae) by the presence of mucronate processes in adults of second generations and relative proportion of oesophagus with body length in juveniles. In the present investigation the recovered populations of entomopathogenic nematodes (EPN) were identified, characterized and validated as an isolate of *S. abbasi* CS17 and CS18 with the application of advanced molecular tools. The phylogenetic analyses were based on the efficacy of conserved genes (ITS, D2-D3 and *coxI*) sequences in taxa validations. The nematodes were tested for their pathogenicity and reproductivity at different doses against wax moth larvae *Galleria mellonella*. *S. abbasi* isolates were found highly pathogenic and caused 100% mortality within 36 and 48 hours respectively in isolate CS17 and CS18. The lowest LC₅₀ value (12.47 IJs/ larva) with highest pathogenicity was recorded with *S. abbasi* isolate CS18 followed by *S. abbasi* isolate CS17. The study revealed that all the tested nematodes are able to propagate in the host cadaver and produced a varied number of 3rd stage infective juveniles at different doses applied. Further their tests on other insects in lab as well as green house and field conditions need to be evaluated to use them as biological control agents for controlling different target insect pests.

Keywords: *Steinernema abbasi*, conserved genes, ITS, D2-D3 and *coxI*, biocontrol agent.

RESPONSE OF ZERO TILLAGE WITH RESIDUE MULCH ON YIELD AND ECONOMICS OF KHARIF MAIZE

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Maize (*Zea mays* L) is one of the most vibrant food grain crops in many parts of the world. Being a C₄ plant, it is cultivated in tropical, subtropical, temperate areas and high hill ecologies. The experiment was conducted at Regional Research Station, Karnal of CCS Haryana Agricultural University, India during *kharif* 2015. Main plot treatments comprised of four planting methods viz., raised bed with residue, raised bed without residue, zero tillage (ZT) with residue and ZT without residue. Three maize hybrids viz., HQPM-1, HM-4 and HM-10 in combination with 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 kept as sub-plots in split plot design with three replications. Soil of the field was clay loam in texture and slightly alkaline in reaction (pH 8.4). Maize sown in ZT with residue recorded significantly highest 100-grains weight (27.37 g), grain yield (7322 kg/ha), harvest index (HI) (44.64%) and net returns (Rs 59958 /ha) as compared to other methods. However, ZT in general was statistically similar to raised bed in respect of grain yield and HI, but higher 100-grains weight and net returns than raised bed. Residue retention resulted in better 100-grains weight, grain yield, HI and net returns as compared to without residue. The hybrid HM-4 produced maximum 100-grains weight (26.96 g), grain yield (7037 kg/ha) and net returns (Rs 58749/ha), but HI was non significant among the hybrids. Higher 100-grains weight, grain yield, HI and net returns were observed under atrazine 750 g/ha (PRE) fb 1 HW at 30 DAS than unweeded check. Hence, maize sown in place of rice in rice-wheat system in ZT with wheat residue as mulch resulted in better productivity and profitability.

Keywords: Grain yield, Maize, Net returns, Zero tillage with residue

PROFITABILITY AND PRODUCTIVITY OF FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.) INTERCROPPING WITH FENNEL (*FOENICULUM VULGARE* MILL.) UNDER VARYING LEVELS OF ZINC

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2014-15 on loamy sand soil. The treatments comprised of 5 levels of intercropping system viz., Sole fennel, sole fenugreek, fennel + fenugreek (2:1) paired row, fennel + fenugreek (2:2) paired row and fennel + fenugreek (2:3) paired row and four levels of zinc (0, 2.5, 5.0 and 7.5 kg/ha) during rabi season, thereby making 20 treatments combinations was laid out in a Randomized Block Design and replicated three times. Results indicated that fennel + fenugreek (2:3) paired row intercropping system recorded significantly higher dry matter accumulation at 105 DAS and harvest over sole fennel. Whereas, dry matter accumulation at 70 DAS recorded significantly higher in 2:2 and 2:3 paired row ratio as compared to sole fennel. The intercropping in 2:3 paired row ratio recorded significantly minimum dry matter at harvest and total chlorophyll content in levels of fenugreek over 2:1 paired row ratio and sole crop but at 80 DAS dry matter accumulation significantly higher over only sole fenugreek. Further, results showed that fennel grown in 2:3 paired row ratio gave significantly higher value of yield attributes viz., number of umbels per plant, number of umbellets per umbel and seeds per umbel and seed, straw and biological yield as compared to sole fennel. Significantly lower seed, straw and biological yields of fenugreek were obtained under intercropping in 2:1 paired row ratio as compared to other intercropping system and sole crop. The fennel grown in 2:3 paired ratio, recorded significantly highest concentration of nitrogen in seed over sole fennel. Fennel recorded significantly higher total uptake of nitrogen and zinc and volatile oil yield under all intercropping systems as compared to sole fennel. Fenugreek recorded significantly lower total uptake of nitrogen and zinc under intercropping 2:1 paired row as compared to other intercropping systems. In the whole system, the intercropping in 2:3 paired row ratio gave significantly highest FEY (1838 kg/ha), LER (1.87) and net returns (Rs. 132278/ha). The graded levels of zinc up to 5 kg/ha significantly increased dry matter accumulation of fennel and fenugreek at different growth stage. The yield attributes and yield of fennel and fenugreek increased up to 5.0 kg Zn/ha, whereas, number of seeds per pod of fenugreek were significantly increase with application of 5.0 kg Zn/ha over control. The nitrogen concentration in seed and zinc concentration in seed and straw of fennel, volatile oil yield and total uptake of nitrogen and zinc by fennel and zinc concentration in seed of fenugreek increased significantly up to 5.0 kg Zn/ha. However, nitrogen concentration in seed and straw and total uptake of nitrogen of fenugreek and volatile oil content in seed of fennel significantly increased with 5 kg Zn/ha over control. Whereas, the zinc concentration in straw and total uptake of zinc and protein content in seed of fenugreek were increased significantly only up to 2.5 kg Zn/ha. Significantly higher fennel equivalent yield (1489 kg/ha) and net returns (Rs. 105074/ha) were recorded with 5.0 kg Zn/ha over preceding levels.

RESPONSE OF SULPHUR AND ZINC ON YIELD, NUTRIENTS CONTENT AND QUALITY OF RICE (*ORYZA SATIVA* L.)

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A field experiment was conducted for two years (2014 & 2015) at Students, Research Farm Chandra Shekhar Azad University of Agriculture and Technology Kanpur-208002. There are nine treatment combinations were tested comprising three levels of each sulphur 0, 30 and 60 kg ha⁻¹ and zinc 0, 3 and 5 kg ha⁻¹. Application of graded doses of S upto 60 kg ha⁻¹ and Zn upto 5 kg ha⁻¹ significantly increased grain and straw yield. Application of 60kg S ha⁻¹ gave 476.00 (10.25%) and 702.00 (10.77%) kg ha⁻¹ higher grain and straw yield respectively over no use of sulphur. Similarly use of 5 kg Zn ha⁻¹ resulted 172.00 (3.60%) and 279.00 (4.15%) kg ha⁻¹ extra grain and straw yield respectively over no use of zinc. application of sulphur upto 60 kg ha⁻¹ significantly increased the sulphur and zinc content in grain and straw. Zinc content in grain and straw increased significantly with the use of 60kg S ha⁻¹. Use of zinc upto 5 kg ha⁻¹ significantly increased the nutrient content in grain and straw. application of sulphur upto 60 kg ha⁻¹ and zinc upto 5 kg ha⁻¹ significantly increased maximum protein content 8.43 % and 8.00 % in grain and 1.90 % & 1.74 % in straw respectively. Use of 60 kg S ha⁻¹ significantly increased kernal elongation and L/B ratio of rice grain.

Keywords: Sulphur, Zinc Protein, Kernal elongation and L/B ratio.

EFFECT OF SULPHUR, ZINC AND INSECTICIDES ON YIELD AND UPTAKE OF NUTRIENTS IN RICE (ORYZA SATIVA L.)

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A field experiment was conducted for two years (2014 & 2015) at Students, Research Farm Chandra Shekhar Azad University of Agriculture and Technology Kanpur-208002. There are eighteen treatment combinations were tested comprising three levels of each sulphur 0, 30 and 60 kg ha⁻¹, zinc 0, 3 and 5 kg ha⁻¹ and two insecticides (Phorate and Carbofuran). Application of graded doses of S upto 60 kg ha⁻¹ and Zn upto 5 kg ha⁻¹ significantly increased grain and straw yield. Application of 60kg S ha⁻¹ gave 476.00 (10.25%) and 702.00 (10.77%) kg ha⁻¹ higher grain and straw yield respectively over no use of sulphur. Similarly use of 5 kg Zn ha⁻¹ resulted 172.00 (3.60%) and 279.00 (4.15%) kg ha⁻¹ extra grain and straw yield respectively over no use of zinc. application of sulphur upto 60 kg ha⁻¹ significantly increased the content and uptake of nutrients (NPKS) by grain and straw. Use of zinc upto 5 kg ha⁻¹ significantly increased the content and uptake of nutrients (NPKZn).

Keywords: Sulphur, Zinc, Phorate and Carbofuran.

SUPERIMPOSITION OF ORGANIC SOURCES OF MANURES TO ENHANCE GROWTH, YIELD ATTRIBUTES AND YIELD OF SCENTED RICE (ORYZA SATIVA L.) AND ITS IMPACT ON SOIL HEALTH

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An experiment was conducted during *kharif* 2012 and 2013 at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) in scented rice (*Oryza sativa* L.). Data revealed that superimposition of organic sources on RDF significantly increased growth and yield attributing characters viz., plant height, number of tillers per plant, dry weight per plant and leaf area and length of panicle, panicle weight, number of grains per panicle and 1000 grain weight of scented rice than control (RDF). Superimposition of organic sources of neem cake @ 3 t ha⁻¹ over RDF produced significantly higher grain (53.60 and 54.76 q ha⁻¹) and straw (83.33 and 84.20 q ha⁻¹) yield than all other treatments except T₈ (RDF + FYM @ 12 t ha⁻¹) and T₉ (RDF + Vermicompost @ 6 t ha⁻¹) where it showed at par with each others during both the years. The magnitude of increase in yield an average as assess to 53 percent over the control. The superimposition of organic sources of manures significantly enhanced organic carbon content and available NPK in soil after harvest of crop. The significant higher organic carbon (OC) and available NPK in soil after harvest of crop was recorded by RDF + neem cake @ 3 t ha⁻¹ which followed by T₈ (RDF + FYM @ 12 t ha⁻¹) and T₉ (RDF + Vermicompost @ 6 t ha⁻¹). However, significantly lowest OC and available NPK in soil after harvest of crop was recorded by RDF only (T₁).

Keywords: Scented rice, superimposition, FYM, vermicompost neem cake, yield, grain and soil health.

SUPERIMPOSITION OF ORGANIC SOURCES OF MANURES TO ENHANCE YIELD AND QUALITY PARAMETERS OF SCENTED RICE (ORYZA SATIVA L.) IN INDO-GANGETIC PLAIN ZONE

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An experiment was conducted during *kharif* 2012 and 2013 at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) in scented rice (*Oryza sativa* L.). Data revealed that superimposition of organic sources of neem cake @ 3 t ha⁻¹ over RDF produced significantly higher grain (53.60 and 54.76 q ha⁻¹) and straw (83.33 and 84.20 q ha⁻¹) yield than all other treatments except T₈ (RDF + FYM @ 12 t ha⁻¹) and T₉ (RDF + Vermicompost @ 6 t ha⁻¹) where it showed at par with each others during both the years. The magnitude of increase in yield an average as assess to 53 percent over the control. The superimposition of organic sources of manures significantly enhanced quality parameters viz., kernel length, kernel breadth, length and breadth ratio and hulling (%), milling (%) and head rice recovery (%) than the control. The physical quality of rice grain such as hulling (77 %) milling (74.33 %) and head rice recovery (54.28 %), length of kernel (9.55 mm), breadth of kernel (1.79 mm) and length and breadth ratio (5.33 mm) responsible for high quality was improved by application of RDF + neem cake @ 3 tonnes ha⁻¹ along with higher production. The aroma was not estimated owing to non-availability of such sophisticated tactic.

Keywords: Scented rice, superimposition, FYM, vermicompost neem cake, yield, grain quality.



AGROBACTERIUM-MEDIATED TRANSFORMATION AND IN VITRO REGENERATION OF RICE (ORYZA SATIVA) PLANTS**Shilpy Singh, Pushpendra Kumar, Vivek Rana and Aastha**

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Rice is the most important staple food for a large part of the world's population. Its production needs increase to meet the predicted demands of increasing population. Studies related to the *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 rice varieties. A number of factors 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. A protocol for Agrobacterium-mediated transformation was developed for rice plant. Transformation was carried out using disarmed *A. tumefaciens* strain LBA4404 harbouring a pCambia1301 vector. Sequencing of plasmid DNA extracted from this strain indicated that it contains a CaMV35S promoter and nopaline synthase (NOS) terminator, hygromycin phosphotransferase (hpt) and β -glucuronidase (GUS) genes, as selectable and marker genes, respectively. The factors that affect transformation/regeneration protocols were optimized in a series of experiments. Results indicated that exposure of explants to Agrobacterium inoculum of 0.8 O.D₆₀₀ for 30 mins, selection on Hygromycin containing medium (Hygromycin concentration of 35mg/L) and subsequent regeneration on MS medium supplemented with 2.0mg/L BAP and 0.5mg/L IAA resulted in transformation efficiency of 13%. GUS expression was observed in transformed rice shoots but never in the control plants. PCR amplification of DNA extracted from the transformed tissues demonstrated the generation of the expected amplicon. This result strongly verifies the successful transformation of the rice cultivars. Moreover, this protocol paves the way for problem solving-applications encompassing other crops of economic importance.

NITROGEN RELEASE PATTERN AND USE EFFICIENCY OF NEEM COATED UREA UNDER DIFFERENT APPLICATION SCHEDULE IN RICE (ORYZA SATIVA L.)**Shrman Kumar Patel, Yogesh Kumar, Atin Kumar**

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A field experiment was conducted during *kharif* season of 2016 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to evaluate the nitrogen release pattern and use efficiency of neem coated urea under different application schedule in rice (*oryza sativa* L). The soil of the experimental field was well drained, sandy loam in texture, alkaline in reaction (pH 8.03), low in available nitrogen, medium in available phosphorus and available potassium with an electrical conductivity of 0.21 dS m⁻¹. Eleven treatments comprising control (No N), 50:25:25 N, 33:33:33 N, 25:25:50 N, 25:50:25 N, 00:50:50 N, 00:75:25 N, 00:25:75 N, 50:50:00 N, 50:00:50 N through neem coated urea as basal, at maximum tillering and panicle initiation stage and LCC based (≤ 4 critical value) replicated thrice estimated in a randomized block design. The experimental results revealed that growth attributes (plant height, number of tillers and dry matter accumulation), yield attributing traits (grains panicle⁻¹ and test weight), yields viz., grain, straw and biological and uptake of nitrogen, phosphorus and potassium in rice differ significantly among different treatments and were maximum with the application of 25% N as basal, 50% at maximum tillering and 25% at panicle initiation stage. Application of 50% N as basal and rest through LCC (≤ 4) critical value improved the organic carbon of soil. Therefore application of 25% N as basal, 50% at maximum tillering and 25% panicle initiation stage, proved to be better for achieving higher yield and maintaining the nutrient status of soil. The rice also accumulated significantly higher nitrogen in grains, straw as well as total (69.65, 59.04 kg ha⁻¹ and 128.69 kg ha⁻¹, respectively) in this treatment.

Keywords: Neem coated urea, nitrogen, yield, uptake, growth attribute, etc.**STUDY OF SOCIO-PERSONAL, ECONOMIC CHARACTERISTICS, KNOWLEDGE LEVEL AND CONSTRAINTS FACED BY VEGETABLE GROWERS IN MAU DISTRICT OF UTTAR PRADESH, INDIA****Ramvinay Pal^{1*}, D.K. Singh², Ankit Singh Yadav², Angad Prasad³, Shalu Kumar⁴, P.D. Chendge⁴ and B.G. Desai⁴**¹Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh²Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh³Central Agricultural University Iroisemba, Imphal, Manipur⁴Dr. B.S. Konkan Krishi Vidyapeeth (Agricultural University), Dapoli, Maharashtra

The present study was conducted in Mau district of Uttar Pradesh state. The main objective of this study to analysed the knowledge level of vegetable growers about recommended vegetable practices. The Mau district consists of nine blocks. Out of which two blocks namely Ranipur and Kopaganj were selected. Among these, four gram panchayats from Ranipur block and four gram panchayats from Kopaganj block were purposefully selected. Eight villages were selected from the selected gram panchayats by using simple random sampling technique and a sample of 80 vegetable growers was selected from these villages by using simple random sampling with proportion to the size of sample in the selected villages. An interview schedule was developed consisting of measuring devices of knowledge level. The result regarding socio-economic status of vegetable Growers showed that maximum no. of vegetable growers (53.75 %) had middle age group, followed by (22.50 %) high school, (88.75 %) backward caste, (48.75 %) large family size, (58.75 %) joint family structures, (100.00 %) married, (43.75 %) one organization, (43.75 %) small size group, (72.50 %) electric motor, (77.50 %) used cycle for transportation, (50.00 %) mixed house, (73.75 %) small dairy, (68.75 %) electric connection available at home and farm, (72.50 %) used electric tub well for irrigation, (47.50 %) sale vegetables production in local market, (38.75 %) income group of 25,001 to 50,000 per annum, (37.50 %) medium socio-economic status. The study indicated 50.00 per cent of vegetable growers were having medium knowledge level about vegetable cultivation practices and 31.25 per cent respondents were having high knowledge level, whereas 18.75 per cent of respondents were having low knowledge level about recommended cultivation practices of vegetable. The major findings of the study was (93.75%) respondents express the unavailability of Govt. information centers as major constraints



faced by vegetables growers, followed by (91.25%) lack of knowledge about plant protection measures, lack of storage facilities (90%), (87.50%) untimely availability of electricity, (85.00%) high prices of chemical and fertilizers, (83.75%) new seeds, higher effects of disease, pest (78.75%), poor roads and transport facility (75.00%), unavailability of critical inputs on Govt. sales centres (73.75%), (67.50%), (65.00%), (60.00%), (56.25%) and (46.25%) lack of proper marketing facility, crop damage from wild animals, hardworking and higher risk, poor seed germination and lack of knowledge about improved varieties, respectively.

PROBLEM AND STRATEGIES OF SUMMER VEGETABLE CULTIVATION IN INDIA

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Warm-season vegetables are most easily damaged by cold temperatures. For this, they are planted outdoors only after the last chance of frost in the spring. Many vegetables require a long growing season to produce fruit and need to be plant as soon as possible to avoid effects of extreme heat in summer. For warm season vegetables, hot conditions are favored for fruit development but restrict flowering and pollination. Vegetable crops are very sensitive to climatic vagaries and sudden rise in temperature at any phase of crop growth can affect the normal growth, flowering, pollination, fruit development. High temperatures can cause significant losses in tomato productivity due to reduced fruit set, and smaller and lower quality fruits. In pepper, high temperature exposure at the pre-anthesis stage did not affect pistil or stamen viability, but high post-pollination temperatures inhibited fruit set. Development of genotypes tolerant to high temperature, moisture stress through conventional, non-conventional breeding techniques, genomics and biotechnology etc. are essentially required to meet summer challenges. Summer vegetable cultivation includes water conservation, increase water absorption, reducing the loss of soil moisture, mulching, use of drip irrigation facilities and use of growth regulators and chemicals. Variety requirements for summer season cultivation are short-stemmed varieties with limited leaf surface minimize transpiration, deep, prolific root systems enhance moisture utilization and quick-maturing varieties are important.

Keywords: Summer Vegetables, India, Problem, Strategies.

NOODLES PROCESSING AND ITS NUTRITIONAL PROPERTIES

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Noodles are one of the staple foods consumed in many Asian countries. Instant noodles have become internationally recognized food, and worldwide consumption is on the rise. The properties of instant noodles like taste, nutrition, convenience, safety, longer shelf-life, and reasonable price have made them popular. Quality factors important for instant noodles are color, flavor, and texture, cooking quality, rehydration rates during final preparation, and the presence or absence of rancid taste after extended storage. Noodles based on wheat are prepared mainly from three basic ingredients; flour, water, and salt. The basic process of dough mixing, sheet forming, compounding, sheeting/reduction, and cutting are essentially constant for all machine-made noodles. Instant noodles are consumed in more than 80 countries and have become internationally recognized food. Noodle industry supplies 95.4 billion servings annually to consumers throughout the world, and the demands are on the rise. Worldwide, China ranks first in the consumption of noodles followed by Indonesia, Japan, and Vietnam according to the world instant noodle association. Noodle processing typically comprises mixing raw materials, resting the crumbly dough, sheeting the dough into two dough sheets, compounding the sheets into one, gradually sheeting the dough into a specified thickness, and slitting into noodle strands. For instant noodles preparation, strands are steamed and dehydrated by drying or frying followed by cooling and packaging with the seasonings. Quality factors important for instant noodles are color, flavor, texture, cooking quality, rehydration rates during final preparation, and the presence or absence of rancid taste after extended storage. Sensory evaluation of noodles is carried out to judge the quality and acceptability of the final product.

Keyword: Noodles, Processing, Quality, Nutritional properties.

UTILIZATION OF DISTILLERY EFFLUENT FOR AGRICULTURAL PURPOSE OF MUNGBEAN (*VIGNA RADIATA* CV TYPE-44)

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he present study was conducted to observe the impact of exposure of different concentrations of distillery effluent (10,20,50 and 100%) on soil and Mungbean plants. The soil pH was slightly decreased after the treatment of soil with effluent due to acidic nature of effluent. There was an increment in the available N, P, K of soil with the increasing conc. of effluent. The higher concentration (>50%) of distillery effluent were detrimental to all Mungbean plants, while <20% concentrations of effluent show beneficial effect on all treated plants. Low concentrations (up to 15%) on contrary to higher ones, promotes the germination, growth and yield parameters of plants. So, the present study suggested that distillery effluent might be used as liquid fertilizer for certain crops after proper dilution with water.

Keywords : Effluent, Yield, Parameter, Growth, Fertilizer.



UTILIZATION OF GINGER (*ZINGIBER OFFICINALE* L.) JUICE IN THE MANUFACTURE OF FLAVOURED MILK**Balasaheb M. Waghmode., Poonam Naik* and V. S. Dandekar**

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The present investigation was conducted at Dairy Laboratory of Department of Animal Husbandry and Dairy Science, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra to determine the utilization of ginger juice for manufacture of flavoured milk. In this investigation, ginger juice was used for fortification at the level of 0.0, 2.0, 4.0 and 6.0 per cent. The milk without addition of fruit flavour was termed as control. Besides it was also tried to use sugar levels at the rate of 5, 7.5 and 10 per cent to find out the optimum sweetness of flavoured milk. Thus, there were total 12 treatment combinations. The trial was conducted with 5 replications. Results showed that fat, protein, total solid, titratable acidity and ash content of flavoured milk varies significantly with the values of 0.514, 0.524, 0.536 and 0.540 per cent, of 3.283, 3.246, 3.233 and 3.136 per cent, 15.993, 15.936, 15.863 and 15.146 per cent, 0.149, 0.155, 0.156 and 0.164 per cent and 0.796, 0.785, 0.775 and 0.765 per cent at 0, 2, 4 and 6 per cent level of ginger juice, respectively. Whereas, chemical composition of flavoured milk viz., fat, protein, total solid, titratable acidity and ash content of flavoured milk after inclusion of sugar at 5.0, 7.5 and 10.0 per cent level as 0.541, 0.529 and 0.521 per cent, 3.300, 3.227 and 3.147 per cent, 13.847, 15.725 and 17.632 per cent, 0.153, 0.157 and 0.159 per cent and 0.789, 0.778 and 0.774 per cent, respectively. From sensory quality viz., Colour and Appearance, Flavour, Consistency and Overall acceptability maximum score recorded blended with 4.0 per cent ginger juice as 7.50, 7.41, 7.55 and 7.488, respectively. The cost for recommended level of flavoured milk i.e. 4 per cent ginger juice and 10 per cent sugar was INR 54.28 per lit. From results of the present investigation it may be concluded that the ginger juice could successfully be utilized for preparation of flavoured milk. Addition of ginger juice in flavoured milk improved sensory quality and acceptability of the product. For fortification of flavoured milk the optimum level of ginger juice and sugar was found to be 4 per cent and 10 per cent, respectively.

“BALANCED USE OF NUTRIENTS FOR HIGH CROP YIELD AND QUALITY OF RICE (*ORYZA SATIVA* L.) IN CENTRAL ALLUVIAL SOIL OF UTTAR PRADESH”**Vivek Kumar Trivedi, M. R. Pandey and Gautam Veer Chauhan***

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The field experiment on rice crop was conducted at Nawabganj Research farm in field No.-96, C.S.A. University of Agriculture & Technology Kanpur, during *Kharif* season 2013. The doses of experiment were 50% NPK, 50% NPK + S40, 50% NPK + S40 + Zn5, 50% NPK + Zn5, 100% NPK, 100% NPK + S40, 100% NPK + Zn5 and 100% NPK + S40 + Zn5. The results showed that the grain yield varied from 29.5 to 45.50 q ha⁻¹ and straw yield from 60.50 to 98.50 q ha⁻¹. The N content in grains ranged from 1.42 to 1.50%, P from 0.32 to 0.38%, K from 1.24 to 1.32%, S from 0.20 to 0.25% and Zn from 13.0 to 18.0 mg kg⁻¹. The N content in rice straw ranged from 0.22 to 0.28%, P from 0.17 to 0.24%, K from 0.35 to 0.44%, S from 0.10 to 0.14% and Zn from 27.0 to 40.0 mg kg⁻¹. It was noted the N uptake varied from 55.21 to 105.82 kg ha⁻¹, P from 19.72 to 40.92 kg ha⁻¹, K from 85.34 to 150.04 kg ha⁻¹, S from 11.95 to 25.16 kg ha⁻¹ and Zn from 201.65 to 473.15 g ha⁻¹. The starch content varied from 65 to 70%, amylase from 28 to 34% and amylopectin from 66 to 72%. The treatment T₉ (100% NPK + S40 + Zn5) gave the best results in terms of yields, nutrient content, uptake values and crop quality.

Keywords: NPK, grain yield, straw yield, nutrient content, uptake, Zn & S**EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON PERFORMANCE OF DIRECT SEEDED RICE AND SOIL HEALTH IN RICE - WHEAT ROTATION****Robin kumar, Vivak kumar and Ashish Driwedi**

Since systematic studies have been conducted on field crops especially on rice and wheat and considering the problem associated with the flood irrigation and importance of residue incorporation for sustainability of rice-wheat system and soil health particularly in puddled condition, the present investigation was carried during *kharif* 2012 and 2013 to study the effect of fertigation and residue management on soil health and performance of direct seeded rice in rice - wheat rotation. Ten treatments consisting fertigation (5) and residue management (2) were tested in a split plot design with three replication considering irrigation techniques as a main plot and residue management sub plot. The soil of experimental field was alkaline in reaction with 0.33 percent organic carbon, 180 kg ha⁻¹ available nitrogen and 47 kg ha⁻¹ available phosphorous and 346 kg ha⁻¹ potassium. Hybrid rice variety Arize 6129 was sown as a test crop. Data were recorded for growth, yield, plant were analyzed for N, P, K to workout uptake and some chemical, physical and biological properties were determined. Available data were subjected to statistical analysis on which basis treatments effect were explained. Results reveal that grain, straw, N and K content was significantly higher with drip fertigation while no effect was found in case of grain P content. Periodic availability of N and K was significantly higher with drip fertigation than the other combination. However, P availability remained unaffected during both the years. Soil reaction, salt concentration also remained unaffected during both the years. Measured physical properties after rice harvest viz bulk density at various depths and infiltration also remained unaffected due to different combination. A significant interaction effect of fertigation and residue management on grain yield of rice was found. Significantly higher water use efficiency than the remaining combinations were found with drip fertigation. Water use efficiency was lowest with flood RDF. Grain and straw yield, grain and straw nutrient content and availability of nutrients in soil. Infiltration rate, bulk density and water use efficiency increased significantly with residue incorporation while soil reaction and salt content remained unaffected. The net return and benefit cost ratio was higher with drip fertigation. The study reveal that drip irrigation coupled with fertilizer application could be option of precise nutrient and water management of direct seeded rice since it yielded more with higher benefit cost ratio.



EFFECT OF LEAF EXTRACTS ON GROWTH OF *MYROTHECIUM RORIDUM* CAUSES LEAF SPOT OF COTTON.**S.K.Arsia and Mukesh Dongre**

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Ten aquas leaf extracts of different botanicals were evaluated in laboratory against on *M. roridum* radial growth at different concentration viz. 10, 15, 20, 25 and 35 %. The growth of pathogen varied significantly with all the botanical extracts after seven days of inoculation and found that inhibition of mycelial growth of *M. roridum* increased with increase in concentration of fungicides significantly. Among the leaf extracts minimum growth (13.4 mm) was obtained in treatment Subabool leaf extract followed by Tulsi leaf extract (16.60 mm), Lantana leaf extract (17.30 mm) and Meethineem leaf extract (19.50 mm) which were significantly over other treatments and control (35.06 mm). Subabool leaf extract was showed minimum radial growth at 35 % concentration while the Meetha neem leaf extract did so at rest of the concentrations.

EFFECT OF DIFFERENT SPACING ON SNAPDRAGON (*ANTIRRHINUM MAJUS* L.) CV. AFRICAN MIX**Ram Lakhan Maurya, Ashok Kumar, Vivak Ujjwal and Manoj Kumar**

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Snapdragon is an important annual grown in the winter season, though traditionally they cultivated as perennial, due to its curious shape of flowers, which resemble a dog, rabbit or dragon, so it is popularly called as snapdragon, dog flower, bunny rabbit or bunny mouth. It is ideally suited for beds, pots, edging, window boxes, rockens and mixed borders or with herbaceous plants. Snapdragon flowers used as cut flower, floral arrangements and in bouquets. Antirrhinum belong to the family *Scrophulariaceae* Juss. Snapdragons may be propagated by seeds, or by cuttings which root readily. The seed germinates in 10 to 14 days at 70-degrees F. Growth and flower production in snapdragon is affected by spacing. Closer spacing provides more number of plants but deteriorates the quality of flower and reduce yield. Optimum spacing provides optimum population of plants and better quality of flower and higher yields. Wider spacing provides less number of population and best quality but lower yield, so it is necessary to transplant at appropriate spacing. The experiment was laid out in Randomized Block Design (factorial) with 3 levels of spacing (30×10 cm, 30×20 cm and 30×30 cm) to studies the effect on snapdragon. It can be concluded from the overall experimental findings that Closer spacing (30×10 cm) enhanced plant height, number of spike/ha. and yield of spike/ha. However, wider spacing (30×30 cm) resulted more spread, number of branches and leaves per plant. Flowering behavior and quality of spike and vase life enhanced in wider spacing 30×30 cm planting distance.

IN VITRO EFFICACY OF DIFFERENT BIO AGENT AND PLANT EXTRACT MANAGEMENT OF WILT CAUSING PATHOGENS OF CHICKPEA DISEASE**Satish Chand, Kamal Khilari, Sachin Kumar Jain, Mukesh, and Abhishek Kumar**

Department of Plant Pathology

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Chickpea (*Cicer arietinum* L), wilt caused by *F. oxysporum* f. sp. *Ciceri*, *Sclerotium rolfsii*, and *Sclerotinia sclerotiorum* is the most destructive disease in India and also first reported from India in 1918. It is seed-borne as well as soil-borne pathogens. Yield losses vary between 10% to 100% depending on varietal susceptibility and agroclimatic conditions. The results concluded that significantly highest mycelia growth inhibition of the target pathogen *F. oxysporum* f. sp. *ciceris* was recorded with *Trichoderma harzianum* (62.06 %), followed by *Pseudomonas fluorescens* (55.70 % at 9 days after inoculation. Whereas, plant extract significantly highest mycelial growth inhibition was recorded with *Parthenium leaf extract* 10 % (38.19%) hoverer, *Sclerotium rolfsii* the highest mycelia growth inhibition was recorded with *Trichoderma harzianum* (74.11 %), followed by *Pseudomonas fluorescens* (69.22 %) whereas, significantly highest mycelial growth inhibition was recorded with Bael leaf extract 10% (57.77%) Incase of test pathogen *Sclerotinia sclerotiorum* significantly highest mycelial growth inhibition of the target pathogen over control was recorded with *Pseudomonas fluorescens* (77.74 %), followed by *Chaetomium globosum* (75.22%) whereas, highest mycelia growth inhibition was recorded with Bael leaf extract 10% (68.88%).

TECHNO-ECONOMIC EVALUATION OF DIFFERENT SEEDING TECHNIQUES FOR WHEAT CROP IN RICE-WHEAT CROPPING SYSTEM**Vivak Kumar¹, Jaivir Singh² and Robin Kumar³**^{1, 2} Assistant Professors, Deptt of AEFT, SVPUA&T, Meerut-250110 ³ Research Associate IIFSR, Meerut.

Conventional tillage and sowing methods in rice-wheat (*Oryza sativa* L.- *Triticum aestivum* L.) system in the Indo-Gangetic Plains (IGP) requires a large amount of costly inputs which are increasingly becomes scarce and expensive. We attempted to evaluate alternatives that would require small amount of these costly inputs. A field experiment was conducted at the instructional farm of SVPUA&T, Meerut (UP), India for 3 years to evaluate various seeding techniques in wheat crop for their machine performance, grain yield, energy use and economic profitability. The yield of wheat was significantly higher in rotovator as compared to FIRB. However, no significant difference in crop yield was observed in all other techniques. In zero tillage technique, total energy requirement was considerably less (>2000 MJ/ha) as compared to conventional practice of sowing wheat crop. Rotovator gave highest wheat productivity (4.34 t/ha) in all the combination of tillage followed by reduced, zero tillage and conventional line with lowest and significantly lower (3.97 t/ha) in FIRB system of wheat cultivation. Net income (US \$/ha) was also higher in rotovator 873, followed by reduce tillage 828, zero tillage 817 as compared to the conventional practice 711.



MANAGEMENT OF RICE ROOT KNOT THROUGH PLANT EXTRACTS**Mukesh, sunil kumar arsia, satish chand, sachin kumar jain**

Rice (*Oryza sativa* L.) is the world's most important food crop of Asian origin. It is an indispensable source of calorie for almost half of the world population with in Asia. Nematodes are small unsegmented worms live in water, soil, plants and animals. Plant parasitic nematodes are mostly microscopic. It causes significant damage for almost all crops. Nematicidal activity of extracts from plants was assayed against *Meloidogyne graminicola*. In pot experiment extracts from Neem (*Azadirachta indica*), Bael (*Aegle marmelos*), Jatropa (*Jatropha curcas*), Eucalyptus (*Eucalyptus globus*), Sahjan (*Moringa oleifera*), Ber (*Ziziphus mauritiana*), Sarifa (*Annona reticulate*), Congress grass (*Parthenium argentatum*) were most effective in killing the nematode. The extracts Neem, Bael, Jatropha, Eucalyptus and Congress grass leaf extracxts were found significantly increased Shoot length, Root length (cm.) and Root weight (gm.) and reduced root gall in different concentration 100% and 50%. The 100% plant leaf extracts of Neem and Bael showed highest significantly increased plant growth parameters of shoot length 30.23 and 29.50 (cm.), root length 54.00 and 51.33 (cm.), root weight 0.66 and 0.43 (gm.) and highest significantly reduction of root gall 22.66 and 35.33 as compared to treatment (T₁ - Nematode alone). The use of organic amendment will act as an asset to control environmental pollution.

STUDIES ON SELECTION PARAMETERS FOR YIELD IMPROVEMENT IN TUBEROSE (*POLIANTHES TUBEROSA* LINN.)**Mohit Chaudhary, Sunil Malik, Vivak Ujjwal, Manoj Kumar Singh and Ashish Kumar,**

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In the present study “Studies on Selection Parameters for Yield Improvement in Tuberose (*Polianthes tuberosa* Linn.)” was carried out during 2015-16 at Horticultural Research Centre, Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India. In the present investigation, twenty-two genotypes were undertaken to examine the genetic variability, genetic advance, correlation coefficient, path coefficient analysis. 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 bulbs, 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. 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, Nirantra Extension, Pragya Culum, Arka Nirantra for getting desired segregates from breeding point of view.

ROLE OF CLUSTER FRONT LINE DEMONSTRATION ON TRANSFER OF KULTHI (HORSE GRAM) PRODUCTION TECHNOLOGIES IN KOREA DISTRICT OF CHHATTISGARH**Sandeep Sharma and R.S.Rajpoot**

Krishi Vigyan Kendra, Korea

Krishi Vigyan Kendra conducted cluster front line demonstration on Kulthi variety Indira Kulthi at farmers fields in different villages of Korea district. during years 16-17 in the Kharif season with 100 frontline demonstrations on Kulthi covering an area of 40 hectare in Korea district of Chhattisgarh to exhibit latest production technologies and compared it with farmer's practice. The results were compared between CFLD plots and control plots. From the Cluster front line demonstrations, it was observed that the improved Kulthi variety Indira Kulthi recorded the higher average yield 5.05 q/ha compared to the farmers' practice variety 2.64 q/ha in the year 2016-17, respectively. The extension gap, technology gap and technology index were recorded 2.41 q/ha, 3.5 q/ha and 40.93%, respectively. The increment in yield of Kulthi crop under Cluster frontline demonstrations was due to spreading of improved and latest technology viz. seed treatment with fungicide, seed inoculation with biofertilizers, recommended seed rate, yellow vein mosaic (YVM) resistant variety, line sowing, proper dose of fertilizers and plant protection measures. Improved technologies gave higher mean net return of 17190 per hectare with a benefit cost ratio 3.93 as compared to farmer's practice 6770 per hectare benefit cost ratio 2.32.

BIOTOXIC IMPACT OF HEAVY METALS ON GROWTH, OXIDATIVE STRESS AND MORPHOLOGICAL CHANGES IN ROOT STRUCTURE OF WHEAT (*TRITICUM AESTIVUM* L.) AND STRESS ALLEVIATION BY *PSEUDOMONAS AERUGINOSA* STRAIN CPSB1**Asfa Rizvi, Mohd. Saghir Khan**

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Rapid industrialization and uncontrolled metal discharge into environment is a global concern for crop production. Metal tolerant bacterium isolated from chilli rhizosphere was identified as *Pseudomonas aeruginosa* by 16S rDNA sequence analysis. *Pseudomonas aeruginosa* tolerated high concentrations of Cu ($1400 \mu\text{g ml}^{-1}$), Cd ($1000 \mu\text{g ml}^{-1}$) and Cr ($1000 \mu\text{g ml}^{-1}$). *Pseudomonas aeruginosa* CPSB1 produced multiple plant growth promoting biomolecules in the presence and absence of metals. Strain CPSB1 solubilized P at $400 \mu\text{g ml}^{-1}$ of Cd, Cr and Cu. The strain was positive for indole-3-acetic acid (IAA), siderophores, hydrogen cyanide (HCN), ammonia (NH_3) and 1-aminocyclopropane-1-carboxylate (ACC) deaminase when grown with/without metals. The phytotoxic effects on wheat increased with increasing Cd, Cr and Cu rates. The *P. aeruginosa* CPSB1 inoculated wheat in contrast had better growth and yields under Cu, Cd and Cr stress. The root dry biomass of inoculated plants was enhanced by 44, 28 and 48% at $2007 \text{ mg Cu kg}^{-1}$, 36 mg Cd kg^{-1} and $204 \text{ mg Cr kg}^{-1}$, respectively. The bioinoculant enhanced number of spikes, grain and straw yields by 25, 17 and 12%, respectively. *Pseudomonas aeruginosa* CPSB1 significantly declined the levels of catalase (CAT), glutathione reductase (GR) and superoxide dismutase (SOD), proline and malondialdehyde (MDA), and reduced metal uptake by wheat. The study demonstrated that *P. aeruginosa* CPSB1 possessed plant growth promoting potentials, showed metal tolerance capability and had ability to counteract deleterious metal impacts. Due to these, *P. aeruginosa* CPSB1 could be used as bioinoculant for enhancing wheat production even in metal contaminated soils.

RESPONSE OF NITROGEN, PHOSPHORUS AND POTASSIUM ON GROWTH, FLOWERING AND BULB YIELD OF TUBEROSE (*POLIANTHUS TUBEROSA* L.) CULTIVAR SINGLE

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An experiment was carried out at Instructional Cafeteria Unit (ICU), KVK Hastinapur, Sardar Vallabhbhai Patel, University of Agriculture & Technology, Meerut. During 2014-15. To study the response of NPK on growth, flowering and bulb yield of tuberose (*Polianthus tuberosa* L.) cultivar Single. The results of the study indicated that increasing NPK levels resulted in superior vegetative growth, flowering and yield of bulbs. The treatments comprise three levels of N (150,200,250Kg N/ha), P (150,200,250Kg P/ha) and K (150,200,250Kg P/ha) in a Randomized Block Design (RBD) with factorial concept replicated thrice. The result revealed that for higher field or spike and bulbs tuberose could be nitrogen at 200 kg per hectare, phosphorus at 150 kg per hectare and potassium at 150 kg per hectare gave maximum of leaves per plant, plant height, number of spikes per plant, spike length, rachis length, number of florets per spike, period of flowering, number of bulbs/clump and weight of bulbs/clump was at par with that of treatments. Flowering was advanced by control (upto 50 kg N/ha) and delayed by the higher levels (100 kg N and above). Nitrogen in the leaf was increased with the increased level of nitrogen. But phosphorus and potassium content in the maximum number of tillers per plant (3.85), number of bulbs/clump (15.40) and diameter of largest bulb (4.03 cm) were recorded under the treatments.

EFFECT OF CHEMICALS ON POSTHARVEST LIFE AND QUALITY OF CUT ROSES (*ROSA HYBRID* L.) CULTIVAR FIRST RED

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An experiment was conducted to assess the Influence of chemicals on postharvest life and quality of cut roses (*Rosa hybrid* L.) cv. First Red at Horticulture Research Centre (HRC), Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110 (U.P.) during the Rabi season 2012-13. The fresh flowers are using five different stages with preservative chemicals. At half open stage, silver nitrate 150 ppm + sucrose 2% and silver nitrate 300 ppm + sucrose 3% extended the vase life to maximum (12 days) while at full open stage, silver nitrate 200 ppm + sucrose 2% and silver nitrate 300 ppm + sucrose 3% extended the vase life to maximum (10 days) the postharvest life of cut rose. Higher level of turgidity influences development of flower buds to half open maturity and normal metabolic activity in the rose cut flowers. The turgidity in plants and flowers is dependent on the balance between water utilization or less and water supply. None of the chemicals could significantly influence the postharvest life and quality of flowers at bud stage. Most of the chemicals improved water losses and water uptake ratio over control.

RESPONSE OF PRUNING IN CANOPY MANAGEMENT & HIGH DENSITY PLANTING IN GUAVA ORCHARD UNDER WESTERN UTTAR PRADESH CONDITION.

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The current study was conducted to examine the response of pruning in canopy management and high density planting in Guava orchard under Western Uttar Pradesh condition. Observation revealed that the with pruning and high density with plant spacing (from 3.0 X 3.0 M) increased in yield significantly. Similarly, with increase in spacing wise pruning in canopy management and high density was need to increased. Plant growth in term of stock girth (47.20 cm) of *P. guajava* cv. Florida seedless and scion girth (44.7 cm) of *P. guajava* cv. Allahabad seedless, tree spread (N - S) and canopy volume increased with the plant spacing (3.0 X 3.0M), while tree height decreased. To increase in plant spacing, number of fruits per plant, yield per plant and fruit density was higher at 3.0 X 3.0M and least in 6.0X6.0M plant spacing. Pruning in canopy management



and high planting density was found to be better owing to maximum absorption of solar radiation and optimum microclimate in the orchard leading to better yield in plants, higher fruit density and yield efficiency, However yield per hectare was maximum 3.0 X 3.0 M spacing in during rainy season and in 6.0 X 3.0 M spacing during winter.

MANAGEMENT OF CERCOSPORA LEAF SPOT OF GREENGRAM BY USING DIFFERENT FUNGICIDES

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A field experiment was conducted at RARS, Lam, Guntur, Andhra Pradesh during *khari*f and *rabi* 2015-16 to evaluate the efficacy of different fungicides on Cercospora leaf spot of greengram. The fungicides namely, Kresoxim methyl (0.05%), Carbendazim(0.1%), Propiconazole (0.1%), Azoxystrobin (0.05%), Hexaconazole + Captan (0.15%), Copper oxychloride (0.3%), Trifloxystrobin + Tebuconazole (0.05%) and untreated check (water). Among the fungicides evaluated, minimum disease index (17.24%) and maximum disease control (71.73%) and good mean (Benefit Cost) B:C ratio (2.53) was observed with foliar application of Propiconazole (0.1%). Hexaconazole + Captan (0.15%) and Trifloxystrobin + Tebuconazole (0.05%) also given best results after propiconazole (0.1%).

SCREENING OF DIFFERENT GREENGRAM GENOTYPES AGAINST CERCOSPORA LEAF SPOT DISEASE

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The present experiment was carried out on greengram genotypes to evaluate their reaction to Cercospora leaf spot disease during the year 2015-2016 in natural field conditions at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. Disease severity data was collected by adopting standard scales (1-9) of All India Coordinated Research Project on MULLaRP (Alice and Nadarajan, 2007). The disease score ranged from 1-7. Out of sixty one genotypes evaluated (*khari*f-51 and *rabi*-9) 12 were found as resistant, 16 were moderately resistant, 16 were moderately susceptible and 17 were found as susceptible. On the basis of these findings, the genotypes which showed resistant reaction may be used in breeding programme for the development of Cercospora leaf spot disease resistant varieties.

EFFECT OF PLANT HEIGHT UNDER PROTECTED CULTIVATION: ADAPTATION TO CLIMATE CHANGE

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Present study was conducted in 2014-15 at Vegetable Science experimental area of CCSHAU, Hisar. Tomato (*Lycopersicon esculentum* Mill.) is the most important, popular and remunerable vegetable crop, grown all over the world. In India, tomato occupies an area of 8.93 lakh ha with production of 191.6 lakh tonnes. However, production of Haryana was 6.66 lakhs tonnes from an area of 27.3 thousands hectare. It contains vitamins A and C, essential mineral and nutrients. Due to unfavourable climatic conditions, the availability of tomato becomes less in off-season. Present study reported that plants height was measured 30, 60 and 90 date after transplanting and it was found in low poly tunnel 26.8 cm, 64.6 cm and 92.2 cm with black polythene mulch and 25.0 cm, 61.7 cm and 87.4 cm with white polythene mulch whereas it was 19.4 cm, 52.8 cm and 68.2 cm under control conditions. While, plants height without low poly tunnel was 19.5 cm, 37.3 cm and 55.0 cm with black polythene mulch and 16.5 cm, 34.2 cm and 50.9 cm with white polythene mulch and height was 15.2 cm, 29.9 cm and 39.5, respectively under control conditions. So, it can be concluded that plant height can be increase with the help to provide artificial environment such as protected cultivation like low poly tunnels and mulching.

TOMATO CROP PRODUCTION UNDER PROTECTED CULTIVATION: ADAPTATION TO CLIMATE CHANGE

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Present study was conducted in 2014-15 at Vegetable Science experimental area of CCSHAU, Hisar (Haryana). Tomato (*Lycopersicon esculentum* Mill.) occupies an area of 8.93 lakh ha with production of 191.6 lakh tonnes and production of Haryana was 6.66 lakhs tonnes from an area of 27.3 thousands hectare. It contains vitamins A and C, essential mineral and nutrients. Considering its importance in daily diet and low returns per unit area in India, it is necessary to increase the production and productivity per unit area of the crop. Moreover, the demand for fresh vegetables is also increasing day by day in India. Due to unfavourable climatic conditions, the availability of tomato becomes less in off-season. Study reported that under low poly tunnel crop yield was 365.7 q/ha under black polythene mulch and 354.6 q/ha with white polythene mulch and yield was 283.7 q/ha under control conditions. In case of without low poly tunnel yield was 315 q/ha under black polythene mulch and 299.5 q/ha under white polythene mulch while crop yield was 234.4 q/ha under control conditions without low tunnel. Study concluded that yield can be increase with the help of artificial technique of protected cultivation like low poly tunnels and mulching. So, growers can get higher yield and increase the growing season.



RELATIVE PERFORMANCE OF SUGARCANE VARIETIES UNDER ALKALINE SOIL CONDITION IN EASTERN UTTAR PRADESH**Pal K., Singh K.K., Singh I.S. and Sharma B.L.**

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Sugarcane is an important field crop grown in the tropical and subtropical parts of the country. Alkalinity is major stress to the plants that can affect the physiological and biochemical process during reducing growth and yield of the crops. In this study to evaluate the performance of sugarcane varieties under alkaline soil condition, the field experiment was conducted at Genda Singh Sugarcane Breeding & Research Institute, Seorahi, Kushinagar, during autumn planting seasons for consecutive (2010-12 and 2012-14) three years. Eight promising sugarcane varieties viz., CoSe 03234, CoSe 98231, CoSe 95422, CoSe 01235, CoSe 01424, CoSe 01434, CoS 8432, and CoS 97261 were planted under soil having pH ranging from 7.5 to 8.2, EC 1.663 mmhos/cm at 25°C. The result revealed that in variety CoSe 01434 (42.62%) recorded higher germination percent than other and higher number of tillers was recorded in variety CoSe 01434 followed by CoSe 95422 and CoS 97261. Hence, variety CoSe 01434 was showed maximum number of millable cane followed by CoSe 95422 and CoS 97261. Two varieties CoSe 03234 and CoSe 01434 were found higher sucrose percent followed by others. Out of them which varieties, two varieties viz., CoSe 01434 and CoS 97261 were found higher yield than other varieties. It is concluded that varieties viz., CoSe 01434 and CoS 97261 have more potential and tolerant for better yield and quality under alkaline soil condition.

AGRONOMIC FORTIFICATION FOR QUALITY PRODUCE IN RELATION TO NUTRITIONAL SECURITY**Devendra Dambiwal, Kaluram Kumawat and Todar Mal**

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Agronomic fortification is the process of providing nutrients to plants (for example, by applying Zn and Fe-fertilizers to soil and foliar) appears to be important to ensure success of agronomic efforts for increasing nutrients concentration in grain. Foliar spray and use of some adjuvant markedly affect the agronomic effectiveness of foliar zinc fertilizers. Reducing pH from 8.3 to 5 increased grain zinc concentration up to 60–70% so that improving soil health. The largest increases in grain Zn concentration were found in the case of combined application of soil and foliar Zn fertilizers that caused more than a 3-fold increase in grain Zn. Recent reports indicate that nearly 500,000 children under 5 years of age die annually because of Zn and Fe deficiencies. Zinc is essential for several enzymes system that regulate vital metabolic reaction in the plant body. It is content of Carbonic anhydrase, Alcoholic dehydrogenase, Superoxide dismutase. Zinc is involved in the synthesis of indole acetic acid, metabolism of gibberellic acid and synthesis of RNA. Increasing the Zn concentration in food crop plants, resulting in better crop production and improved human health. Zinc deficiency is responsible for many severe health complications, including impairments of physical growth, immune system and learning ability, combined with increased risk of infections, DNA damage and cancer development. Maintenance of the adequate amount of readily available Zn in soils or high Zn concentrations in seeds ensure good root growth and contribute to protection against soil-borne pathogens. Replenishment of Zn is needed not only for improving Zn concentrations of edible parts of plants, but also for sustaining high yields. Recently observed an increase of 5–12% for grain Fe and 5–8% for grain Zn concentration with foliar application of micronutrient fertilizers under on-farm conditions (soils deficient in micronutrients). Zinc application through soil as well as foliar spray was comparatively studied in finger millet. The results indicated that soil application of ZnSO₄ @ 12.5 kg ha⁻¹ at the time of sowing enhances the grain yield by 13.3% grain zinc content by 8.95%, while foliar spray of ZnSO₄ @ 0.5% increased the grain zinc content by 10.2% and grain yield. It concluded that agronomic fortification gives better quality and quantity of nutrition in different crops. Enrichment of micronutrient (Fe and Zn) and biological availability (protein, starch, Carotene etc) in the grain and different edible part of crops. Sustainable soil health due to increasing and maintain level of micronutrient through soil and foliar application of micronutrients.

SUITABILITY OF CUT CORMS AS PLANTING MATERIAL ON GROWTH AND YIELD IN DIFFERENT GLADIOLUS (GLADIOLUS GRANDIFLORUS L.) VARIETIES**Swapnil Bharti, Urfi Fatmi, Upesh Chandrakar and V.Priyadarshini**

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The present investigation entitled, “Suitability of cut corms as planting material on growth and yield in different gladiolus (*Gladiolus grandiflorus* L.) varieties” was under taken in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during Rabi season (2016-2017). The experiment was laid out in Factorial Randomized Block Design (FRBD) with 12 treatments and each treatment replicated thrice. The treatments consist of different division of corms (Full, Half and one-third) and 4 varieties (Deepest Red, Jessica, Amsterdam and Esta Bonita). Early sprouting (5.98days), maximum plant height (68.67cm) and maximum number of leaves (7.20) was found when full corms were planted for Amsterdam variety. Number of florets per spike (14.83), diameter of daughter corms (65.16mm), weight of daughter corms (52.85g) per plant were found to be best in variety Amsterdam when full corms were planted whereas number of cormels (59.57) were found to be maximum in variety Deepest Red. Therefore based on the results obtained it can be concluded that full corms were better in terms of growth and corm size parameter whereas half and one third corms were found to be best in terms of daughter corm and cormels yield thereby increasing the planting to many folds in next season and ultimately providing benefit to the farmers.



VARIABILITY STUDIES FOR FODDER YIELD AND ITS RELATED TRAITS IN FORAGE SORGHUM**Ashok Kumar Dehinwal* and S. K. Pahuja**

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A study was made in *Sorghum bicolor* with line $\times$ tester (6 females $\times$ 4 males) to estimate the fodder yield and its component traits of different hybrids and parents under different environments. For this purpose, 24 specific cross combinations were developed by using 10 diverse parents during *kharif* season in 2014-15. These hybrids along with 10 parents and two standard checks (SSG 59-3 and MFSH 4) were evaluated at two locations (Hisar and Karnal) with early and late sowing during *kharif* season in 2015-16. The analysis of variance indicated the presence of variability among hybrids and their parents. Among the male parents HJ 541 (337.9 g) and G 46 (299.6 g) and in female parents 467A (407.1 g) and 56A (372.3 g) exhibited highest green fodder yield. Among male parents HJ 541 (90.0 g) and G 46 (87.5 g) and among female parents 56A (104.2 g) and 467A (105.4 g) showed highest dry fodder yield. Hybrid 465A $\times$ HJ 513 showed maximum green fodder yield (413.1 g) followed by 467A $\times$ G 46 (412.2 g), 9A $\times$ IS 2389 (370.8 g). This hybrid was also good for dry fodder yield (110.8 g), leaf length (76.5 cm) and leaf breadth (6.2 cm). Maximum dry fodder yield was recorded by the hybrid 467A $\times$ G 46 (114.6 g) followed by 465A $\times$ HJ 513 (110.8 g) and 9A $\times$ IS 2389 (109.6 g). This hybrid was also good for green fodder yield (412.2 g), leaf length (78.9 cm) and stem diameter (15.0 cm).

ANTHROPOMETRIC MEASUREMENT OF RURAL SCHOOL CHILDREN AGED 6-12 YEARS**Ruchi Pandey*, Rajesh Singh**, Sadhna Singh*, Dipti Giri***

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The present study was done to assess the nutritional status of rural school children of 6 to 12 years of Kumarganj town Faizabad district of eastern U.P. All students enrolled in two purposively selected primary schools of Kumarganj area constituted the sample. Out of the total (125) students 84.8 per cent were Hindu whereas, 15.2 percent were Muslim. Total 54.4 per cent subjects were from Nuclear and 45.6 per cent were from Joint family. Total 16.8 per cent children were from general, 30.4 per cent from SC and 52.8 per cent were from OBC category. The result of the study showed that the mean Height, Weight, Mid-Upper Arm Circumference and Body-Mass-Index of children increased with increasing age. The average height and weight of the children was less than the NCHS standard. Data showed that girls were better than boys in case of height, weight, BMI and MUAC.

DEVELOPMENT OF TRANSGENIC CHICKPEA (*CICER ARIETINUM* L.) PLANTS WITH *OSRUVB* GENE FOR SALT STRESS TOLERANCE**Preeti and Pushpa Kharb**

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Chickpea (*Cicer arietinum* L.), also known as bengal gram or channa, is an edible legume. It is a self pollinating diploid ($2n=2x=16$) with genome size of 740 Mb. In India, it tops the list of pulse crops with a total production of 8.83 million tons with an average yield of 925.5 during 2015-16. In addition to biotic stresses, chickpea faces various abiotic stresses such as drought, cold, terminal heat and salinity etc. Chickpea production is adversely affected due to salinity in arid and semi-arid regions of the world as salt stress reduces water potential, creates imbalance in ion concentration and causes toxicity. RuvB is a helicase found in bacteria but now several reports show its presence in plants like *Oryza sativa* where it is required for normal levels of genetic recombination and DNA repair, by which the plant overcomes salt stress. We have developed transgenic chickpea plants with *OsRuvB* gene for salinity tolerance by using in planta transformation method for which patent has been granted (Kharb *et al.*, 2012). The putative T_0 plants were screened by PCR analysis and the PCR positive plants with transformation efficiency of 17% were observed. The plants are further being characterized for integration, expression and transgene copy number using suitable molecular techniques.

RESPONSE OF ZERO TILLAGE WITH RESIDUE MULCH ON YIELD AND ECONOMICS OF *KHARIF* MAIZE**Rajbir Singh Khedwal, Dharam Bir Yadav, V.S. Hooda, Seema Dahiya and Mohinder Singh**

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Maize (*Zea mays* L) is one of the most vibrant food grain crops in many parts of the world. Being a C_4 plant, it is cultivated in tropical, subtropical, temperate areas and high hill ecologies. The experiment was conducted at Regional Research Station, Karnal of CCS Haryana Agricultural University, India during *kharif* 2015. Main plot treatments comprised of four planting methods viz., raised bed with residue, raised bed without residue, zero tillage (ZT) with residue and ZT without residue. Three maize hybrids viz., HQPM-1, HM-4 and HM-10 in combination with 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 kept as sub-plots in split plot design with three replications. Soil of the field was clay loam in texture and slightly alkaline in reaction (pH 8.4). Maize sown in ZT with residue recorded significantly highest 100-grains weight (27.37 g), grain yield (7322 kg/ha), harvest index (HI) (44.64%) and net returns (Rs 59958 /ha) as compared to other methods. However, ZT in general was statistically similar to raised bed in respect of grain yield and HI, but higher 100-grains weight and net returns than raised bed. Residue retention resulted in better 100-grains weight, grain yield, HI and net returns as compared to without residue. The hybrid HM-4 produced maximum 100-grains weight (26.96 g), grain yield (7037 kg/ha) and net returns (Rs 58749/ha), but HI was non significant among the hybrids. Higher 100-grains weight, grain yield, HI and net returns were observed under atrazine 750 g/ha (PRE) fb 1 HW at 30 DAS than unweeded check. Hence, maize sown in place of rice in rice-wheat system in ZT with wheat residue as mulch resulted in better productivity and profitability.



INFOCHEMICALS INVOLVED IN PEST MANAGEMENT: A REVIEW

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Infochemicals are chemicals that convey information in an interaction between two individuals evoking in receiver a behavioural or physiological response that is adaptive to one of interactants or both. Information conveying compounds, so-called infochemicals, are divided into two broad categories according to their use within and between species. Pheromones are substances that mediate interactions of individuals belonging to the same species. Allelochemicals, the second group of infochemicals, mediate interactions of individuals belonging to different species. Depending on the benefits for sender and receiver, they are categorized into allomones (beneficial for the sender), kairomones (beneficial for the receiver) and synomones (beneficial for sender and receiver). Kairomones are mainly involved in the host selection process including the habitat preferences and a series of consecutive behaviours that lead to the successful parasitisation of the host. These chemicals may originate from the host itself (e.g., cuticular compounds) or different stages of host (eggs, larvae, pupae, adult) host by-products (e.g., frass, exuviae, mandibular gland secretions, defense secretions etc.). In addition, parasitoids rely also on volatiles of the hosts food plant (synomones) induced by feeding or oviposition of the herbivore. Application of allelochemicals in pest control is impossible without knowledge of the behavior induced by the chemicals. Application of infochemicals have initiated many ideas in pest control: Enhancing searching efficiency of natural enemies, Bringing the natural enemies in a specific search mode, making novel or artificial host-prey species acceptable in a mass rearing, breeding plant cultivars that have an increased emission rate of natural enemy-attracting synomones. Chemicals are among the main information-conveying agents available to predatory arthropods. They play an essential role in almost all stages of prey searching and prey selection. The idea of enhancing search efficiency through application of allelochemicals has been seriously tested in laboratory and field situations with *Trichogramma* spp. The 'push-pull' strategy, is based on practical use of allelochemicals, management of cereal stem borers in Africa have been successfully accomplished through push-pull strategy.

APPLICATION OF BIOENERGY FOR ENERGY OR MATERIALS: FUTURE PERSPECTIVE THROUGH ENERGY EFFICIENCY

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The demand for energy continued to outstrip supply and necessitated the development of biomass option. Residues were the most popular forms of renewable energy and currently biofuel production became much promising. Agricultural wastes contained high moisture content and could be decomposed easily by microbes. Agricultural wastes were abundantly available globally and could be converted to energy and useful chemicals by a number of microorganisms. Compost or bio-fertiliser could be produced with the inoculation of appropriated thermophilic microbes which increased the decomposition rate, shortened the maturity period and improved the compost (or bio-fertiliser) quality. The objective of the present research was to promote the biomass technology and involved adaptive research, demonstration and dissemination of results. With a view to fulfill the objective, a massive field survey was conducted to assess the availability of raw materials as well as the present situation of biomass technologies. In the present communication, an attempt had also been made to present an overview of present and future use of biomass as an industrial feedstock for production of fuels, chemicals and other materials. We may conclude from the review paper that biomass technology must be encouraged, promoted, invested, implemented, and demonstrated, not only in urban areas but also in remote rural areas.

Keywords: Biomass resources, agricultural wastes, energy, environment, sustainable development

AGRICULTURAL RESIDUES FOR FUTURE ENERGY OPTION IN SUDAN: AN ANALYSIS

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Like many tropical countries, Sudan has ample biomass resources that can be efficiently exploited in a manner that is both profitable and sustainable. Fuel-wood farming offers cost-effective and environmentally friendly energy solutions for Sudan, with the added benefit of providing sustainable livelihoods in rural areas. This article provides an overview of biomass energy activities and highlights future plans concerning optimum technical and economical utilization of biomass energy available in Sudan. Results suggest that biomass energy technologies must be encouraged, promoted, implemented, and fully demonstrated in Sudan.

Keywords: Biomass resources, wastes, woodfuel, biofuels, energy, environment, sustainable development, surfactant sciences

ROLE OF AGRICULTURE IN ENVIRONMENTAL DISTRESS

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The ever-increasing population in India has put a great stress on the agro ecosystem. According to various estimates, the population in our country would cross the one billion mark by the turn of the century. To meet the food requirements of the expanding population, India would have to increase food production from the current level of 180 million tons to 240 million tones. Apart from the use of certain innovative approaches, we would have to considerably increase the use of various agricultural inputs like pesticides, fertilizers/ irrigation facilities, farm machinery, etc. to achieve this increased food grain production. The future use of these agricultural inputs would, therefore/ have to be very carefully planned so that we may prevent the environment from further deterioration and at the same time produce enough food for



feeding the expanding population. In order to feed the expanding population, food grain production in India would have to be increased from the current production of 180 million tons to 240 million tons by the turn of the century. The excessive and non-judicious use of fertilizers leads to environmental degradation. Therefore efforts need to be concentrated to improve the fertilizer use efficiency with proper management practices so as to avoid losses through leaching/ de-nitrification and runoff. Nutrient imbalances have resulted from the excessive use of nitrogen fertilizers. Deficiencies of phosphorus, potassium, zinc, sulphur and copper have appeared in many areas. Therefore to obtain sustainable production, balanced use of nutrients and integrated nutrient management practices have to be worked out. Future efforts should, therefore, aim at balancing the claims of continued agricultural growth and environmental protection. The thrust should be to evolve new style of eco-friendly agro technology which aims at producing food for the rapidly expanding population while preserving the food producing and life sustaining potential of our natural resources.

Keywords: Fertilizer Management and Population of Environmental Distress.

SOIL WATER CONSERVATION FOR SUSTAINABLE DRY LAND AGRICULTURE

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Rain water is an essential input for raising the crops in dry land farming. Due to inefficient use of rain water, productivity of dry land agriculture is reduces. Character of monsoon rain is one of the major factors causing the degradation. Indian monsoon rain is very erratic in nature. Its intensity and duration is not evenly distributed over the rainy seasons. Many times the dry spell between the two showers is too large. It may extend beyond 30 days; the developed soil moisture due to showers gets depleted to a large extent. Thus the standing crops over the area get badly suffer due to the water stress, resulting less yield. Some times the crops can not survive against the moisture stress and get total failure. The poor farmers unable to with stand the financial loss in such situations. To overcome the problems and to get better yield, certain rain water harvesting techniques has to adopt. In rain water harvesting techniques will improve the soil moisture conditions and will help to increase the crop yields. In this paper the techniques and methods for building, conserving, in situ soil moisture and optimizing the use of available soil moisture for successful raising the crops are discussed. Adoption of the in situ rain water harvesting techniques will be an effective tool to overcome the evils and helpful in sustainable crop production

LAND-USE PRACTICES AFFECT THE METHANOTROPHIC POPULATION DENSITY IN DRY TROPICAL REGION

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The upland soils play a major role in the methane (CH₄) oxidation. The CH₄ oxidation is solely mediated by methanotrophic bacteria in soils. In past decades, due to human interventions the natural forests are steadily getting converted into crop lands. These changes in land-use may strongly affect the CH₄ consuming activity of methanotrophs. However, the information concerning the impact of land-use changes in methanotrophic community structure in dry tropical soil are lacking far behind. Therefore, divergence in methanotrophs density across different land-uses viz. natural forest, mixed forest, savanna and crop land situated in Mirzapur and Sonbhadra districts of Uttar Pradesh (Vindhyan region) has been selected for the study. The methanotrophic population in the dry tropical region may be disembodied significantly with rapid soil disturbances. The order of methanotrophs density along the study sites may be natural forest > mixed forest > savanna > farming land. The land use exercise may also be responsible for the changes in soil physico-chemical characteristics, and consequently, the reduction in methanotrophs population density in the disturbed soils. The early investigations suggest that changes in soil properties due to anthropogenic activity (land use practices) significantly affect the soil methanotrophic community structure in dry tropical soils. Further, the investigation is going on to find out the divergence in methanotrophs diversity along different land uses on selected study sites.

Keywords: CH₄, methanotrophs, land-use change, mixed forest, savanna, agriculture land, etc.

METHANOTROPHS: AN EMERGING AND ECO-FRIENDLY TOOL IN BIOREMEDIATION OF ORGANOCHLORINE PESTICIDES

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Methanotrophs is a methane-consuming microbe plays an essential role in global warming issues, as they are the only biological sink for methane and are ubiquitous in nature found in different habitats, such as in soils, sediments, wetlands, freshwater and marine environments where oxygen and methane are readily available. halogenated organochlorine pesticides like lindane has been used globally for the control of agricultural and medical pest till the ban of their uses in many countries. Unfortunately, this chemical is persistent in the environment and distributed worldwide due to global distillation effect and has been considered as Persistent Organic Pollutants (POPs). Because of potential toxicity in nature, lindane has been found to cause adverse effects on various trophic levels in food chain of ecosystems. Presently, microbial mediated bioremediation is believed as a possible tool to clean up the polluted sites contaminated by lindane because of its advantages over other alternatives including incineration, storage, or soil washing. Methane-oxidizing bacteria (MOB), the only biological sink of CH₄ possess a broad spectrum methane monooxygenase (MMOs), recently has been reported to use several organochlorine compounds such as trichloroethylene (TCE) which was degraded by methanotrophs species name as *methylosinus trisporium OB3b*. Therefore, methanotrophs can be utilize efficiently in bioremediation of other organochlorine pesticide, due to its MMOs enzymes may be an effective, eco-friendly and sustainable tool to remove POPs pollutants like hexachlorocyclohexane from the environment.

Keywords: bioremediation, bio-accumulation, methanotroph, POP, lindane, MMOs.



ENVIRONMENTAL WASTEWATER POLLUTION TREATMENT THROUGH MICROBIAL AND NANO-REMEDICATION**Sumit Kaushal and Jay Shankar Singh**

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Remediation of emerging pollutants in contaminated wastewaters through biomass-based technologies, including bio-adsorption using both terrestrial and marine bioresource and agro-industrial wastes along with derived activated carbons. Phytoremediation, microbial remediation using bacteria, fungi, yeasts along with an addition to some interesting combination scenarios such as biodegradation/filtration, adsorption/biodegradation, and adsorption/ozonation. Water shortage and pollution are serious challenges for many countries and nanomaterials are promising new tools for water quality management due to unique physicochemical properties, high economic benefit, high removal efficiency and environmental friendliness. Generally, the new ambit of research, the scientific community is actively involved in the development of new strategies and novel nanomaterials synthesis includes four types of nanomaterials used for water treatment such as nanofiltration membranes, photocatalytic nanomaterials, adsorption nanomaterials and reducing nanomaterials. Nanomaterials, such as carbon nanotubes, magnetic nanoparticles, noble metal nanomaterials and quantum dots, could be used for water quality monitoring, especially for the detection of the extremely low concentration organic pollutants, inorganic pollutants, and pathogens. Emphasis also has been given to green synthesis of nanoparticles aimed to address problems associated with textile effluents through nano bioremediation. The knowledge achieved offers the possibility of using the novel material in the treatment of surface water, groundwater and wastewater especially for the removal of heavy metals, organic and inorganic solutes and microorganism.

Keywords: Wastewater pollution, Bioremediation, Nanomaterials, microbial remediation**CONSERVATION OF NATURAL RESOURCES FOR SUSTAINABLE DEVELOPMENT****Binod Kumar**

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As the human population is continuously growing, the consumption of natural resources is also increasing. Due to increasing urbanization, industrialization, the per capita land availability is shrinking day by day. Fresh water constitutes only 2.5% of total water on planet and remaining 97.5% water is the salty water in the ocean. Only 0.40% the fresh water is available in surface and atmosphere. If they are not properly used and well managed, a serious scarcity will result. Therefore, we need to conserve natural resources in judicious manner. Soil and Water conservation measurements are one of the essential inputs for increasing agricultural outputs in the country. Soil conservation is a set up management strategies for prevention of soil being eroded from the earth surface or becoming chemically altered by overuse, acidification, salinization or other chemical soil contamination. Soil erosion can be prevented by adopting afforestation, contour farming, proper drainage and irrigation with preventing overgrazing. Soil fertility can be preserved by practice of multiple cropping along with application of suitable manures and fertilizers. Water can be conserve through using water economically and preventing wastage. Preventing deforestation and promoting afforestation is also effective to maintain the water cycle. Hence, an urgent need of judicious and rational use of natural resources coupled with appropriate cropping pattern, equitable distribution of water along with adoption of integrated agricultural practices is required so that, it may be available to the future generation.

Keywords: Afforestation, Contour Farming, Cropping pattern, Deforestation, Natural resources, Soil conservation.**RESILIENCE THINKING: SUSTAINING INDIAN AGRICULTURE IN A CHANGING CLIMATE****Sachin Shinde, Minakshi Neware, Priya Pardeshi, Swapnil Tayade and Nandan Tayade**

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Indian agriculture faces high degree of sensitivity to climate change, which is compounded in areas of extreme poverty and high dependency on agriculture. The anticipated changes in climate as well as their associated impacts are all likely to affect substantially the potential of future agriculture in India. The agriculture sector in India is susceptible to the frequent and erratic climatic irregularities. Anticipated changes in the climate due to intensive anthropogenic activities may cause worst conditions. The climatic changes led to increase in temperature and water stress, which caused heavy losses in yield of any crop. It may be a big challenge for the agriculture scientists and country leaders to feed the coming future Indian population sufficiently. Development of new climate resilient crop varieties, generation of renewable energy resources and use of green technologies might be helpful for mitigating the impact of climate change and sustained agriculture productivity in near future. To cope with intense changes as projected in climate, new research paradigm of bringing all stake holders is urgently required to establish suitable long-term strategies for addressing the Indian agriculture sustainability.

Keywords: Indian Agriculture, Climate change, Impact, Strategies & Policies**NO-TILL AGRICULTURE: GOOD FOR THE SOIL CONSERVATION****Suneeta Pant**

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The goal of sustainable agriculture is to meet society's food and textile needs in the present without compromising the ability of future generations to meet their own needs. Land management and advanced technologies can help maximize the "crop per drop" that farmers produce worldwide. Improving irrigation systems is therefore crucial to making contributions to water savings in agriculture. Herbicides play a major role in water conservation. They are used in crop management to control weeds, which compete with crops for water, light and nutrients, and



thus contribute significantly to a more efficient use of water during crop growth. Additionally, land management approaches that improve water retention such as conservation tillage often make use of herbicides. Herbicides are also the basis of innovative rice production practices which require less water than traditional production systems. Conservation (or minimum) tillage subsequently evolved, which enabled less soil damage when used with herbicides. Selection pressure, however, has resulted in weed species that have made adaptations for survival in conjunction with tillage. In no-till agriculture, the farmer uses a disk or chisel plow to prepare the field for seeding. Rather than turning the field, these plows create a narrow furrow, just large enough for the crop's seeds to be injected. The no-till farmer will see an increase in the organic matter of the soil, and a decrease in the amount of erosion. More organic matter and less erosion mean more fertility, less fertilizer, and higher yields. Additionally, with the advances in cover crops and green manures, the no-till farmer can greatly reduce the use of high-cost herbicides. Other advantages include excellent erosion control, soil moisture conservation, minimum fuel and labor costs, builds soil structure and health.

CLIMATE CHANGE EXACERBATE GLOBAL WARMING

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Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter. Climate change is exacerbating the challenges faced by the agriculture sector, negatively affecting both crop and livestock systems in most regions. Without consistent policy signals, autonomous efforts by farmers are unlikely to be sufficient to create a sustainable, productive and resilient agriculture sector. It is becoming clear that their destruction is only exacerbating climate change. If we're serious about tackling this, then preserving our remaining ancient forests has to be a priority. Changes in forest management and agricultural practices could significantly reduce the threat of global warming much more quickly than can technological solutions. More widespread adoption of so-called no-till farming, a practice that involves leaving unharvested crop stalks and other plant matter behind in the field undisturbed by plows and other soil-agitating instruments, Growing crops for fuel—known as bio fuels—represents another potential way of cutting greenhouse gases thus resulting global warming by replacing fossil fuels. Investing in new infrastructure, or radically upgrading existing highways and transmission lines, would help cut greenhouse gas emissions and drive economic growth in developing countries. Farmers can still play an important role in generating clean energy from solar, double cropping through energy-generating greenhouses and farm-based biogas production to integrating wind farms with farm farms. The clean energy revolution has plenty of opportunities for the innovative farmer. As climate change continues to put pressure on the natural environment, farmers can play a huge role in helping species adapt to changing circumstances. Reducing emissions of greenhouse gases through better transport, food and energy-use choices can result in improved health, particularly through reduced air pollution.

ROLE OF CONSERVATION OF AGRICULTURE IN SUSTAINABLE DEVELOPMENT

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Agriculture is central to human survival as it provides food, fuel and other ecosystem services. Agriculture remains the key sector for the economic development for most developing countries. It is critically important for ensuring food security, alleviating poverty and conserving the vital natural resources that the world's present and future generations will be entirely dependent upon for their survival and well-being. The world populations will inevitably double by the middle of the twenty first century, that we are soon to enter, that is in the space of just two generations. Agriculture is, however, also a major source of environmental degradation, contributing to climate change, depleting freshwater resources, degrading soil fertility and polluting the environment through fertilizer and pesticide use. Today agriculture is facing serious challenges due to increased use of chemical fertilizers and pesticide in last about five decade's years under the compulsions of increased production and making the country self sufficient in food grains and other food items. Toward achieving the goal of livelihood security it is important to conserve the agriculture, this paper deals with benefits of conservation agriculture. Conservation agriculture defined by FAO as 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 enhanced and sustained agricultural production. It can also be referred to as resource efficient or resource effective agriculture. The paper concludes that conservation agriculture is a more sustainable and environmentally friendly management system for cultivating crops. The paper also concludes that agriculture in the next decade will have to sustainably produce more food from less land through more efficient use of natural resources and with minimal impact on the environment in order to meet growing population demands.

MITIGATION OPTIONS OF CO₂ EMISSION IN INDIA

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Due to combustion of fossil fuel, deforestation, forest fire, changing land use pattern, rice production with indiscriminate use of irrigation water and fertilizers, and several other faulty agricultural practices continuously increasing the greenhouse gases (CO₂, CO, CH₄, and NO₂) in the atmosphere. The level of CO₂ in the atmosphere rapidly increasing from an average of 6.3 Pg-C year⁻¹ in 1990-99 to 7.8 Pg-C year⁻¹ in 2000-09. According to a recent prediction of IPCC, atmospheric CO₂ concentration will increase over this century, reaching 730–1020 ppm by 2100. With the increasing atmospheric CO₂, the level of ozone (O₃) and rising temperature ranging from 1.1 to 6.4 °C depending on global



emissions situations. To achieve food security and agricultural development goals by 2030, adapting to climate change and lowering emissions will be necessary because as CGIAR articulated around 41% of GHG come from agriculture. India is the 4th largest CO₂ emitter nation which emit about 6% of the world's CO₂. Because of India is a developing country and it should be noted that while developing countries being blamed for increasing levels of emission, they pay more than they contribute to climate change. In 2006, the cost of a 2°C rise in the global temperature was expected to be equivalent to 1% of the global GDP, but the cost of climate change for India, as estimated by the World bank in 2006, was found to be 5%. Reasonable distribution of the cost of climate change is impractical because the developing countries bear 80% of the world's population and will end up paying the most despite skewed consumption patterns. For example, India was contributing about one-sixth population of the world, which have only 1.7 MT emission compare to 17 MT in the US in 2011. In Indian context, there is need to take some step like enhancing coal efficiency and shift to natural gases, efficient transport and alternate fuel, carbon sequestration, gradual shift to renewable energy, and some changes in rice growing practices such as direct sowing rice (DSR), system of rice intensification (SRI), application of fertilizer on need based etc. to mitigate emission of CO₂ and other GHGs. So, in this review we will discuss about above mentioned points for scientific intervention to reduce the impact of climate change to a manageable level in developing countries like India.

FOREST ECOSYSTEM - MORE THAN JUST TREES

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The common idea for many people is that forests are just collection of trees. However, they are much more than that. They are a complex, functional system of interacting and often interdependent biological, physical and chemical components the biological part of which has evolved to perpetuate itself. This complexity produces combinations of climate, soils, trees and plant species unique to each site, resulting in hundreds of different forest types around the world. A forest ecosystem is not just about the forest environment, however. It is also about the animals that live in the forest. For example, birds nest in the trees of a forest, members of the fungus kingdom grow on the forest floor and a variety of insects and mammals also take up their homes in a forest. An ecosystem is a biological community of interacting organisms ecosystem is a terrestrial unit of living organisms and their physical environment. A forest ecosystem is a terrestrial unit of living organisms (plants, animals and microorganisms), all interacting among themselves and with the environment (soil, climate, water and light) in which they live. The forest is one of the main resources in our world. Nearly it occupies 40% of the world's land area. In India 21% of the land is occupied by the forest. An ecosystem is a region with a specific landscape form such as forests, grasslands, deserts, wetlands or coastal areas. The nature of an ecosystem is based on geographical features such as hill, mountains, plains, rivers, lakes and coastal areas. It is controlled by climate condition such as the amount of sunlight, the temperature and the rainfall in the region. Types of ecosystems are natural (terrestrial and aquatic) and artificial ecosystems. Factors of an ecosystem are abiotic factors (soil, water and air etc.) and biotic factors (producer, consumers and decomposers etc.)

Keywords: Components, Environment, Ecosystems, Forest, Organisms.

RHIZOSPHERE BIOREMEDIATION - A TECHNOLOGY FOR HEAVY METALS REMOVAL FROM ELECTRONIC WASTE CONTAMINATED SOIL

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Electronic waste (e-waste) is one of the fastest-growing pollution problems worldwide given the presence of a variety of toxic substances which can contaminate the environment and threaten human health, if disposal protocols are not meticulously managed. E-waste problem is of global concern because of the nature of production and disposal of waste in a globalized world. Electronic waste (e-waste) is a heterogeneous mixture of metal, plastics, glass and ceramics, containing a range of toxic compounds, including polychlorinated biphenyls (PCBs) and brominated flame retardants (BFRs), as well as a broad range of toxic metals such as Cu, Pb, Sn, Ni, Fe, Al, Cd, Be, Pd, etc. Rhizoremediation technology is an environmental friendly and visually attractive technology for the remediation of heavy metals from e-waste. Removal of toxic metals from contaminated soil occurs when inorganic ions are taken up by plant roots and translocated through the stem to aboveground plant parts. Soil micro flora of plant roots (rhizosphere zone) is involved in xenobiotic metabolism. The catabolic activity within the rhizosphere has been attributed to both bacteria and fungi whose presence and enzymatic expression are believed to be modulated by organic chemicals released from both living and dead roots. Both the direct and indirect degradation of soil contaminants by plant root physiology and biosynthetic pathways can potentially occur at the lowest depth of root penetration, a special feature of plant remediation. Rhizosphere bioremediation is a green technology for remediation of pollutants to clean up the environment and more cost-effective than conventional physical and chemical processes. Rhizosphere bioremediation can be considered as lab to land technology.

PAN-EVAPORATION ESTIMATION IN TARAI REGION OF UTTARAKHAND, INDIA

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In this study, the potential of multi-layer perceptron neural network (MLPNN), co-active neuro-fuzzy inference system (CANFIS) and multiple linear regression (MLR) were assessed in estimating weekly pan-evaporation at Pantnagar, located in the *Tarai* region of Uttarakhand, India. This study utilized, a non-linear modelling tool i.e. gamma test (GT) to identify the most significant input variables for MLPNN, CANFIS



and MLR techniques. The estimated values of weekly pan-evaporation using these three techniques were compared with the empirical models such as Stephens-Stewart (SS) and Griffith (G) based on root mean squared error (RMSE), Nash-Sutcliffe efficiency (NSE) and coefficient of correlation (COC). The results of comparison revealed that the MLPNN model performed superior than the CANFIS, MLR, SS and G models, however CANFIS models performed better than the MLR, SS and G models in estimating the weekly pan-evaporation using the available meteorological data for study location.

Keywords: Multi-layer perceptron neural network, Co-active neuro-fuzzy inference system Multiple linear regression, Gamma test, Pantnagar

THE SCENARIO OF CLIMATIC CHANGES AND ITS ADVERSE IPACT ON AGRICULTURE OF THE NORTH BIHAR

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In the view of the present scenario of the north Bihar of devastation, the researcher selected the title and had a little attempt to investigate and propound the main causes all of a sudden happening critical situations time to time before the north Bihar. As all know that the study area of the author is the north Bihar State which covers about 50% of the total land and habitat intense and pock population. Bihar is a partial part of The great north middle plane where is the significance of new alluvial soil which is made of the silts brought by the Ganga and its subsidiary rivers which is by nature and as per properties the most fertile. But all know that the monsoon continues to play the game of definite and indefinite. Thus on account of adverse whether condition forming is no longer as well as the poverty of Bihar's pleasant is not capable to tolerate the adverse climatic situation. Bihar's topography as well as other geographical conditions in spite of suitable for demography time to time are suffered from flood and draught. The major objective of the study are to investigate the impact of climatic changes in Bihar over various meteorological stations, to correlation deteriorating agrarian system with climate change and to find out result of adverse impact of climatic changes on agriculture of devastated part of Bihar state and its solution. With aforesaid descriptions the author deals with the conclusion that irregular monsoon has been adversely being affected agriculture for several decades back. At last I would like to mention that these are deterministic and humanistic paradigm.

IMPACT OF AIR POLLUTION ON HUMAN HEALTH

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Air pollution is defined as imbalance in the quality of air so as to cause ill effects. Growing industrialization and transportation and the increasing use of pesticides and unwanted chemicals in the air has polluted the whole atmosphere and its impact is very dangerous not only on man and other living organisms but also on environment itself. The industrial, automotive and domestic activities have resulted in increasingly outrageous insults to the atmosphere. Poisonous gases, emission of automobiles, use of chemicals and petrochemicals, deforestation, experiments of atomic weapons, chemicals and biochemical weapon, mining and increasing urban population are main cause of air pollution. Combustion, transportation emissions, industrial processes, use of solvents and radioactivity elements are main source of air pollution. Air pollution mainly effects the respiratory system. Bronchitis, emphysema, asthma and lung cancer are some of the chronic diseases caused due to exposure to cancer is caused mainly due to polluted air because carcinogens are found in the polluted air. Sulfur dioxide is the most serious and wide-spread air pollutant. Its lower concentration is a cause of spasms in the smooth muscle of bronchioles and its higher concentration induces increased mucus production. Carbon monoxide often affects the oxygen carrying capacity of blood. Nitric oxide is reported to be a pulmonary irritant and hydrogen sulfide causes of brain damage. The particulate pollutants such as asbestos, silica, carbon, beryllium, lead etc. are capable of exerting a noxious local action in the intestinal areas of the lungs.

GLOBAL WARMING IMPACT ON THE EARTH

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Atomic properties of elements and compounds are prone to change due to fluctuation of surrounding temperature and pressure. General properties of elements and compounds are exhibiting at par with the normal temperature and pressure (NTP). As the cause of global warming, the atomic properties of elements and compounds will not behave normally as in NTP. Their characteristics and applications are subjected to evergreen changing process, since natural temperature and pressure are not remaining constant in case of global warming. Whole life pattern of the living beings will be full of complexity and not guided by any rules in case of global warming. Industries, refineries, excessive electromagnetic wave propagation through air, transport vehicles – road and airways, rapid growth of entertainment equipment like air conditioned (A.C) machine, refrigerator, television, mobile phone, computer etc are the main cause of increasing environment temperature. To solve this emerging problem, Industrialization (Industry should grow with minimum working space effecting least environment pollution) and Naturalization (Maximum portion of the earth must be covered with either agricultural green trees or clean water) have to be provided side by side and at the same time people have to minimize using all type of entertainment equipment, otherwise global warming may cause destruction of the world.

Keywords: Atomic Properties, Industrialization, Naturalization, Normal Temperature and Pressure (NTP).



RAINFALL RUNOFF MODELLING USING RRL AWBM MODEL IN SHIPRA RIVER BASIN**Ayushi Trivedi, S. K Pyasi and Ravi Galkate**

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Rainfall-Runoff is a major component of the hydrologic cycle plays a key role in water resources management. Runoff estimation in catchment is a serious challenge for the hydrologist where most of the watersheds are ungauged. Various approaches for runoff estimation are available ranging from lumped to physically based distributed models for runoff estimation. This paper describes the use of RRL AWBM (Rainfall Runoff Library Australian Water Balance Method Model), to investigate its performance, efficiency and suitability in Shipra river basin situated in Madhya Pradesh, India. The AWBM is a catchment water balance model that relates runoff to rainfall with daily or hourly data. AWBM model was calibrated and validated using daily weighted precipitation, daily evapotranspiration and daily observed runoff time series and the same was validated for the time series. The reliability and performance of AWBM model was evaluated based on Accuracy criteria such as Coefficient of determination (R^2), Nash–Sutcliffe Efficiency Index (E), Root Mean Square Error (RMSE), and correlation coefficient (r). The model was found suitable for Shipra basin in simulating hydrological response of the basin to the rainfall and predicting daily runoff with good degree of accuracy.

Keywords: Rainfall runoff modeling, RRL, AWBM, Nash–Sutcliffe Efficiency Index, Sensitivity analysis, Shipra basin

CLIMATE CHANGE: A VITAL ROLE IN SPREADING DISEASES**Priyanka Swami, Ramniwas, M. L. Khichar, Praveen Kumar*, Anupam Maharshi****

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Climate change has the potential to influence the earth's biological systems. Developing nations with limited resources are expected to face a host of health effects due to climate change, including vector-borne plant disease. Due to increased level of green house gases particularly CO_2 the weed biomass has significantly increased, this increased weed population act alternative host for disease vector when the crop is not grown in field. Besides this, fluctuations in temperature, rainfall, humidity and other weather variables leads to great exposure of vector to completely new environment and because of this the disease can be introduced to a new place. Current study includes the association of cotton leaf curl disease of *Bt*-cotton with different weather variables over the years from 2003-2014. The disease is caused by virus and is vector borne in nature. Whitefly (*Bemisia tabaci*) act as a vector and transfer the pathogen in weed plants when the crop is not sown in the field. The study was carried out at Chaudhary Charan Singh Haryana Agricultural university, Hisar, Haryana. The study reveals the strong relationship between changing weather conditions and the occurrence of CLCuD (Cotton Leaf Curl Disease). The relationship was found out by calculating PDI (Plant Disease Intensity) as per the disease scale (0-6) of All India Coordinated Cotton Improvement Project (AICCP) and the weather data were collected from IMD, Pune. The result shows that rapidly changing climate and shifting of seasons leads to a greater exposure of plants to pathogens and thereby reducing crop productivity.

Keywords: climate change, *Bt*-cotton, cotton leaf curl disease

EXTENT OF GLOBAL WARMING AND ITS PREVENTION**Indu Singh**

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Global warming is defined as the increase of the average temperature on Earth. As the Earth is getting hotter, disasters like hurricanes, droughts and floods are getting more frequent. Almost 90% of the observed temperature increase over the last 50 years has been due to the increase in the atmosphere of greenhouse gas concentrations like water vapour, carbon dioxide (CO_2), methane and ozone. Greenhouse gases are those gases that contribute to the greenhouse effect. The largest contributing source of greenhouse gas is the burning of fossil fuels leading to the emission of carbon. Deforestation increases the severity of global warming. The ocean is a huge carbon sink, holding about 50 times as much carbon as the atmosphere. The climate change would increase the number of people suffering from death, disease and injury from heat waves, floods, storms and droughts. The effects of global warming include higher or lower agricultural yields, further glacial retreat, reduced summer stream flows, species extinctions. As a further effect of global warming, diseases like malaria are returning into areas where they have been extinguished earlier. Floods are low-probability, high-impact events that can overwhelm physical infrastructure and human communities. Major storm and flood disasters have occurred in the last two decades. One can help to reduce the demand for fossil fuels, which in turn reduces global warming, by using energy more wisely.

Keywords: Global warming, fossil fuels, carbondioxide.

A PRECISION FARMING TOOL FOR SMALL HOLDER CONSERVATION IN AGRICULTURE**Devesh Kumar, Ashok Tripathi*, Uday Veer Singh, Manish kumar, Surendra Pal**

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Conservation in agriculture and precision agriculture can improve farm efficiencies and the environment in rainfed farming systems. Along with benefits that include reduced soil compaction through controlled traffic systems, conservation agriculture involves carbon farming undertaking specific farming practices in order to sequester carbon and maybe obtain tradable rights in that carbon). Precision agriculture matches cropping, including fertilizer application, with field variability, by using GPS technology and on-the-go sensors. Application algorithms are being developed and economics need to be defined for rainfed systems. Precision agriculture is a key component of the third wave of modern agricultural revolutions. The first agricultural revolution came along during the advent of increased farmer produced enough food to feed about 26 people during this time. The 1990s prompted with new methods of genetic modification, which led to each farmer feeding about 155 people. It is expected that by 2050, the global population will reach about 9.6 billion, and food production must effectively double from current levels in order to feed every mouth. With new technological advancements in the agricultural revolution of precision farming, each farmer will be able to feed 265 people on the same acreage in agriculture and food technology. Globally the majority farmers, they produce 80% of the food in developing countries. Most of these farmers struggle with little access to farm power and with basic hand tools and application of inputs such as seeds and rarely available fertilizer. 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, and 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.

Keywords: Precision agriculture, Conservation Agriculture, nature remorse, sustainable cropping, agriculture models

Climate Change and Global Warming

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Climate change is influenced by human activities. Climate change and global warming both are closely related to each other. Changes occur by human activities in the environmental composition play key role in global warming. Human burns coal, petroleum, natural gas, biomass for development and emitted of different kind of gases. Green house gases are responsible for the global warming. These gases are carbon dioxide, methane, nitrous oxide, fluorinated gases, hydro fluorocarbons, perfluorocarbons sulfur hexafluoride. Carbon dioxide is main green house gas. These gases absorb the heat (long wavelength) and increase the temperature of troposphere. Global warming influence ice melting, sea level rise, climate change. Climate change and global warming had their bad impact on human health, plants, animals and their habitat. Climate change has various effect such as influence the production of biodiversity, contraction in habitat (mainly in forest and wetland), increase in desertification, loss of aquatic ecosystem(coral reef and fishes), migration of animals and plants, effect on reproduction process, extinction of some species in some special region, changes in many crop pattern , reduction in agricultural production, change. Global warming and climate change effect the precipitation decrease in seasonal and perennial snow and ice extent. Human induced climate change is now likely to continue for many centuries. Human beings are venturing into unknown with climate, and its impacts could be very disruptive.

Keywords: Climate change, Global warming, Human health, Biodiversity

CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE

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Agricultural production is sensitive to weather and thus directly affected by climate change Global climate change is a change in the long-term weather patterns that characterize the regions of the world. In the long run, the climatic change could affect agriculture in several ways such as quantity and quality of crops in terms of productivity, growth rates, photosynthesis and transpiration rates, moisture availability etc. Climate change is likely to directly impact food production across the globe. Increase in the mean seasonal temperature can reduce the duration of many crops and hence reduce the yield. Since climate change impacts on soil water balance will lead to changes of soil evaporation and plant transpiration, consequently, the crop growth period may shorten in the future impacting on water productivity. Crop yields affected by climate change are projected to be different in various areas, in some areas crop yields will increase, and for other areas it will decrease depending on the latitude of the area and irrigation application. Drivers of climate change through alterations in atmospheric composition can also influence food production directly by its impacts on agriculture as well as horticulture production. The consequences of agriculture's contribution to climate change, and of climate change's negative impact on agriculture, are severe which is projected to have a great impact on food production and may threaten the food security as well as agriculture and horticulture production.

Keywords: Water use efficiency, photosynthesis, Agriculture productivity and Climate change

ENVIRONMENTAL CONSERVATION & PROTECTION OF NATURAL RESOURCES

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The natural resources of the world fall into two main groups. The one, represented by the products of agriculture and forestry, may be renewed, either annually or at longer intervals, by cultivation, and may be consumed as income, while the other, including mineral wealth, must be regarded as capital, and once consumed is not renewed. Soils should perhaps form a third category, for while they may be maintained in fertility for thousands of years. The natural resources of the world fall into two main groups. The one, represented by the products of agriculture



and forestry, may be renewed, either annually or at longer intervals, by cultivation, and may be consumed as income, while the other, including mineral wealth, must be regarded as capital, and once consumed is not renewed. Soils should perhaps form a third category, for while they may be maintained in fertility for thousands of years, as in China, they are only too easily ruined by careless or greedy exploitation, leading to exhaustion and erosion, or by mining operations, which may cause subsidence as in parts of England, or burial under debris through hydraulic mining as in California. This paper is mainly concerned with the conservation of those mineral resources on which modern industrial civilization increasingly depends on those mineral resources on which modern industrial civilization increasingly depends.

Keywords: forestry, conservation, exhaustion.

UNDERSTANDING POTENTIAL OF LEAF LITTER IN REJUVENATION OF DEGRADED LANDS IN TROPICS

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The study investigates the biological potential of two tropical species for the restoration of degraded lands. It is therefore necessary to evaluate litter production, its temporal variation, their rate of decomposition and nutrient release. In this study, we examined patterns of litter fall production, quality of litter, and decomposition pattern of selected multipurpose tree species, viz., *Tectona grandis* and *Butea monosperma* trees in the dry tropical deciduous forest of Vindhyan highland, India. Average litter fall was 4.15 ± 1.71 Mg ha⁻¹yr⁻¹ and varied significantly among species as follows *T. grandis* > *B. monosperma*. The highest fraction in both the species comprised of leaf litter. In the litter bag experiment, mass loss and mineralization rate were significantly affected by the initial chemical composition of the litter. Similar release of carbon and nitrogen was studied at monthly interval in the same litter bags. Annual relative mass loss was evidently higher in *B. monosperma* than by *T. grandis*. An initial increase in the percentage of nitrogen was observed as the decomposition progressed but it decreases at the later stages. A significant decrease in the percentage of carbon was observed throughout the study. Initial higher percentage of nitrogen, lower initial lignin, lignin: N and C: N governs the rate of decomposition in both the species. The study recommended that *B. monosperma* shows better results for the rapid recovery of degraded lands as their rate of litter decomposition is relatively faster than *T. grandis*. Although, *T. grandis* shows higher litter production but their release of nutrient is slow in to the soil. The faster decomposition increases the more release of nutrient in to the soil and thus increases the rate of organic matter turnover and enhances nutrient cycling.

Keywords: Restoration, Litterfall, carbon, nitrogen, lignin

CLIMATE CHANGE VS VEGETABLES

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Vegetables are an important part of human diet as they are the main source of nutrients, vitamins and minerals. They are also good remunerative to the farmer as they fetch higher price in the market. Likewise other crops, they are also being hit by the consequences of climate change such as global warming, changes in seasonal and monsoon pattern and biotic and abiotic factors. Success in mitigating climate change depends on how well vegetable crops and systems adapt to the changes and concomitant environmental stresses of those changes on the current systems. Farmers in developing countries need tools to adapt and alleviate the adverse effects of climate change on agricultural productivity, and particularly on vegetable production, quality and yield. Current, and new, technologies being developed against biotic and abiotic stresses can potentially contribute to mitigate threats from climate change on vegetable production. However, farmers in developing countries like India are usually small-holders, have fewer options and highly depend on resources available in their farms or within their communities. Thus, technologies that are simple, affordable, and accessible must be used to increase the resilience of farms in less developed countries. AVRDC – The World Vegetable Center and other agricultural institute in country has been working to tackle the hazardous effects of environmental stress on vegetable production. Germplasm of the major vegetable crops which can tolerate temperature fluctuations, flooding and drought has been recognized and advanced breeding lines are being developed. Efforts are also in progress to identify nitrogen-use efficient breeding lines. In addition, development of production systems geared towards improved water-use efficiency and expected to mitigate the effects of hot and dry conditions in vegetable production systems are pinnacle research and development priorities.

ASSESSMENT OF PRODUCTION TECHNOLOGY OF VEGETABLE CROPS UNDER CHANGING CLIMATE WITH REFERENCE TO ABIOTIC STRESSES

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World population is increasing at an exponential rate and at the same time the farmers are challenged with growing abundant, safe and nutritious food in the changing climatic conditions that affect the vegetable production through biotic and abiotic stresses. As we know, vegetables are the rich source of vitamins, minerals and income for those involved in production and marketing. In India, where wide range of agro-climatic conditions from tropical to temperate exists, makes it ideal for off-season vegetable production throughout the year. Among all, climate change poses significant challenges and negative impacts upon for the present vegetable production. There is mounting evidence that farmers in developing countries like India are facing increased climate variability and climatic change including more extreme events like average means of temperature and precipitation which is clearly linked to increased greenhouse gas (GHG) emissions and ultimately leads to low level of



production. Climate change may promote plant pests/diseases but research on crop resistance to abiotic stresses has not acknowledged much attention. Therefore, adapting vegetable crops to the changing environments may be the single most important step for us to take to mitigate the adverse effects of climate change. Thus, there is an urgent need to mitigate these abiotic stresses through development of new heat-tolerant vegetable varieties that will thrive in future conditions. We should breed cultivars with multiple resistances or tolerances against abiotic and biotic stresses. On one hand, the climate change makes crop production more difficult and simultaneously on the other hand, population growth and health-conscious consumers demand more and better horticultural products. The challenges and opportunities coexist for our dynamic and resilient industry. Thus more inspiration, interest, discussion, and collaboration on these issues are required and promote future progress in this important field in the changing scenario of climate.

Keywords: Vegetable production, Climate change, abiotic stress and production technology

SOIL AND WATER CONSERVATION: OUR HISTORY AND FUTURE CHALLENGES

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Remembering our past is an essential first step into the future. Building on that philosophy, we summarize two presentations from a 2012 Soil Science Society of America (SSSA) symposium focused on soil management challenges in response to climate change to examine: (i) how the Soil and Water Management and Conservation Division evolved, (ii) how soil management research approaches have changed since the division was founded, and (iii) how division scientists are helping an increasing global population respond to a dynamic and changing climate. There are always strong links between measures for soil conservation and measures for water conservation, and this applies equally in semi-arid areas. Many measures are directed primarily to one or the other, but most contain an element of both. Reduction of surface run-off by structures or by changes in land management will also help to reduce erosion. Similarly, reducing erosion will usually involve preventing splash erosion, or formation of crusts, or breakdown of structure, all of which will increase infiltration, and so help the water conservation, soil conservation and water conservation. There are always strong links between measures for soil conservation and measures for water conservation, and this applies equally in semi-arid areas. Reduction of surface run-off by structures or by changes in land management will also help to reduce erosion.

Keywords: Soil conservation, Erosion, Infiltration, Water conservation.

CLIMATE CHANGE AND FOOD SECURITY

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Between now and 2050, the world's population will increase by one-third. Most of these additional 2 billion people will live in developing countries. At the same time, more people will be living in cities. If current income and consumption growth trends continue, FAO estimates that agricultural production will have to increase by 60 percent by 2050 to satisfy the expected demands for food and feed. Agriculture must therefore transform itself if it is to feed a growing global population and provide the basis for economic growth and poverty reduction. Climate change will make this task more difficult under a business-as-usual scenario, due to adverse impacts on agriculture, requiring spiralling adaptation and related costs. This transformation must be accomplished without depletion of the natural resource base. Climate change is already having an impact on agriculture and food security as a result of increased prevalence of extreme events and increased unpredictability of weather patterns. This can lead to reductions in production and lower incomes in vulnerable areas. These changes can also affect global food prices. Developing countries and smallholder farmers and pastoralists in particular are being especially hard hit by these changes. Many of these small-scale producers are already coping with a degraded natural resource base. To achieve food security and agricultural development goals, adaptation to climate change and lower emission intensities per output will be necessary.

Keywords: Climate change impacts, Crop yield and Food security

RESOURCE MANAGEMENT IN VEGETABLE CULTIVATION UNDER POLYHOUSES

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Indian farmers confront a few difficulties such as small land holding, fewer yields due to dependence on inefficient methods of farming, too much reliance on natural phenomena such as rainfall and lack of knowledge of modern package of practice or modern methods of agriculture. Polyhouse cultivating is an alternative new technique in agriculture to picking up position in rural India. It diminishes reliance on rainfall and makes the ideal utilization of land and water assets because of guaranteed framework. In polyhouses, the water is supplied by drip irrigation with due effect water is less utilized when contrasted with open cultivation. Polyhouse cultivating is a cutting-edge technique for cultivating in which we can expect more yields with high nutritive esteems without much utilization of destructive bug sprays and different chemicals. In polyhouses cultivating, we can shield our crops from any adverse climatic conditions such as high humidity or high temperature. There is a facility in polyhouse to control temperature or humidity. There will be an increase in the production of vegetables in polyhouses farming without losing their quantity and quality. Polyhouses can secure the crops by preventing the entry of animals and birds into the farm. When we cultivate in normal farm, nearly one-third of the crops may be lost due to the attack of insects and worms, whereas in polyhouses farming, we can



harvest the crops about 2 to 3 times more without much damage or loss. Polyhouse farming can help the farmer generate income around the year growing multiple crops and fetching premium pricing for off-season vegetables.

IMPACT OF CLIMATE CHANGE ON RURAL DEVELOPMENT OF INDIA

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Climate change is very important, extensive and intensive global environmental problem. It has been number of evil consequences on the economic development along with the different productive sectors and economic development activities in the economy. The study has an objective of analyzing the present state of climate change with emphasis on India, and to examine the prominent contributor to the global warming and consequently climate change. The present studies conclude that even though India is not a dominant contributor to the global warming and climate change.

Keywords: Green house, CO_2 , global warming, climate change, rural development.

ENVIRONMENTAL POLLUTION: IT'S EFFECT ON HUMAN BEING AND ITS REMEDIES

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Environment pollution is a wide-reaching problem and it is likely to influence the health of human populations is great. This paper provides the insight view about the affects of environment pollution in the perspective of air pollution, water and land/ soil waste pollution on human by diseases and problems, animals and trees/ plants. Study finds that these kinds of pollutions are not only seriously affecting the human by diseases and problems but also the animals and trees/ plants. According to author, still time left in the hands of global institutions, governments and local bodies to use the advance resources to balance the environment for living and initiates the breathed intellectuals to live friendly with environment. As effective reply to contamination is largely base on human appraisal of the problem from every age group and contamination control program evolves as a nationwide fixed cost-sharing effort relying upon voluntary participation. This includes air, water, and soil pollution and climate change. New techniques for the study and measurement of pollutants and their effects are also encouraged as well as papers on new types of environmental challenges such as pollution/antibiotic resistances of organisms.

Keywords: Environment Pollution, Air Pollution, Water Pollution, Soil Pollution.

SPATIAL DISTRIBUTION OF BASIC EXCHANGEABLE CATIONS UNDER DIFFERENT LAND USES IN SOILS OF HAMELMALO, ERITREA

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The study was conducted at two sites; Hamelmalo Agricultural College and Basherri watershed area in sub Zoba Hamelmalo, Keren, to determine the status of basic exchangeable cations (Ca, Mg, K and Na) under different land uses and their relationship with physico-chemical properties of soils. Global Positioning System based soil samples were collected randomly from different land use systems, cultivated (cereals and horticulture) and non-cultivated open wood lands. The pH values ranged from neutral to strongly alkaline and electrical conductivity values were found to be non-saline in nature. The textures of majority of the surface samples were found sandy loam. Availability of exchangeable Ca^{++} , Mg^{++} , K^+ and Na^+ in surface soils of all land uses varied from high to very high, moderate to high, very low to low and very low to moderate, respectively. Exchangeable K^+ showed highly significant positive correlation ($p < 0.01$) with clay content. However exchangeable Ca^{++} contents in soil was positively and significantly correlated ($p < 0.05$) with pH, clay, silt and negative significant correlation ($p < 0.05$) with BD. Mg^{++} had positive significant correlation ($p < 0.05$) with clay content and negative significant correlation ($p < 0.05$) with sand.

Keywords: Calcium, magnesium, potassium, sodium, soil texture, bulk density, correlation

NEED OF SOIL AND WATER CONSERVATION

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Soil is the most fundamental and basic resource and vital resource that provides food, feed, fuel, and fiber. Essentiality of soil to human well-being is often not realized until the production of food drops or is jeopardized when the soil is severely eroded or degraded to the level that it loses its inherent resilience. Similarly over the years rising populations, growing industrialization, and expanding agriculture have pushed up the demand for water. Water conservation has become the need of the day. Conservation of soil and water resources is critical to human well-being. Their prudent use and management are more important now than ever before to meet the high demands for food production and satisfy the needs of an increasing world population. Despite the extensive research and abundant literature on soil and water conservation strategies,



concerns of worldwide soil degradation and environmental pollution remain high. Managing soils under intensive use and restoring eroded/degraded soils are top priorities to a sustained agronomic and forestry production while conserving soil and water resources. Two main agents affecting soil erosion by water are rainfall and runoff erosivity. Factors that contribute to water erosion are length of slope, steepness of slope, soil type soil infiltration, lack of lack of surface cover. Soil erosion is a very visible negative impact of pastoral land use. That image may affect our “clean green” image and trade in the future. We care about future generations, and that means ensuring ample soil remains available to sustain agricultural production capacity.

Keywords: soil conservation, water conservation, erosion and agriculture production

SYSTEM OF RICE (*ORYZA SATIVA* L.) INTENSIFICATION FOR BETTER PRODUCTIVITY AND RESOURCE MANAGEMENT – A CRITICAL REVIEW

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System of rice intensification (SRI) is an integrated and agro ecologically sound and a new approach to rice (*Oryza sativa* L.) cultivation. This system was developed in 1983 by Father Heneri de Laulanie in Madagascar. However, this is now practiced by the scientists and farmers of the over 60 countries in the world. This method improves the productivity, resource use efficiency and profitability of rice by changing the way that time, space, water, nutrient and labour are managed. The average yield obtained by SRI method, around 7 t ha⁻¹ compared to world average 3.8 t ha⁻¹ while a record yield of 19 t ha⁻¹ has been reported by China. However, the superiority of this system has been reported by 50- 100% higher yields over conventional methods of rice cultivation. Reports revealed that hybrids and long -medium duration varieties of rice performed better and gave higher yield as compared to short duration cultivars. This method is suitable for a variety of soils. The SRI involved transplanting of 10-12 days old single seedling/hill at 25 cm X 25 cm spacing. The wider spacing provides better crop geometry for profuse tillering and nutrition to rice plants. However, several studies have suggested that a spacing of 20 cm X 20 cm is ideal for rabi season rice under SRI method. Rice yields were found the maximum when irrigations were done after 3 days of disappearance of water from the fields. Integrated nutrient management consisting 50% from organic and 50% from inorganic resources of recommended dose have been reported for getting targeted yield in SRI culture. Likewise, integrated weed management was found most economical in this system of rice cultivation.

Keywords: System of rice intensification, cultivar, seedling, productivity, resource use efficiency.

RESPONSE OF WHEAT [*TRITICUM AESTIVUM* (L.) EMEND. FIORI & PAOL] VARIETIES TO ANTITRANSPIRANTS AND FERTILITY LEVELS

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Jaipur) during two consecutive *rabi* seasons 2013-14 and 2014-15 to study the response of wheat varieties to antitranspirants and fertility levels grown on irrigated loamy sand soil of semi-arid eastern plain zone of Rajasthan. The experiment consists of two varieties (Raj 3077 and Raj 3765), three fertility levels (Control, 75 % RDF and 100 % RDF) and four antitranspirants (Control, cycocel @ 1000 ppm, PMA @ 250 ppm and kaolin 5 %), thereby making twenty four treatment combinations were replication three times in split plot design keeping varieties and fertility levels in main plots and antitranspirants in sub plots. Results showed that variety Raj 3077 gave significantly higher magnitude of growth parameters (plant height, dry matter accumulation, total number of tillers/m row length), LAI, LAD, CGR, RGR, NAR, RWC, rate of photosynthesis and transpiration rate and yield attributes (total number of effective tillers/m row length, ear length and grains/spike) leading to increased grain, straw, biological yields and harvest index as compared to Raj 3765. Results further indicated that application of 100 % RDF recorded higher growth parameters (plant height, dry matter accumulation, total number of tillers/m row length), LAI, LAD, CGR, RGR, NAR, RWC, chlorophyll content, rate of photosynthesis and transpiration rate and yield attributes (total number of effective tillers/m row length, ear length, grains/spike and test weight) and grain, straw, biological yields and harvest index as compared to control. Application of antitranspirants responded favourably to wheat crop wherein use of cycocel @ 1000 ppm significantly increased the growth parameters (dry matter accumulation, total number of tillers/m row length), LAI, LAD, CGR, RGR, NAR, RWC and chlorophyll content, and yield attributes (total number of effective tillers/m row length, ear length, grains/spike and test weight) and grain, straw, biological yields and harvest index as compared to control.

EFFECT OF DRIP IRRIGATION AND MULCHING ON WATER PRODUCTIVITY, WATER USE EFFICIENCY AND BENEFIT COST RATIO OF MANGO CV. PANT SINDURI

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The present investigation was conducted at Horticultural Research Centre, Patharchatta of G. B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand during the year 2015 – 2016. The experiment was laid in randomized block design with 9 treatment and three replications of each treatment. Water use efficiency and water productivity showed significant effect of the treatments. Maximum water use efficiency was recorded in T₅- 0.3 PE with mulch (3.33 kg/ tree- mm) closely followed by T₆- 0.4 PE with mulch (2.69 kg/ tree- m) on the other hand maximum value for water productivity was recorded in conventional method of irrigation with least water productivity was recorded in this treatment (23.52 l/ kg) and minimum value of water productivity was recorded in T₅- 0.5 PE along with mulch with highest water



productivity (3.01 l/ kg) was recorded in this treatment. Economics worked out for different treatments revealed that T₇- 0.5 PE along with mulch was best with respect to highest net return (Rs 213990.94) and benefit cost ratio (4.20:1) which was closely followed by T₈ 0.6 PE along with mulch having net return 206198.74 and benefit cost ratio 4.08:1. The future need focuses on the development of system to suit the agro-climatic conditions of the specific area. Adequate extension activities and awareness program should be undertaken regarding its utility, knowledge of application and method of operation and maintenance. The distribution networks needs to be strengthened particularly at rural adjoining areas. The fertilizer control order need to ensure be reviewed to the availability of liquid fertilizers.

CONTINGENCY PLANNING: DEVELOPING ROAD MAP TO TACKLE IMPACTS OF CLIMATE CHANGE

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Climate change impacts on agriculture are being witnessed all over the world, but developing country like India are more vulnerable in view of the high population depending on agriculture and excessive pressure on natural resources. Some part of the country or the other experiences monsoon failure almost every year and most states encounter drought once in 2 to 4 years. Monsoon failures result in drought and excess rainfall lead to flooding which has serious implications for small and marginal farmers and livelihood security of the rural communities and heat stress cause irreversible damage to plant growth and development. Any contingency measure, either technology related (land, soil, water & crop) or institutional and policy based, which is implemented based on real time weather pattern (including extreme events) in any crop growing season is considered as real time contingency planning (RTCP). These climate change impacts can be reduced by some contingency measures/planning and secure the crop production which was given below. Aberrant rainfall situations often lead to poor crop performance or total crop failures. While late onset of monsoon or early season droughts have to be combated with operations like gap filling, re-sowing, transplanting and alternative crops/varieties. Dry spell during crop period and early withdrawal of monsoon (mid and late season/terminal droughts), excess rainfall (flooding) have to be managed with appropriate contingency measures related to crop management (ratooning/thinning and weed control), soil management (mulching) nutrient management (spray of thiourea, potassium solution and antitranspirants) and moisture conservation measures such as in situ and ex-situ moisture conservation (farm pond, percolation ponds and check dams) with protection irrigation. Convergence of contingency planning with government scheme like MGNREGA, RKVY, NHM, IWMP and DRDA can provide an opportunity to respond to different kind of weather aberrations as contingencies on real time basis.

Keywords: Contingency Planning, Climate Change, Monsoon, Agriculture, Nutrient Management

CLIMATE CHANGE: IMPACT AND MITIGATION ON TEMPERATE FRUIT CROPS

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The greatest concern of mankind in 21st century is climate change. The major effects of climate change on fruits are unpredictable high temperature, frost, drought, hailstorms, more erratic rainfall patterns and spells which will consequently reduce productivity and quality of temperate fruit crops. High temperature during chilling period of temperate fruit crops will result in inadequate chilling, subsequently abnormal pattern of bud break and development. Timing of phenology and pollination will be adversely due to higher temperature. Floral abortions, flower and fruit drop will occur frequently. The requirement of annual irrigation will increase and heat unit requirement will be achieved in much lesser time. More often in spring time, the inclement weather prevails and temperature goes fairly low and spring frosts are experienced resulting in frost injury and damage to the flowers, poor fruit set and ultimately low yields. Due to wide fluctuation in temperature, hailstorms are now commonly experienced which cause damage to the flowers and developing fruits at various stages of growth and development. Temperature variation can have significant impact on the postharvest quality by altering important quality parameters such as synthesis of sugars, organic acids, antioxidant compounds, peel colour and firmness. High temperature and moisture stress has resulted in increased incidences of sun burn and cracking in apple which has markedly decreased its fruit quality. Efficacy of crop protection chemicals is also affected due to changes in temperature and precipitation. Mitigation strategies for climate change on temperate fruits can be achieved through diversification and development, introduction, cultivation of low chilling cultivars besides having tolerance to high temperatures, drought, stagnant water and high water use efficiency. Use of evaporative cooling technique to improve chilling requirement, chemicals for breaking dormancy of buds. Regular and weather based monitoring strategies for rapid diagnosis and timely management of insect, pest and diseases.

SKUAST-KASHMIR DEMONSTRATES TECHNOLOGY FOR HIGH DENSITY APPLE ORCHARDING IN KASHMIR VALLEY

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Jammu and Kashmir State being endowed with natural advantages of topography and climate with enormous diversity of agro-climatic conditions has immense scope for horticultural development. Among the temperate fruits, apple ranks first covering 43.30 per cent area and 80.18 per cent production. Yield of apple has shown an increase from 4.12 to 10.00 MT/ha (1975-2014). Though it appears to be highest among the apple producing states in the country, yet it is far below the level achieved by advanced countries where productivity is of 50-60 MT/ha. So to solve the problems of low productivity, poor quality, less colour and irregular bearing habits in current apple plantations in Kashmir valley, four apple varieties namely Super Chief Sandidge, Gala Red Lum, Fuji Zehn Aztec and Golden Clone B were imported from Italy on M9T337 rootstock and planted in spring 2013 at a distance of 1.5 × 3m on four wire trellis system (2222 trees/ha). The varieties were studied for their various morphological and quality attributes. The variety Super Chief Sandidge performed best in terms of quality parameters while



as variety Golden Clone B recorded highest yield (10MT/Ha) and yield efficiency (1.42kg/cm²). The overall results indicate that the introduced apple varieties and planting systems are characterised with different biological and quality polymorphism. Most of the studied varieties show positive characteristics and can be recommended for further evaluation in Kashmir valley.

EFFECT OF CLIMATE CHANGE AND GLOBAL WARMING ON TEMPERATE HORTICULTURE

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Global warming and climate change is the greatest concern of mankind in 21st century. Climate change influences the established commercial varieties of fruits, vegetables and flowers poorly in an unpredictable manner. Due to global warming and climate change the melting of ice cap in the Himalayan regions will reduce chilling effect required for the flowering of many of the horticultural crops like Apple, Saffron, Rhododendron, Orchid, etc. Winter chill is essential for most of the plants that fall dormant in the winter in order to avoid frost damage and do not resume growth until a certain amount of winter chill has accumulated for fulfilling their chilling requirement. Climate change is likely to affect chilling requirement of temperate fruit crops significantly and therefore, the opportunity to meet this requirement will be reduced as the climate becomes warmer. Insufficient chilling greatly influences flower initiation and fruit colouration along with deterioration in fruit texture and taste. Further, the lack of proper chilling is also posing serious problems like scab disease, premature leaf fall and infestation of red spider mite in apple. High temperature and moisture stress is increasing sunburn and cracking in apple, apricots and cherries in the higher altitudes. Insufficient chilling reduces pollination, fruit set and ultimately the yield in walnuts, pistachio and peaches. Reduced flower size and pedicel lengths were observed in cherry due to less chilling. Hence there is a need to protect these valuable crops for sustainability against the climate change scenario. The most effective way is to adopt conservation agriculture, using renewable energy, forest and water conservation, reforestation etc. To sustain the productivity, modification of present horticultural practices and greater use of greenhouse technology are some of the solutions to minimize the effect of climate change. Development of new cultivars of horticultural crops tolerant to high temperature, resistant to pests and diseases, short duration and producing good yield under stress conditions, as well as adoption of hi-tech horticulture and judicious management of natural resources will be the main strategies to meet this challenge.

RAINFALL- RUNOFF MODELLING AND GROUND WATER FLUCTUATION OF GONDA DISTRICT UTTAR PRADESH

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Various quantitative analyses are required for complex and dynamic nature of water resources systems to manage it properly. Groundwater table fluctuations over time in shallow aquifer systems need to be evaluated for formulating or designing an appropriate groundwater development scheme. This paper demonstrates a methodology for modeling rainfall-runoff and groundwater table fluctuations observed in a shallow unconfined aquifer Gonda district Uttar Pradesh. The rainfall recharge contributed to its annual increment in the ground water reserve which in turn is reflected in the rise of water table during the post monsoon period. The linear regression model between water table and annual rainfall was derived by Karl Pearson's method. The value of statistical errors of R², RMSE and EC were found to be 0.6198, 0.454 and 81.3%, respectively. The fitted models, values of fluctuation determination R² was found to be significant close to observed value. It has been found that fluctuation was more as compared to the availability. A good correlation was found between seasonal rainfall and change in ground water level. The increment in ground water reserve, correlation between climatic parameter and ground water level showed positive and negative relationship. Highest correlation was found in rainfall and ground water level. The developed equation may be adopted for reasonable estimate of ground water table depth at piezo metric stations based on depth for the effective planning & management of ground water resources of the basin.

TILLAGE SYSTEMS FOR BIOLOGICAL SOIL CONSERVATION

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This umbrella term can include reduced tillage, minimum tillage, no-till, direct drill, mulch tillage, stubble-mulch farming, trash farming, strip tillage, plough-plant. Land and water are the most precious natural resources important to human civilization. The natural resources of the state include land, water, soil and biodiversity, which dictate the opportunities for livelihoods and income for the people. However, both are facing threats of deterioration due to unrelenting human pressure and utilization incompatible with its capacity. The application is mainly in mechanized high production farming with good rainfall, or for the control of wind erosion where there is large-scale mechanized cereal production. It is less applicable to low input level crop production, or subsistence agriculture. The principles are equally effective in any conditions - to maximize cover by returning crop residues and not inverting the top soil, and by using a high crop density of vigorous crops. Conservation tillage also has the advantage of reducing the need for terraces or other permanent structures. However there are several disadvantages which hinder the application of conservation tillage in semi-arid conditions. One of the reasons for low yields in semi-arid areas is the limited amount of moisture available to crop roots. The available moisture will be increased if the rooting depth is increased and it has been shown that in some cases deep tillage can help, for example on the dense sandy soils (luvisols) in Botswana (Willcocks 1984). Reviewing many studies of experiments of depth of tillage on alfisols, El-Swaify finds varied results; deep tillage is beneficial for some crops but not all, and on some soils but not all. Also deep tillage requires greater draught power which is usually in short supply in semi-arid areas. Ripping or sub soiling can be beneficial, either to increase the porosity of the soil, or to break a pan which is reducing permeability. The deep placement of fertilizer can also be used to encourage more rooting at depth, but again the application of this technique to subsistence farming will be difficult. Like conservation tillage, this



title covers many different farming techniques. It includes any farming practice which improves yield, or reliability, or decreases the inputs of labour or fertilizer, or anything else leading towards improved land husbandry, which we have defined as the foundation of good soil conservation.

GENOTOXICITY EVALUATION OF WASTEWATER IN THE VICINITY OF AN OIL REFINERY

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Oil refinery effluents are composed of various chemicals that consist of oil and greases, phenols (creosols and xylenols), sulphides, ammonia, suspended solids, cyanides, nitrogen compounds and heavy metals (Cr, Fe, Ni, Cu, Mo, Se, V and Zn). Moreover, it also contains toxic and persistent contaminants like aromatic hydrocarbons including benzene, toluene, ethyl benzene, xylene (BTEX) and polycyclic aromatic hydrocarbons (PAHs) which are persistent organic pollutants (POPs), released into the environment mainly by exploration activities of petroleum industry. These pollutants are mutagenic, carcinogenic, immunotoxic and teratogenic to lower and higher forms of life i.e. microorganisms to humans.

The present study was conducted in order to assess the genotoxic potential of wastewater collected from the effluent canal of Mathura Oil refinery using chromosomal aberration assay in the meristematic root tip cells of *Allium cepa*. The squash preparations from root tip cells of *A. cepa* showed that the test samples affected mitotic index in dose dependent manner and several types of chromosomal (c-mitosis, delayed anaphase, laggard, vagrant chromosomes and stickiness etc.) and clastogenic aberrations (chromosomal breaks, chromatin bridge and ring chromosomes) were observed in meristematic root tips of *A. cepa*. The present study suggested that irrigation of agricultural fields with wastewater should be avoided as there is a possibility of accumulation of pollutants which may enter into food chain and cause health hazards to humans.

POTENTIAL ROLE OF AGROFORESTRY IN MITIGATING CLIMATE CHANGE ON FARMERS FIELD

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Agroforestry, the integration of trees and shrub with annual crops production, is an age old management system practiced by farmer to provide shade, a steady supply of food and/ or income throughout the year, arrest degradation and maintain soil fertility, diversify income sources, increase and stabilize income, enhance use efficiency of soil nutrients, water and radiation, and provide regular employment. Recognizing the ability of agroforestry system to address multiple problems and deliver multiple benefits, the IPCC Third Assessment Report on Climate Change (IPCC, 2001) states that “Agroforestry can both sequester carbon and produce a range of economic, environmental and socioeconomic benefits. For example, trees in agroforestry farms improve soil fertility through control of erosion, maintenance of soil organic matter and physical, increased N, extraction of nutrients from deep soil horizons, and promotion of more closed nutrient cycling. Trees accumulate CO₂ (which is the most predominant GHG) in their biomass. Agroforestry not only helps in climate change mitigation but also climate change adaptation. It is an established fact that despite our present effort at climate change mitigation (GHG reduction), there is a more pressing need to cope with the impact of climate change (Adaptation). Agroforestry hold considerable potential for improving carbon sequestration and carbon storage in both soils and the biomass. The changing climate of the earth has adversely affected the sustainability of rural livelihoods due to the loss of productivity of crops and may be improved through carbon sequestration by reducing carbon-dioxide level in atmosphere. Agroforestry provides twin advantage by storing carbon through enhanced build up of soil organic matter and increased wood biomass production that could absorb more carbon dioxide from the atmosphere. Biomass production through multi species stands in agroforestry on degraded lands may be a priority for providing a cleaner environment. Poplar exhibits some of the highest CO₂ exchange rates and photosynthetic capacities among woody plants and therefore, forms a unique combination with agricultural crops for sequestration atmosphere carbon. For instance, the trees in agroforestry provide shade for both companion crops and the farmer against the rising temperature, and also shelter the crops against the harmful effect of raging storms. The full genetic potential of many crops and varieties can only be realized when environmental conditions are close to optimum. While removing the extra energy accumulated and trapped by atmosphere is not feasible, agroforestry system with appropriate shade trees offer a promising option to moderate the effect of heat stress locally. Trees on farm bring about favourable changes in the microclimatic condition by influencing radiation flux, air temperature, wind speed, saturation deficit of understorey crops all of which will have a significant impact on modifying the rate and duration of photosynthesis and subsequent plant growth, transpiration, and soil water use. Some examples where the beneficial aspects of microclimatic changes are extensively used are shade trees to protect heat sensitive crops like coffee, cacao, ginger and cardamom from high temperature, wind breaks and shelter belts to slow down the wind speed to reduce evaporation and physical damage to crops, mulches to reduce soil temperature and various crop tree mixes to reduce erosion and maximize resource use efficiency. The presence of trees on the farms ensures income diversification through the provision of additional resource like fruits, vegetables, fodder, etc. These help the farmer cushion the effect of climate change impact like crop failure.

E- WASTE: CONSTRAINTS, CHARACTERISTICS AND MANAGEMENT

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The electronics age made unprecedented impact on human society and spectacularly enhanced our connectivity across the globe. E-waste is a serious problem at both local and global scales. E-waste comprises of a multitude of components, containing toxic substances that can



have an adverse impact on human health and the environment if not handled properly. In India, e-waste management assumes greater significance due to the generation of its own e-waste as well as due to dumping of e-waste from developed countries. Disposal of e-waste is an emerging global environmental and public health issue, as this waste has become the most rapidly growing segment of the formal municipal waste stream in the world. This is coupled with India's lack of appropriate infrastructure and procedures for its disposal and recycling. Advancement in technology, changes in style, fashion & status has increased both the consumption and the production of EEE. The hazardous nature of e-waste is one of the rapidly growing environmental problems of the world. The ever-increasing amount of e-waste associated with the lack of awareness and appropriate skill is deepening the problem. A large number of workers are involved in crude dismantling of these electronic items for their livelihood and their health is at risk; therefore, there is an urgent need to plan a preventive strategy in relation to health hazards of e-waste handling among these workers. Required information should be provided to these workers regarding safe handling of e-waste and personal protection. For e-waste management many technical solutions are available, but to be adopted in the management system, prerequisite conditions such as legislation, collection system, logistics, and manpower should be prepared. Several tools including Life Cycle Assessment (LCA), Material Flow Analysis (MFA), Multi Criteria Analysis (MCA) and Extended Producer Responsibility (EPR) have been developed to manage e-wastes especially in developed countries.

DEVELOPMENT AND MANAGEMENT OF ECOLOGICAL NICHE

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In ecology, a niche is a term with a variety of meanings related to the behaviour of a species living under specific environmental conditions. The ecological niche describes how an organism or population responds to the distribution of resources and competitors. The ecological niche describes the functional position of an organism in its environment. An ecological niche is a role of an organism or population plays in an ecosystem. Each species has different adaptations called unique adaptations so they don't able to compete for all the resources of the species so they have their own niches. For example Giraff, Gazelle and Beetles live in the same habitat for occupying their own niche. Like wise Rain forest provided more number of niches because they have more diversity. When two species use the same resource they are said to compete. No two organisms can occupy exactly the same niche at the same time. Grinnellian, Eltonian and Hutchinsonian are types of niches present in the environment. Niche construction is the process in which an organism alters its own environment, often but not always in a manner that increases its chances of survival. Niche construction is that the organisms have changed the environment on which they live. Niche construction is as important to evolution as natural selection i.e., not only does an environment cause changes in species through selection, but species also cause changes in their environment through niche construction.

EFFECTS OF CLIMATE CHANGE AND GLOBAL WARMING ON WEEDS AND DISEASES

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Climate change is likely to cause a spread of tropical and sub-tropical weed species in to temperate areas and to increase the numbers of many temperate weed species currently limited by the low temperature at high latitudes. Climate change resulting in increased temperature could impact weed population in several complex ways. Changes in the pattern of rainfall will cause the alteration in the water availability, which eventually will lead to weed shift. Response to drought in agronomic conditions is dependent on species and cultural conditions any factor which increases environmental stresses on crops may make them vulnerable to attack by insects by plant pathogen, which result in less competing ability with weeds. The increases in temperature have a significant impact on agriculture in general crop weed competition and weed management in particular. It has been argued that weeds of tropical origin highly responsive to small increases in temperature, and several examples are available for substantial increases in weed growth with increases in temperature. Increases in temperatures and UV radiations and a decrease in relative humidity may render natural plant products, entomopathogenic virus, fungi, bacteria, and nematodes and synthetic pesticides to be less effective, and this effect will be pronounced on natural plant products and the bio-pesticides. These changes can influence the food quality and secondary metabolites of the crop plants

DELINEATION OF WATERSHED BOUNDARIES AND ASSESSMENT OF SOIL EROSION POTENTIAL IN HEAVY RAINFALL AREA

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Soil is very important to sustain the life on earth. Serious concern in many parts of the world is experienced due to accelerated erosion which was caused by environmental disturbance directly or indirectly by human beings. In this present study, Delineation of watershed boundaries and erosion potential of Nainital district of Uttarakhand state was estimated using LANDSAT 8 imagery of 3 December 2014. To delineate the boundaries of the sub-watersheds inside the Nainital district, QGIS 2.18.4 software has been used by utilizing the digital elevation map (DEM) of this region. The QGIS 2.18.4 software, ArcGIS and ENVI 4.7 image processing softwares have been used to process satellite images and land use land cover map was prepared by unsupervised classification in ENVI 4.7 with proper ground truth technique. RUSLE was applied to predict the spatial distribution of the average annual soil loss in his district. The potential soil loss in the Nainital district was found between the



range of 0.0 to 219.65 ton ha⁻¹ yr⁻¹ on spatial basis. Maximum area is under severe erosion potential with soil loss rate 40 to 80 ton ha⁻¹ yr⁻¹. Study suggested that urbanization is causing more soil erosion and support conservation practices such as terracing, contour cultivation and strip cropping helping to reduce soil erosion in this region.

ROLE AND PARTICIPATION OF CHILDREN (DIFFERENT AGES) IN WASTE MANAGEMENT, CONSERVING RESOURCES AND SAVING ENVIRONMENT

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Children are said to be the future pillars of the society. They are the ones who are going to be ultimate generation with depleted resources, dirtier planet and filthy air. Since, we all know and worry, it becomes the duty of all elders to teach kids from the very beginning- the various tips and tricks to save the environment. This research paper will focus on how little alteration, teaching and overall education can be helpful in bringing out huge results in saving the environment and conserving the natural resources. This paper will also trace out that at which age which all steps the kid can take to have a fruitful, neater, cleaner and healthier future and life. The research is based on library research wherein research papers related to the topic will be analysed and would help to draw conclusions which should be implemented in the lifestyle of the kids, not only at home but formally, at school level too. The awareness should be imbibed in each child and the lesson of saving the environment should be the moral motto of life.

EFFECT OF RAINFALL INTENSITY ON SEDIMENT OUTFLOW AND RUNOFF UNDER DIFFERENT LAND SLOPES CONDITIONS

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Rainfall simulators are an essential research tool for investigating the process dynamics of soil erosion and surface hydrology. The problem of soil erosion in India is very serious. About 18.5% of the world's total soil erosion takes place in India, which is about 16.4 tons/ha/year. Organic mulches are very effective in preventing soil erosion, reduce sediment, runoff rate and increasing infiltration. The study was carried out with the objectives to observe the sediment outflow from various treatments at selected land slopes under simulated rainfall conditions by using rainfall simulator of size 10 m × 1.2 m × 0.5 m with the locally available soil material collected from Crop research centre, Pantnagar. In the present study, three rainfall intensities viz. 11cm/h, 13cm/h and 14.65cm/h at 0%, 2% and 4% land slopes were selected. The duration of rainfall was fixed (10 minutes) for every experiment. The total runoff volume was found to be varying with particular rainfall input and land slope. The runoff distribution pattern was observed to be increasing with the increase in land slope. The average sediment concentration and outflow was found to be increasing with the increase in land slope. The sediment outflow rate was found to increase with the increasing land slope and rainfall intensity. We can prevent sediment transport and reduce runoff rate with the help of using organic mulches and organic residues.

BIODEGRADATION AND DETOXIFICATION OF CYPERMETHRIN BY LIGNOLYTIC ENZYMES ESTERASE AND LACCASE PRODUCING BACTERIA *BACILLUS SPP.*

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Cypermethrin degrading bacterial strains were isolated from pesticide contaminated agricultural fields. Out of ten isolated bacterial strain one bacterial strain 2D was selected for the further study on the basis of their minimum inhibitory concentration (450ppm). Bacterial strain was characterized on the basis of morphological, physiological, biochemical characteristics tests and 16S rDNA sequence analysis, the strain was determined to be a *Bacillus spp.* The strain *Bacillus spp.* is aerobic and optimum growth temperature for the strain was found to be 30-35 °C with initial pH range 6.0-8.0 and pH 6.8 was found to be the optimum. Total percent degradation was checked at different days interval for cypermethrin with the help of GC. After 15th days the maximum degradation was found for the cypermethrin (trans) 95%. Degraded metabolites was also analyzed by using GCMS the compounds were Phenol, cyclododecylamine, 1-decanol, chloroacetic acid, acetic acid, cyclopentan, palmitoleic acid, decanoic acid found. Biodegradation ability of strain *Bacillus spp.* without toxic byproducts reveals its potential for further study as a biological agent for the remediation of soil, water or crops, contaminated with cypermethrin.

MANAGEMENT OF EMERGING WEED SPECIES IN CONSERVATION AGRICULTURE AN OVERVIEW

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Conservation agriculture (CA) is gaining popularity around the globe due to its sustainable approaches such as permanent soil cover, minimal soil disturbance, planned crop rotations and integrated weed management. Even though the adoption of CA in India is still in an early stage, it has been successfully used in the irrigated rice-wheat cropping systems of the Indo Gangetic Plains (IGP). Weed control is the biggest challenge to CA adoption. Weed species shifts and losses in crop yield as a result of increased weed density have been found as major hurdles to the widespread adoption of CA. The shift from conventional puddle transplanted (CT-TPR) to dry direct-seeding (DSR) in rice with reduced or ZT, typically results in changes in tillage, crop establishment method, irrigation practices, and weed management that influence weed diversity and abundance. Increased weed problems during the 'transition period' tends to be the most common hurdle in adoption of CA



by farmers. Research has shown that cover crops could play an important role in weed management in CA systems; however, their level of adoption at present is fairly low. Changes in patterns of tillage, planting systems, and other management strategies can alter the soil environment and lead to a major change in weed flora. Herbicide use has been an extremely important component of weed management in CA but greater effort is needed to integrate non-chemical weed control tactics with herbicides. In CA, the presence of residue on the soil surface may influence soil temperature and moisture, which may affect weed seed germination and emergence patterns over the growing season. Soil surface residues can interfere with the effectiveness of herbicides, so there is a greater likelihood of weed escapes if residue is not managed properly or herbicide application timings or rates are not adjusted. In the absence of tillage, perennial weeds may also become a more serious challenge in this system. Thus integrated weed management compatible to cropping patterns and climatic conditions offers the best results in CA. Efforts are required to increase the rate of adoption of direct seeded rice and zero-till wheat throughout the IGP. At present, residue retention on farmer fields tends to be low. Greater awareness of the benefits of residue retention for improved soil health is needed. Research effort needs to be enhanced to develop CA and promote its adoption in non-rice-wheat cropping systems in India.

NATURAL RESOURCES AND CONSERVATION IN INDIA

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Nature provides us the basic needs like food, shelter, clothes, etc. for our survival. We use air, water, soil, minerals, coal, petroleum, animals, plants etc.. But do you ever think, how long these precious materials of the nature will be available for our use. The growing population, rapid industrialisation and urbanisation have created heavy demand on all these materials. It is feared that unless proper steps are taken to conserve them in time, we will face tremendous hardship in future. The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving the nature and natural resources. Natural resources were conserved in the form of sacred groves/forests, sacred pools and lakes, sacred species etc. 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 tribal to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. This practice is wide spread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals and. Similarly, several water bodies e.g., Khecheopalri lake in Sikkim was declared sacred by people, thus protecting aquatic flora and fauna.

CLIMATE CHANGE AND GLOBAL WARMING SIGNIFICANT EFFECT ON ENVIRONMENT

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Global warming refers to the phenomenon of increasing average surface temperatures of the Earth over the past one to two centuries. The concept is related to the more general phenomenon of climate change, which refers to changes in the totality of attributes that define climate not only surface temperatures, but also precipitation patterns, winds, ocean currents, and other measures of the Earth's climate. For this reason, I will favor the use of the more general term 'climate change' throughout this essay, recognizing that global warming is simply one of the attributes of climate change. Climate change can be viewed as consisting of two components, one of which is human in origin and coincides in timing with the industrial period of the past two centuries, and the other of which is natural and has played a role in both past and current climate variability. Global warming generally refers to the anthropogenic component of climate change alone, and only the surface warming associated with it. On Earth, human activities are changing the natural greenhouse. Over the last century the burning of fossil fuels like coal and oil has increased the concentration of atmospheric carbon dioxide (CO₂). This happens because the coal or oil burning process combines carbon with oxygen in the air to make CO₂. To a lesser extent, the clearing of land for agriculture, industry, and other human activities has increased concentrations of greenhouse gases.

EFFECT OF LONG-TERM FERTILIZER TREATMENTS ON SOIL P^H, ELECTRICAL CONDUCTIVITY ORGANIC CARBON AND PRODUCTIVITY OF RICE-WHEAT SYSTEM

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Soil p^H, EC, organic carbon and productivity were evaluated after 23 years of continuous cropping of rice and wheat to which different levels and combinations of NPK fertilizers had been applied. Continuous application of fertilizers resulted in decline of soil p^H significantly while minimum p^H was recorded in balanced use of NPK fertilizer treatments. The treatment receiving three nutrients NPK showed maximum EC (0.18 dS/m). The organic carbon content of soil increased in all the treatments except control. Highest grain and straw yield of rice and wheat was recorded in treatment receiving 120 kg N, 80 kg P and 40 kg K per hectare. Results showed that balanced use of NPK fertilizers with inclusion of sulphur containing fertilizers are needed to maintain soil p^H, EC, organic carbon and productivity of rice and wheat in long run.

RICE STRAW DEGRADING MICRO-BIOMES WHO HELP IN SOIL FERTILITY AND ENVIRONMENT PROTECTION

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Rice *Oryza sativa* L. (**2n=22=AA**) has shaped the culture, diets and economic of millions people. For more than half of the humanity “rice is life”. In India, rice is being grown in 44.10 Mha area with production of 105 MMT and productivity of 3.52 MT/ha, respectively in 2016–17. Rice and straw ratio is 1:1.5 indicated that there is 1.5 times production of paddy straw in nature. The main components of rice straw are hemicellulose (26 to 35%), cellulose (38 to 41%), lignin (12-16%), water soluble polysaccharides (8%), 15 – 20% of ash and 9 – 14% of silica, which is recalcitrant for degradation. Rice straw is a major substrate for the production of methane, a greenhouse gas, in flooded rice fields. Wetland rice fields annually release about 60 to 100 MMT of CH₄ and thus contribute substantially to the global warming of the atmosphere. Methane emission from rice fields starts after the flooding of the fields and stops when the fields are drained for harvest. Rates of CH₄ production were higher in incubations with straw from the stems >leaf blades> leaf sheaths >unamended soil. In many countries, massive amounts of the post-harvest rice residues are eliminated through burning, which represents a threat to public health and poses an environmental pollution problem. Alternatives to burning include potential feedstock to produce biofuels, bio-fertilizers, animal feed, bio-based industry chemicals, cheap substrate for fermentation of enzymes, biogases, mushroom cultivation and bio-compost. The anaerobic degradation of biopolymers, the formation of methane, is performed by methanogenicarchaea. The responsible microorganisms i.e the genera *Methanosaeta*, *Methanobacterium*, and *Methanosarcina*, in rice field soil. The aforementioned potential technologies and products generated from rice straw are highly dependent on effective lignocellulose degrading microorganisms. In nature, lignocellulose biomass can be degraded efficiently with the co-operation of many species of microorganisms. *Pleurotuseryngii*, bacterial lignocellulose enzymes and *Streptomyces badius* were also regarded as efficient decomposer of natural lignocellulose. The feasibility and eco-friendly strategy of lignocellulose decomposing conditions including temperature, pH, Solids Retention Time (SRT) remarkably influence anaerobic digestion process parameters such as stability and product formation. Methanogenesis, the terminal step of methane formation is temperature dependent. Anaerobic digestion is usually operated at mesophilic temperature (30-40°C). However, anaerobic digestion offers numerous advantages in thermophilic operation (50-60°C) such as an increase of reaction rates, an increase of efficiency, an improvement of solid-liquid separation and an increase of the elimination of pathogenic organisms. Rice straw is a promising low-cost carbon source for fungal enzyme production for rice straw. *Humicola insolens* enzyme preparations are rich in xylanase and biological pre-treatment by *Aspergillus niger* involves different enzymes production that cause the degradation of lignocellulosic material producing digestible reducing sugars. *Pseudomonas viridilivida*, *Klebsiella oxytoca*, *Raoultellaplanticola* and *Corynebacterium urealyticum* were reported as cellulose degrading microorganisms also.

BIOAMELIORATION OF THE MODERN FARMING SYSTEM THROUGH UNDERWATER FARMING

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In the Developed world, industrial agriculture based on large scale monocultures is becoming the dominant system of modern farming, although there is growing support for sustainable agriculture. Modern agronomy, plant breeding, agrochemical such as pesticides and fertilizers, and technological improvements have sharply increased the yields from cultivation but at the same time have caused widespread ecological damages and negative impacts on human welfare. Underwater farming solves most of the problems that we faced in the modern agriculture. There is no requirement for fresh water; no use of agrochemicals, per unit area of food productivity is high. Climate change doesn't affect its productivity. Underwater farming provides zero input food. Over 10,000 edible plants in oceans are available which can be cultivated through 3D farming (Vertical underwater farming), the requirements are quite simple; as compare to 100 acres of land used in usual land agriculture system, this type of farming system requires just 20 acres of water body area and this 20 acres have more productivity than a 100 acres land. Thus this approach will act as an escape route for the land crisis will suffer nowadays due to the modern urbanization. This sea-basket approach will cause an upraise in the blue green economy which will help and give a new approach to tackle the declining food productivity. Besides from these benefits, the sea farms also acts as artificial reefs and storm surge protectors. In India also, baby steps towards this concept has been put forward through the Biosaline farming, that takes place in kerala state.

STUDY OF SOLUTE-SOLVENT INTERACTION OF O-BENZO QUINONE WITH AQUEOUS SOLVENT (T.H.F)

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Ultrasound Velocity, Density and viscosity measurements have been used calculate isentropic Compressibility (β_s), Intermolecular free length (L_f), Ultrasound velocity (V), Density (ρ), Excess viscosity (η), specific acoustic Impedance (τ) Rao's constant (R), Shear's Relaxation Time (τ_s), Apparent molal adiabatic Compressibility (ϵ_k), and Excess Value (A^E), of solution of Benzo Quinone in aqueous organic solvents such as THF. in each calculate Ultrasound Velocity increases and isentropic Compressibility (β_s), Decreases, Intermolecular free length (L_f), Density (ρ) increase and viscosity decreases with increases in molar concentration of O-Benzo quinone. The Ultrasound Velocity increases on increasing concentration of solute and solvent.

THE EFFECT OF AIR POLLUTANTS ON HUMAN HEALTH AND THEIR MECHANISMS OF CELLULAR ACTION

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Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. The air we breathe affects every part of our body. Immediately, breathing toxic air can cause shortness of breath and irritation in our nose and throat. Many forms of atmospheric pollution affect human health and the environment at levels from local to global. These contaminants are emitted from



diverse sources, and some of them react together to form new compounds in the air. Hazardous chemicals escape to the environment by a number of natural and/or anthropogenic activities and may cause adverse effects on human health. Increased combustion of fossil fuels in the last century is responsible for the progressive change in the atmospheric composition. Air pollutants, such as carbon monoxide, sulfur dioxide, nitrogen oxides, volatile organic compounds, ozone, respirable particulate matter and heavy metals, differ in their chemical composition, reaction properties, emission, time of disintegration and ability to diffuse in long or short distances. Air pollution has both acute and chronic effects on human health, affecting a number of different systems and organs. It ranges from minor upper respiratory irritation to chronic respiratory and heart disease, lung cancer, acute respiratory infections in children and chronic bronchitis in adults, aggravating pre-existing heart and lung disease, or asthmatic attacks. In addition, long-term exposure to air pollution can cause cancer and damage to the immune, neurological, reproductive, and respiratory systems. In extreme cases, it can even cause death.

IMPORTANCE OF SOIL AND WATER CONSERVATION

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Soil is the most fundamental, vital and basic resource that provides food, feed, fuel, and fiber. Soil is the basis of all terrestrial life, food security and environmental qualities that are essential for human existence. In addition to sustaining all life on Earth, soil water provides a pool of dissolved nutrients from which all plant nutrients are assimilated. Benefits of soil and water conservation on agricultural lands through the experience derived from the adoption and spread of Conservation Agriculture world-wide. Conservation Agriculture is an agro-ecological approach to sustainable agriculture production. It involves the application of three inter-linked principles that underpin agricultural production systems based on locally formulated practices: (i) permanent no or minimum mechanical soil disturbance, which in practice entails direct seeding through mulch into no-till soils; (ii) maintenance of soil cover with crop residues and green manure crops, particularly legumes; and (iii) diversified cropping system involving annuals and perennial in rotations, mixed cropping, inter cropping, sequences and associations. Soil and water are the two basic resources which are under intense pressure from increased population and degradation has already set in at many fragile watershed ecosystems. These two natural resources management greatly affect the social and economic structure of our villages and whole nation. It is expected that we need to produce about 64 per cent more of present level of agricultural production and need to conserve and optimum utilization of soil and water resources to feed the growing population up to 2020 and that is possible only through adoption of sustainable agriculture.

CLIMATE CHANGE: MITIGATION AND ADAPTATION IN AGRICULTURE

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Climate is the primary determinant of agricultural productivity which directly impact on food production across the globe. Agriculture sector is the most sensitive sector to the climate changes because the climate of a region determines the nature and characteristics of vegetation and crops. Climate change scenarios include higher temperature, changes in precipitation and higher atmospheric CO₂ concentrations which may affect on yield (both quality and quantity). As a mitigation and adaptation measures farmers can adapt to climate changes to some degree by shifting planting dates, choosing varieties with different growth duration, or changing crop rotations, integrated pest management, developing short-duration and climate-resilient crop varieties that can tolerate higher temperatures, drought and salinity; efficient water use such as frequent but shallow irrigation, drip and sprinkler irrigation for high value crops, irrigation at critical stages; efficient fertilizer use such as optimum fertilizer dose, split application of nitrogenous and potassium fertilizers, deep placement, use of neem, karanja products and other such nitrification inhibitors, liming of acid soils, use of micronutrients such as zinc and boron, use of sulphur in oilseed crops; resource conservation technologies such as no tillage, laser land leveling, direct seeding of rice and crop diversification (by growing non-paddy crops in rain fed uplands to perform better under prolonged soil moisture stress in kharif) which will help in reducing in the global warming potential. Crop diversification can be done Provide technical, institutional and financial support for establishment of community banks which provide more funds to strengthen research for enhancing adaptation and mitigation capacity of agriculture.

SOIL AND WATER CONSERVATION

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Soil and water is the most important resource on which agriculture is based. Proper management of these valuable resources is vital to sustain long-term agricultural productivity. Soil conservation is the preventing of soil loss from erosion or reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination. Slash-and-burn and other unsustainable methods of subsistence farming are practiced in some lesser developed areas. A sequel to the deforestation is typically large-scale erosion, loss of soil nutrients and sometimes total desertification. These are the Methods and Techniques of Soil Conservation viz Contour Plowing, Terrace Farming, Keyline Design, Windbreaks, Cover Crops, Crop Rotation, Soil Conservation Farming, Agrostological Measures, No till farming, Green Manures, Stream, Bank Protection, mulching and Prevent Overgrazing. 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. These are the Methods and Techniques of water Conservation viz- use sprinkler system, adopt drip irrigation system, collect water in Talab /Bandhi, Bawari, Taanka, AharPynes, Khadin, Kundand Nadi.

EFFECT OF IRRIGATION METHODS, MOISTURE REGIMES AND NITROGEN MANAGEMENT IN POTATO (*SOLANUM TUBEROSUM* L.)

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A field experiment was conducted to study the “Effect of irrigation methods, moisture regimes and nitrogen management in potato (*Solanum tuberosum* L.)” during Rabi season of 2015-16 at Agronomy Research Farm, Narendra Deva University of Agriculture & Technology Kumarganj, Faizabad. The treatments included to irrigation methods viz M₁ (regular furrow irrigation method) and M₂ (alternate furrow irrigation method), moisture regime viz. 0.8 IW/CPE, 1.0 IW/CPE and 1.2 IW/CPE with 6 cm irrigation water depth and nitrogen management viz. N₁ (100% dose of N through urea), N₂ (75% dose of N through urea + 25% dose of n through FYM) and N₃ (50% dose of N through urea + 50% dose of N through FYM). The experiment was laid out in Split Plot Design with four replications. The soil of experimental field was silt loam in texture, poor in organic carbon and nitrogen, medium in available phosphorus and rich in potassium with pH 8.0. The planting was done by hand on ridges on 18th November, 2015. Initial plant stand was non-significant under various irrigation methods, moisture regimes and nitrogen management. The growth characters viz. plant height, number of haulms at 30 DAP was also insignificant but at 60 and 90 DAP, there were significantly superior under M₁ (regular furrow irrigation method) with I₂ (1.0 IW/CPE) and N₂ (75% dose of urea through N + 25% dose of N through FYM). Number of leaves, fresh and dry weight of haulms were recorded significantly higher under regular furrow irrigation method and 1.0 IW/CPE over alternate furrow irrigation method and 0.8 IW/CPE respectively. In case of nitrogen management all the growth characters were recorded highest under nitrogen management treatment N₂, which was statistically superior over rest of nitrogen management treatments. Yield attributes viz., weight (grade wise) hill⁻¹ (g), weight (grade wise) kg plot⁻¹ and tuber yield (qha⁻¹) were found highest under regular furrow method of irrigation (M₁) and moisture regime, 1.0 IW/CPE (I₂) over 0.8 IW/CPE (I₁) and 1.2 IW/CPE (I₃). Number of all grade of tubers was found to be significant due to effect of moisture regimes. In nitrogen management all the yield attributes were recorded significantly higher under nitrogen management treatment (N₂), which was statistically superior over rest of the nitrogen management treatments. Quality parameters viz. dry matter and starch content did not influence significantly due to irrigation methods, moisture regimes and nitrogen management. The suitable irrigation method for potato was found to be regular furrow irrigation (M₁) with pertinent moisture regime to be of 1.0 IW/CPE and nitrogen management practice 75% dose of N through urea + 25% dose of N through FYM (N₂). Highest WUE efficiency was recorded with irrigation method (M₂), moisture regime at 0.8 IW/CPE (I₁) and nitrogen management practice (N₂). The highest net return and benefit-cost ratio of Rs. 86446.00 ha⁻¹ and 1.33 were worked out under treatment combination M₁I₁N₂ (regular furrow irrigation method, 0.8 IW/CPE ratio and 75% dose of N through urea + 25% dose of N through FYM).

EFFECTS OF CLIMATE CHANGE AND GLOBAL WARMING IN INDIA

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Now a day's climate change and global warming is a major problem in India. Global warming is the term used to describe a gradual increase in the average temperature of the Earth's atmosphere and its oceans, a change that is believed to be permanently changing the Earth's climate. The increased volumes of carbon dioxide and other greenhouse gases released by the burning of fossil fuels, land clearing, agriculture, and other human activities, are believed to be the primary sources of the global warming that has occurred over the past 50 years. Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent. This increase is the result of humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the oceans. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing by about 2 billion tons per year. The impact of global warming on health can be seen in the vascular and infectious diseases. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, changes in pests and diseases; changes in the nutritional quality some foods. Climate change will probably increase the risk of food insecurity for some vulnerable groups, such as the poor. Many numbers of beneficial insects, birds and animals which are responsible for maintaining the ecosystem and food web are declining year by year due to the climate change and global warming effect.

FLOATING RAFT- A INNOVATIVE PHYTOREMEDIATION METHOD FOR WASTEWATER RECYCLING

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As the population explosion occur after half of the 19th century, huge wastewater generation was observed and also in fresh water scarcity in several part of the world. Hence, to combat the fresh water scarcity, it is extremely necessary to reuse the wastewater after certain treatment for various non-potable purposes. In this regard the present experiment focused on floating raft based phytoremediation of wastewater, in which plants grown on artificial floating platform. Phytoremediation potential of Canna (*Canna indica*) and Pistia (*Pistia stratiotes*) were assessed for wastewater, collected nearby Mahakaleshwar Temple, Pantnagar. Selected parameters for wastewater quality assessment were viz. electrical conductivity, pH, biological oxygen demand, chemical oxygen demand, total solids, total suspended solids, total dissolved solids, total carbon, total nitrogen, total potassium, total phosphorus and heavy metals (Pb, Cr, Zn, Ni, Cu, Co, Fe). The result of this experiment was



relatively assessed to select plant species out of *Canna* and *Pistia* and it was observed that *Canna* shown more phytoremediation potential as compared to *Pistia*. Most of the above selected parameters were removed by 20-30% in 2 days HRT by *Canna* and 15-20% in 3 days HRT by *Pistia*. Hence, *Canna* was selected for further extension of this method at field level for phytoremediation of domestic wastewater discharge through residential colony at G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand.

Keywords: Phytoremediation; *Canna indica*; *Pistiastratiotes*; Wastewater recycling

SOIL PROPERTIES IN RELATION TO RESOURCE CONSERVATION TECHNOLOGIES

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Indian agriculture has been successful in increasing food grain production in the past, guided by the goals of the “self sufficiency” in the country. The mission of increasing food grains production somehow stands achieved, however, accompanied by series of problems related to the environment and natural resources. We have reached a situation where we must look for new directions, learning from our past (**Abrol and Sanger, 2006**). The resource conservation technologies primarily focus on resource savings through minimal tillage, ensuring soil nutrients and moisture conservation through crop residues and growth of cover crops, and adoption of spatial and temporal crop sequencing (**Singh et al., 2011**). Over the past three decades or so, internationally, rapid strides have been made to evolve and spread resource conservation approaches like zero and reduced tillage systems, better management of crop residues, planting systems, laser land leveler, site specific nutrient management (SSNM), leaf colour chart (LCC), green seeker, soil test crop response, fertigation, customized fertilizer and Agro-forestry, which enhance conservation of soil, water and nutrients.

Physical, chemical and biological properties of the soil environment are considered to be most influenced by the soil tillage operation in agricultural production. Tillage would aim to create a soil environment favorable to the plant growth (**Klute, 1982**). Based on 8 years of studies **Zhang et al., (2003)** reported that the mean soil bulk density was 0.8-1.5% lower in ST (sub-soiling with retention of all surface plant residues) and NT (consisted of zero tillage; planting was through the previous plant residues) treatments than in CT (Conventional tillage). A significant increase in available water capacity by 18-35% and total porosity by 35-46% in silt loam soil under the application of mulch at 0, 2, 4, 8 and 16 Mg/ha/year without crop cultivation (**Mulumba and Lal, 2008**). Micro organisms such as bacteria, fungi and actinomycetes influence profoundly the physical, chemical and especially the biological properties of soils. The microbial indicators of soil quality viz., soil microbial carbon (SMBC) and soil microbial biomass nitrogen (SMBN) were significantly present in higher concentrations under RCT's as compared to the conventional tillage (**Kaure et al. 2006**). Soil carbon or organic matter in general, is important because it affects all soil quality functions (**Fenton et al. 1999**). Carbon and Nitrogen in dryland soil could conserve better with the reduced tillage and increased cropping intensity and crop residues than the traditional conventional tillage with wheat- fallow system in Northern Great Plains (**Sainju et al., 2007**). It is estimated that carbon in soil stores five times more than conventional tillage in indian crop land situation. It is also of particular importance to reduce tillage on organic soils because of their high carbon content, these soils were found to emit more C when disturbed as compared to mineral soils.

In contrast the nature and dimensions of the problems being faced today are much different and complex than those faced in 1960s and 1970s. Past strategies are no longer taking agriculture forward therefore conservation agriculture can be seen as a new way forward for conserving resources and enhancing productivity to achieve the goals of sustainable agriculture, which demands a strong knowledge base and a combination of institutional and technological innovations by the way of strategies, policies and actions which must be adopted to move forward in new directions.

RECENTLY EMERGED TECHNOLOGY: CONSTRUCTED WETLAND COUPLED WITH MICROBIAL FUEL CELLS FOR WASTEWATER TREATMENT AND ENERGY PRODUCTION

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Microbial fuel cells (MFCs) have been widely applied in bio-electricity generation from organic matters in the presence of electrochemically active bacteria (EAB) under mild reaction conditions. The constructed wetland- microbial fuel cell (CW-MFC) is a newer treatment system in which the cathode and anode of an MFC are embedded in a constructed wetland (CW). CWs are used widely in wastewater treatment and have been applied to treat many types of wastewater including domestic, industrial, urban, and agricultural. MFCs can recover renewable energy from organic sources, and they are considered a promising wastewater treatment technology. CW-MFCs have the advantages of both CWs and MFCs for wastewater treatment. They can transform chemical energy directly into electrical energy, thereby reducing energy loss. Moreover, they are reliable and suitable for long-term operation. Research has shown that MFCs can be used to treat various types of wastewater, including domestic sewage and food processing wastewater. In addition, CW-MFCs have been used in domestic sewage treatment, showing better disposal efficiencies than conventional treatment systems based on studies conducted under closed circuit promoted pollutant degradation. In recent, novel power generation technologies, MFCs are integrated with constructed wetlands (CW-MFCs) and significant progresses have been made. It has reported that the maximum power density (15.73 mW m⁻²) and current density (69.75 mA m⁻²) were obtained with wastewater containing 1000 mg L⁻¹ dye. Combining the two technologies (termed as CW-MFC) has emerged in recent years with the aim of improving the wastewater treatment capacity of wetlands while simultaneously producing electrical power. The outcome of the new integrated process may develop a cost-effective clean and green technology.



SOIL BIOLOGICAL PARAMETERS AND THEIR MANAGEMENT FOR SOIL HEALTH AND CROP PRODUCTION. A REVIEW**Pushpa Yadav^{1*} and Maitreyie Narayan**

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Soil is a dynamic living body that contains enormous numbers of diverse living organisms ranging from invisible microbes, bacteria, algae, protozoa and fungi to the more familiar macro fauna such as earthworms, mites, ants and insects. The soil biota can be conceived of as the “biological engine of earth”. Soil biota plays important role in ecosystem services which are critical to the ability of soils to produce crops, viz. carbon cycling, nutrient cycling, soil structure integrity, biotic regulation and mutualism. Soils and their biodiversity thus play a critical role in maintaining soil health. Physical and chemical properties of soil are shaped by biological activity and biological activity is enhanced or limited by chemical and physical condition. Soil biological properties respond quickly for a change in soil quality and have been suggested better indicators than soil physical and chemical properties which alters only after drastic change in soil quality. Relevant biological properties include microbial biomass, respiratory activity, nitrogen mineralization, soil enzymes, soil fauna and population of suppressive organisms. Soil micro organisms mainly bacteria and fungi are the major component of soil organisms and contribute to 80–90% of soil biological activity. Non return or diminished return of organic matter and residues deprive the soil biota of their food with loss of soil health and fertility. Proper management of soil biodiversity will help in sustainable agriculture and reduce the cost of external inputs especially for nutrient supply and crop production. Strategies for improvement in soil biological properties requires understanding of numerous interactions among soil biological community and diversity, climate, soil type, plant species and soil management practices. Soil biological properties can be improved by soil management practices which vary with soil type, climate and vegetation. The beneficial effect of microbial inoculation, zero tillage or reduces tillage, cropping system, INM, long term fertilizer use and soil amendments on microbial population, biomass C and N and activities of soil enzymes have been demonstrates in several studies. In order to obtain benefits of soil organisms in sustainable crop production, a greater understanding of linkages among the soil organisms, soil biological processes, soil physical, chemical and biological properties, ecosystem functions, and impact of human interventions is required. Studies are required to establish indices of various biological properties for soil health assessment under different soil type, cropping system and climatic conditions.

CHALLENGES OF LAND DEGRADATION AND STRATEGIES OF THEIR MANAGEMENT**Shiv Singh Meena and Vineet Kumar**

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Land degradation is generally defined as a human-induced or natural process that negatively affects the land to function effectively. It is the temporary or permanent lowering of the productive capacity of the land (UNEP, 1992). Soil degradation in India is reported in the area of 147 Mha. This is extremely serious for Indian scenario, as it has 18% of world's human population as well as 15% of world's livestock population on a tiny land area (2.4%) of the world (Bhattacharyya *et al.*, 2015). The major challenges of land degradation in India are population explosion, deforestation, careless forest management, overgrazing, urbanization, industrialization, mining, agricultural activities (low and imbalanced fertilization, excessive tillage, use of heavy machinery, crop residue burning, poor water management, poor crop rotations, pesticide overuse, soil pollution) and poor economy as well (Bhattacharyya *et al.*, 2015). Gypsum is the most extensively used soil amendment for the reclamation of saline-sodic soils because of its low cost, general availability, and rich supply of Ca^{2+} followed by leaching can ameliorate saline-sodic soils (Ghafoor *et al.*, 2013). Maximum sorghum fodder yield with gypsum could be achieved, as it enhances soil permeability and maintains favorable $\text{Ca}^{2+} : \text{Na}^+$ ratio in soil solution (Yadav *et al.*, 2007). Singh *et al.*, (2008) reported that sorghum-berseem fodder based crop rotation gave the greatest sorghum fodder yield of 29.62 t ha⁻¹. Liming along with farm practices was reported for increased yield of different crops such as wheat yield increased by 52%, mustard by 35% in West Bengal; groundnut by 45%, pigeonpea by 43% in Orissa and black gram by 26% in Kerala. The response of combined application of NPK along with lime has been found better than alone additive effects of fertilizer and lime (Sarkar *et al.*, 2007). Combating to reduce further land degradation and investing in land conservation are the major task for sustainable management of degraded land and their natural conservation. Management options include various agronomic, mechanical and forestry practices, which lead to better physical soil conditions, improve soil quality, soil productivity and soil fertility as well. Improved grazing practices, efficient irrigation management, controlled urban sprawl and sustainable mining could play the crucial role in the prevention of land degradation.

AVAILABILITY OF SOME MACRO AND MICRONUTRIENTS AND THEIR CORRELATION WITH SOME PHYSICO-CHEMICAL PARAMETERS IN MOLLISOLS SOIL OF UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND**Vineet Kumar and Shiv Singh Meena**

An investigation was carried out to study the distribution of available macronutrients (N, P, K and S) and some micronutrient cations (Fe, Mn, Cu and Zn), their relationship with some physico-chemical properties of Mollisols soil of different blocks of district Udhm Singh Nagar (Uttarakhand). The soils of the district were found sufficient in Phosphorus, Potassium and Sulphur but low in available Nitrogen content. The values of the Alkaline KMnO_4 extractable N, Olsen's P, neutral normal Ammonium Acetate extractable K and available sulfur in the Udhm Singh Nagar district ranged between 125.44-338.68 kg N ha⁻¹, 7.34-76.70 kg P ha⁻¹, 66.08-271.04 kg K ha⁻¹ and 2.41-42.5 ppm, respectively. The average Nitrogen, Phosphorus, Potassium and Sulfur was 187.26 N ha⁻¹, 34.93 P ha⁻¹, 130.0 K ha⁻¹, and 17.42 ppm S, respectively. Values of DTPA-extractable Fe, Mn, Cu and Zn in soil samples of the district were ranged from 12.42-54.06, 0.96-22.06, 0.26-3.79 and 0.59-5.04 ppm with an average of 30.57, 6.84, 1.31 and 1.75, respectively. The available macro and micronutrients status was correlated with pH, electrical conductivity, organic carbon, sand, silt and clay content of the soil. In general the macronutrients were correlated significantly and negatively



with pH and positively with organic carbon. The DTPA-extractable micronutrient cations were positively and significantly correlated with organic carbon and clay content but negatively with pH of the soil.

Findings from present study can successfully be utilized for the larger parts of *Tara* region of Uttarakhand as effective guide for efficient and balanced fertilizer recommendations for the farmers.

DEGRADED SOILS, THEIR PROBLEMS AND MANAGEMENT FOR ENHANCING CROP PRODUCTION

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Soil degradation is a global problem that is especially severe in the tropics and sub-tropics. It is defined as the rate of adverse changes in soil qualities resulting in declining productive capacity of land due to processes induced mainly by human intervention (UNEP, 1992). In India it is estimated to be occurring on 147 million hectares (Mha) of land, including 94 Mha from water erosion, 16 Mha from acidification, 14 Mha from flooding, 9 Mha from wind erosion, 6 Mha from salinity, and 7 Mha from a combination of factors (NBSS&LUP, 2005). This is extremely serious because India supports 18% of the world's human population and 15% of the world's livestock population, but has only 2.4% of the world's land area. The pervasive problems associated with soil degradation are low soil fertility, nutrient depletion, multi nutrient deficiency, physical degradation and accelerated erosion. Mechanisms that initiate soil degradation include physical, chemical and biological processes. Soil structure is the important property that affects all three degradative processes. The overall decline in soil quality, both by natural and anthropogenic factors, has strong positive feedbacks leading to a decline in ecosystem services and reduction in nature conservancy. Restoration can be defined as re-establishing the presumed structure, productivity and species diversity that was originally present at a site that has been degraded, damaged or destroyed (SER, 2004). Ecological restoration improves biodiversity, human livelihood, empowers local people and improves ecosystem productivity. Adoption of techniques like contour farming, agroforestry, conservation agriculture, recycling run-off etc. can combat soil degradation. Nair (2011) stated three environmental benefits of agroforestry systems: water-quality enhancement, C sequestration, and soil improvement. In the Indo-Gangetic Plain region, bed planting under conservation tillage and zero tillage saved irrigation water without sacrificing crop productivity (Gathala *et al.*, 2011). Mandalet *et al.*, (2013) observed in Vertisols (of Central India) that broad bed and furrow system decreased soil loss to a greater extent (31% to 55%) compared to that of flat on grade system. Improvement in ground water levels, soil and moisture conservation, water regeneration capacity, forestry and horticulture development, change in land use pattern and cropping pattern in an integrated watershed management were noticed by Adhikari *et al.*, (2013). Ghosh *et al.*, (2011) reported that intercropping cowpea with maize (2 rows of cowpea with 1 row of maize) decreased runoff by 10% and soil loss by 28% compared to pure maize. Sustainable agricultural intensification using innovative farming practices have tremendous potential of increasing productivity and conserving natural resources, particularly by sequestering soil organic carbon (both labile and recalcitrant) and improving soil quality. Improved grazing practices, irrigation management, control on urban sprawl and mining are a few other solutions for preventing land degradation.

UTILIZATION OF AGRICULTURAL WASTES FOR ENVIRONMENTAL SUSTAINABILITY

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Agricultural waste is the waste produced as a result of various agricultural operations and from agro based industries. Agricultural waste includes crops residues such as straw, stem, stalk, leaves, husk, peels, cane trash, corn leaves and cobs, cassava stem, coconut shell and leaves etc. and also Agro-industrial wastes such as sugarcane bagasse, oil cakes, by-product of sugar industry, vegetable and fruit processing wastes, wheat bran, rice bran, corn cobs, cassava peels, peanut shells, coffee husks and wheat straw, fruit peels etc. About 600 to 700 metric tons of agricultural wastes are generated in India every year, but most of it is not used properly. Agricultural waste, if not properly utilized, like left in the field to rot or burned down, can cause short-term and long-term effects on ecosystems, land and broader environments. Agricultural wastes are most renewable and cost-effective resources; we can develop many economical processes for implementation on industrial scale. Utilization of agricultural wastes can solve the energy crises, fuel and environmental problems. Large amount of the agricultural wastes are mainly composed by "lignocellulosic materials" which gives complex structure to these agricultural waste biomass. These lignocellulosic materials can be converted into simpler one with the help of microorganisms used as a tool in environmental biotechnology. So, with the help of Environmental biotechnology agricultural wastes biomass can be converted into variety of value added products such as Bioethanol, Biohydrogen, Biocompost, Bioplastics, Biochar, Biogas, Biosurfactants, Bioactive compounds, bioinsecticides etc. These Environmental friendly methods are very important for converting waste to wealth.

CONSERVATION AGRICULTURE- OPPORTUNITIES AND LIMITATION FOR SUSTAINABLE AGRICULTURE IN INDIAN CONTEXT:

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As per food and agriculture organization (FAO) "Conservation agriculture aims to conserve, improve and make 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 enhanced and sustained agricultural production and can also be referred to as resource efficient or resource



effective agriculture.” As per FAO definition, the conservation agriculture is to (i) Achieve acceptable profits (ii) High and sustained production levels and (iii) Conservation environment (FAO; 2009). Increasing concerns of food security arising from increasing population, changing life styles and basic issues of livelihood of a vast majority of rural poor, overall slowdown in agricultural growth, deceleration in productivity growth of most crops and increasing food prices have led to the need for a fresh thinking on technological and other options for recurring the sector's growth (Planning commission- Eleventh plan Documents, 2008). Globally the total area under CA in different countries is 98 m ha and the countries that have adopted the system so far are USA (25.30), Brazil, Argentina, Canada, Australia, South America, India, Europe, Africa and China. There are three principles which form the basis of CA. (i) Minimum soil disturbance. (ii) Soil cover. (iii) Cropping system and have led to benefits of yield improvement, less cost and time, Carbon sequestration less soil and water erosion increased WUE, reduced labor, time, farm power and cost.

SOIL AND WATER CONSERVATION IN HORTICULTURE.

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Soil is the most fundamental and basic resource. Soil is a vital resource that provides food, feed, fuel, and fiber. Strategies that enhance water and nutrient use efficiency in vegetable production may contribute to increase productivity and reduce diffuse (non-point source) nutrient pollution. A combination of optimal water management and applying fertilizer rates adjusted to crop requirements should not only reduce the risk of adverse environmental impact but also be the most profitable choice for the farmer. Water management strategies oriented towards improving nutrient use efficiency in horticultural systems. This is particularly relevant when transforming rain fed cropping systems into irrigated ones, because the soil may increase mineralization and supply large amounts of nutrients during the transition period. Nitrogen losses occur mainly by leaching and, together with phosphorus, by erosion and runoff from open fields. Nitrate leaching is frequently the most important loss process in horticulture because large input of N fertilizer are applied to maintain high productivity, roots of many vegetable crops are superficial, and the N remaining in the field as crop residues after harvest is a large fraction of the plant N uptake. Losses by leaching and effluents from greenhouses may also be responsible for diffuse pollution. Water management greatly affects greenhouse gas emission and may help to design horticultural systems with low emissions of atmospheric pollutants.

Keywords: Diffuse water pollution Nitrogen Phosphorus Salinity Vegetable production Water quality

SOLID WASTE MANAGEMENT IN INDIA: RECENT SCENARIO REVIEW

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Industrialization becomes very significant for developing countries like India having large number of population. Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. In recent times, E-waste and plastic waste also contribute considerably to total waste stream due to utilization of electronic and other items. Solid waste is defined as discarded solid fractions, arising from domestic, trade, commercial, industrial, agricultural, institutional, public services and mining activities. The term waste refers to useless, unwanted or discarded material. These wastes may cause a potential hazard to human health or environment if any of the aspects of solid waste management is not managed effectively. In India, approach towards Solid waste management is still unscientific. Solid Waste collection efficiency in India is around 70%, while same is almost 100% in the developed countries. Even today, large portion of solid waste is dumped indiscriminately on outskirts of towns or cities without any prior treatment. This leads to groundwater contamination and increase in air pollution due to leachate percolation and release of gases respectively. Various study reveals that out of total solid waste, 80% can be utilized again either by recycling or reusing. Like other developing countries in India, also the common man's perception about solid waste management suffer “not in my backyard” syndrome and leave waste to be taken care by urban local municipal bodies only. There is complete lack of at-source segregation and management of solid waste. Thus it becomes really difficult to manage burgeoning waste without active participation of the people. Awareness towards safe disposal of waste, public-private partnership, and selection of appropriate technology according to waste characteristics is important. This paper gives a picture about the municipal solid waste management scenario in India including challenges and possible solutions.

Keywords : solid waste, urbanisation, pollution, human health, safe disposal

ASSESSING COMPARATIVE SALINITY REDUCTION POTENTIAL OF WETLAND VEGETATION FOR REMEDIATING MARGINAL QUALITY WATERS

Arshi Naaz, Ravinder Kaur, K.G. Rosin and Khajanchi Lal

Under freshwater scarcity, wastewater reuse for irrigation is inevitable. To get rid of the pollutants present in wastewater, conventional treatment methods generally followed are highly expensive and generate toxic sludge. For developing an alternative, low cost and eco-friendly technology, laboratory studies were conducted at IARI, New Delhi to evaluate the potential of certain weedy plants to treat saline wastewaters. Keeping in view the economic feasibility and availability, the plants chosen for the study comprised of *Arundo donax*, *Vetiveria zizanioides*, *Typha latifolia*, *Acorus calamus* and *Phragmites karka*. The wastewaters of residential colony of IARI were collected and artificially salinized to maintain electrical conductivity (EC) levels of 4, 8 and 12 dS/m. The test weedy plants were irrigated with these saline wastewaters during spring (February, 2017) and summer (April and May, 2017) seasons in microcosmic facility established in IARI farm area. The inlet and the outlet water samples from these microcosms were analysed for their electrical conductivity. Investigations revealed that *Arundo donax* was associated with the highest salinity reduction potential at each salinity level viz. 10.23 % at 4 dS/m, 14.29 % at 8 dS/m and 21.29 % at 12 dS/m.



However, there was a significant reduction in the salinity reduction potential of *Arundo donax* with increasing ambient temperatures during summer season viz. 5%, 6.02% and 10.48 % at 4 dS/m, 8 dS/m and 12 dS/m during April, 2017 and 6.3 %, 5.51% and 2.23 % at 4 dS/m, 8 dS/m and 12 dS/m during May, 2017 respectively. Comparative analysis of salt concentration in the leaves of the test plants revealed lowest salt accumulation in *Arundo donax*. This was followed by the *Phragmites karka*, *Vetiveria zizanioides*, *Acorus calamus* and *Typha latifolia*. Scanning of literature suggested that comparatively lowest transpiration rates, coupled with the highest vegetative biomass generation in *Arundo donax* wetland vegetation could be the most important factors responsible for its comparatively highest salinity reduction potential. The study thus suggested *Arundo donax* based wetland systems as one of the most viable, low-cost technologies for remediating saline waters.

Keywords : Wastewater, Salinity, Weedy Plants, Irrigation, Reduction Potential

IMPACT OF CLIMATE CHANGE ON SOIL PROPERTIES AND THEIR QUALITY IN INDIAN CONTEXT

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According to the IPCC, global temperatures are expected to increase between 1.1 and 6.4 °C during the 21st century and precipitation patterns will be altered. Soils are intricately linked to the atmospheric/climate system through the carbon, nitrogen, and hydrologic cycles. Because of this, altered climate will have an effect on soil processes and properties. Recent studies indicate at least some soils may become net sources of atmospheric C, lowering soil organic matter levels. Soil erosion by wind and water is also likely to increase. However, there are many things we need to know more about. How climate change will affect the N cycle and, in turn, how that will affect C storage in soils is a major research need, as is a better understanding of how erosion processes will be influenced by changes in climate. The response of plants to elevated atmospheric CO₂ given limitations in nutrients like N and P, and how that will influence soil organic matter levels, is another critical research need. How soil organic matter levels react to changes in the C and N cycles will influence the ability of soils to support crop growth, which has significant ramifications for food security. Therefore, further study of soil-climate interactions in a changing world is critical to addressing future food security concerns.

Keywords: climate change; food security; soil properties; soil processes; soil health/quality

THE CHALLENGE OF RISING FOOD PRICES AND CLIMATE CHANGE

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Future population and income growth will result in increased demand for food that will outstrip productivity, resulting in higher food prices. Climate change, which adds stress to agricultural systems, has a multiplier effect resulting in even higher food prices. Rising food prices will negatively affect the nutrition of the poor who cope by protecting consumption of staple foods (whose cost has risen) to keep from going hungry. In doing so, they reduce consumption of more expensive nonstaple foods. However, nonstaple foods have higher micronutrient content, so further reducing the already low amounts of these foods that the poor consume will increase micronutrient malnutrition. In those societies where preference is given to males in the intrahousehold distribution of nonstaple foods, women and children are likely to be most negatively affected. Biofortification can help make up for the expected micronutrient shortfall, especially among poor consumers. Climate change may also have an impact on the nutritional quality of the crop itself. While rising CO₂ levels may accelerate plant growth initially, some studies suggest that the nutrient content of crops is likely to decline, especially as plants adapt to higher atmospheric CO₂ levels. One review found a decline in micronutrient content. Overall, the evidence on effects of climate change on nutritional quality is mixed. Further research is needed as there is variability in how plants will respond to the different effects of climate change. Biofortification could offer a solution in those instances where crop nutritional quality will decline. Sources: Fábio M. Damatta, Adriana Grandis, Bruna C. Arenque, Marcos S. Buckeridge. "Impacts of Climate Changes on Crop Physiology and Food Quality," Food Research International 43, no. 7 (2010): 1814–1823; I. Loladze, "Rising Atmospheric CO₂ and Human Nutrition: Toward Globally Imbalanced Plant Stoichiometry?" Trends in Ecology & Evolution 17 (2002): 457–461; Gerald C. Nelson, Mark W. Rosegrant, Amanda Palazzo, Ian Gray, Christina Ingersoll, Richard Robertson, Simla Tokgoz, Tingju Zhu, Timothy B. Sulser, Claudia Ringler, Siwa Msangi, and Liangzhi You, Food security, farming, and climate change to 2050 (Washington, DC: IFPRI, 2010).

Keywords: Climate change, Food Prices, Challenge, Biofortification

CONSERVATION OF NATURAL RESOURCES AND TRADITIONS OF INDIA

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As the human population is continuously growing the consumption of natural resources is also increasing. With the increasing industrialization and urbanization of the modern human society, the use of all the resources is rising. If they are not properly used and well managed, a serious scarcity will result. Therefore we need to conserve the natural resources to maintain the ecological balance. That is why if we destroy any kind of diversity, it would disrupt the ecological balance which is against the environmental ethics. Conservation is the proper management of a



natural resource to prevent its exploitation, destruction or degradation. Conservation is the sum total of activities, which can derive benefits from natural resources but at the same time prevent excessive use leading to destruction or degradation. Thus there is an urgent need to conserve the nature. Some of the needs are *To maintain ecological balance for supporting life. * To preserve different kinds of species (biodiversity). * To make the resources available for present and future generation * To ensure the survival of human race. . The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving the nature and natural resources. Natural resources were conserved in the form of sacred groves/forests, sacred pools and lakes, sacred species, etc. In our country the conservation of natural forests is known from the time of King Ashoka. Sacred forests are forest patches of different dimensions dedicated by the tribal to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. This practice is wide spread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals. Similarly, several water bodies, e.g., Khecheopalri lake in Sikkim was declared sacred by people, thus, protecting aquatic flora and fauna. Worshipping certain plants like banyan, peepal, tulsi, etc. has not only preserved them but also encouraged us for their plantation. History recalls numerous instances where people have laid down their lives in protecting the trees. Chipko movement in India is one of the best example. This movement was started by the 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. This saved about 12000 square kilometers of the sensitive water catchment area. Similar movements also occurred in some other parts of the country.

Keywords: Natural resources, Ecological balance, Biodiversity, Sustainable development.

CONSERVATION AGRICULTURE: A PRECISION FARMING TOOL FOR SMALLHOLDERS

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The Concept: Conservation Agriculture involves core components, which are necessary, to make “no-till” sustainable. CA in practice is characterized by three linked principles, namely: 1. Continuous minimum mechanical soil disturbance. 2. Permanent organic soil cover. 3. Diversification of crop species grown in sequences or associations. 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. The objective of this abstract is to evaluate the potential use of Precision Agriculture principles and technology for Conservation Agriculture.

Conclusions:

- Global trends are obliging all stakeholders to combine forces to find efficient, lean, sustainable solutions to global challenges of food production and food security
- Smallholder farmers are an integral part of the challenge and the solution
- CA shows similar positive results across regions
- – increased yields, decreased production cost;
- – Higher profits, better livelihoods for farmers;
- More secure harvests even in extreme climate
- Agricultural machinery innovations are the driving force towards achieving more sustainable, energy-efficient, lean, affordable, precise and cost-effective solutions.

CONSERVATION OF NATURAL RESOURCES AND ENVIRONMENTAL ISSUES

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The natural resources of the world fall into two main groups. The one, represented by the products of agriculture and forestry, may be renewed, either annually or at longer intervals, by cultivation, and may be consumed as income, while the other, including mineral wealth, must be regarded as capital, and once consumed is not renewed. India is the most populous country in the world and with the impact of population explosion, there is exhaustion of natural resources and environmental degradation. The main areas that have been highlighted are rural poverty and environmental degradation, effects of disasters and natural hazards, assessing risks, impacts and opportunities from natural resources and the environment, precise insinuations for environment, sustainability and green development, greening rural development and economic growth and environmental sustainability. The issues have been taken into account and the measures also have been underscored that are essential in order to lead to preservation and sustenance of natural resources and the environment.

Keywords: Environmental degradation; Disasters; Natural hazards; Sustainability; Green development; Conservation; Natural resources



NATURAL RESOURCES CONSERVATION

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Natural resources are raw materials that we get from the earth naturally, i.e. man can not make these itself. In different ways human beings are beneficial by natural resources. Daily extra & unusual needs of human beings are dangerous for natural resources. Air, Water, Soil, Flora and Fauna, Minerals, Solar energy etc. are natural resources. These are derived from the environment, while few of them are used to satisfy our daily needs. From forest to mountains, minerals to coastal shores, each of these has its own importance. Natural resources are classified on the basis of renewable, non-renewable, biotic, abiotic, recyclable and non-recyclable divisions, among these flora and fauna are biotic while Air, Water and some metals are abiotic natural resources.

Conservation of natural resources is our responsibility because in their absence life will be dull or in other words life is not possible on the earth. It is a key of protecting and saving of the environment. It is mandatory for all of us. To conserve the natural resources must be our motto. If we fail to conserve the resources, imagine then what will be provide for our future generations. We should follow different methods of conservations to conserve our natural resources and also minimize our daily needs. We protect these through prudent management. Unfortunately threats to biodiversity are high caused due to detrimental human activities across the world. The U.S. Bureau (BLS) of labour statistics reported that there will be minimal growth of 1% in the number of conservation scientists 2012-2022. The field of natural resources conservation involves public policy and sustainable development. Studies in natural resources conservation should be multidisciplinary covering topics in resource management, recreation development of ecosystem. Biology, ecology, botany and other natural sciences are important

Key words :Conservation – to protect or Save , Abiotic – non living

ENVIRONMENTAL CHALLENGES AND SUSTAINABLE DEVELOPMENT

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Abiotic and biotic components of the environment result in environmental degradation over world. Major environmental issues/challenges are air and water pollution, loss of biodiversity and wildlife, ozone layer depletion, global warming and climate change degraded environment at global level. Environmental problems can be easily traced by the life style and development processes during the evolution of industries. There is a close relation between environment and development. Today the conservation, protection and improvement of environment which is degraded by human itself are major issues all over the world. Land, water, air, plants, animals and all other forms of life present in the environment are to be conserved or managed. Urbanisation, overexploitation of resources, depletion of natural ecological balance, population pressure, loss of biodiversity etc. are the main concern of environmental degradation. For all this Sustainable development is a buzzword throughout the world and this is practically adopted. Sustainable development follows ‘a form of growth and development in the society that meets the current human needs by preserving the natural resources for meeting the future needs’. There are various programmes for Sustainable development ie. World conservation strategy, UNCED, The Rio summit follow up, WSSD etc. Agroecology is a new and only way of Integrated Sustainable development. We can no longer live in such isolated environment. If environment of India is degraded, the global environment is to be affected.

Keywords: Environment degradation, Biodiversity, Global warming, Urbanisation Overexploitation

ADVANCEMENT IN MEMBRANE TECHNOLOGY FOR WATER PURIFICATION

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Over population and rapidly growing demand of pure water for drinking and other uses is currently requiring urgent solution. The scarcity of fresh water creates undesirable conditions in different parts of the globe, particularly in the arid and semi-arid regions. Presently the water need for different purposes is showing an increasing trend and it is highest in developing countries. The well known advanced water purification (wastewater and saline water) technologies include Membrane technology; advanced oxidation or reduction technologies; advanced bioactive technologies and new solutions such as electrolysis/electrodialysis, electron beam irradiation, and electromagnetic treatment. The advanced technology containing membranes is very appealing alternative that full fills this requirement. Some of the well known membrane processes available for water desalination are Reverse Osmosis (RO), nanofiltration (NF) and electro-dialysis (ED). The seawater desalination membranes have been progressively developing and have showed more tangible achievements in performance. Many researchers had made theoretical evaluation on the pore sizes of Reverse Osmosis membranes and drew their conclusion that the size of the pore to be 1.85 nm. Asymmetric structured membranes are used in industrial separation processes, so that they are called asymmetric membranes. There are two layers in asymmetric membrane, one very thin dense layer at the top of the membrane and a porous sub-layer underneath the top dense layer also called top skin layer. Typically, water treatment processes can be broken down into the following three categories: Physical, Chemical and Biological. Membrane treatment processes can be generally classified as physical processes in which constituents are separated from the raw water. The membrane technology is highly applicable and useful method for removal of different pollutants including organic matter, solids, turbidity and many different heavy metals. The membrane technologies used for the wastewater treatment.



IMPACT OF CLIMATE CHANGE ON VEGETABLE CROP PRODUCTION VIS A VIS MITIGATION AND ADAPTATION STRATEGIES**Sunidhi Mishra^{1*} and Versha kumari²**^{1 & 2} Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) Pin code- 492012

Currently, the world of agriculture especially the vegetable production is passing through a difficult situation and faced with the challenge of food/nutritional security to meet the requirement for ever growing population. We have to produce more and more food from less and less land and resources. The problem gets aggravated because of the growing biotic and abiotic stresses and decline in the quality of environment and along with the menace of increasing global warming caused by the green house gases. The succulent vegetable crops are highly sensitive to climatic conditions of heat, drought and flooding. Therefore, there is an urgent need to focus attention on studying the impacts of climate change on growth, development, yield and quality of crops. The focus should also be on development of adaptation technologies and quantify the mitigation potential of the crops. Elevated CO₂ has positive effect ranging from 24-51% on productivity of vegetable crops. However, rise in temperature affects crop duration, flowering, fruiting, fruit size and ripening of vegetable crops with reduced productivity and economic yield. Therefore, overall impact of climate change and global warming will depend on interaction effect of elevated CO₂ and temperature rise. Development of new cultivars of crops tolerant to high temperature, resistant to pests and diseases should be the main strategies to meet this challenge. Accurate impact analysis of global warming on vegetable crops is required to evolve adaptation measures and future strategies to cope with climate change and global warming.

Keywords: Climate Change, Mitigation, Global warming and Adaptation Strategies**IMPACT OF CLIMATE CHANGE ON ARID LANDS AGRICULTURE****Kedar Gurjar^{1*}, ShyamLalBuj¹Kapil Nagar² AndLakhanLal Bairwa²**¹Department Of Agronomy, Rajasthan College Of Agriculture²Department Of Genetics And Plant Breeding, Rajasthan College Of Agriculture, MaharanaPratap University Of Agricultural And Technology , Udaipur Rajasthan 313001India

The planet earth, on which we live in communities, is being increasingly 'ruptured' because of human activities; its carrying capacity is under great stress because of demographic pressures. The pressure is especially affecting the people living in the dry areas because of the marginal and fragile nature of the resources they have access to. There are over 2,000 million hectares of land that have been degraded, with a loss of agrobiodiversity, increased water scarcity and increased natural resource destruction. Superimposed on this is the fact that the neglectful and exploitive use of natural resources has set the train of global climate change in motion. It is anticipated that the impact of climate change will cut across all boundaries. Crops, cropping systems, rotations and biota will undergo transformation. To maintain the balance in the system, there is a need for new knowledge, alternative policies and institutional changes. The marginalized people in dry areas are likely to be most seriously hit by the shifts in moisture and temperature regimes as a result of the global climate change. To help them cope with the challenges, there is a need for a new paradigm in agricultural research and technology transfer that makes full use of modern science and technology in conjunction with traditional knowledge. This necessitates more investment by international agencies and national governments for supporting the relevant integrated research and sustainable development efforts, with full participation of the target communities. Only such an approach can enable the vulnerable communities of the dryland areas to use the natural resources in a sustainable manner and thus help protect the environment for future generations. The clock is ticking and the future of the world lies in the collective responsibility and wisdom of all nations on this planet. This should be reflected in the endorsement of a solid future plan.

Keywords: Adaptation, arid lands, biotechnology and nanotechnology, climate change, drought tolerance, dry lands, mitigation, water resources**RELATIVE POLLUTANT REDUCTION EFFICIENCY OF MACROPHYTE COMBINATIONS IN SUB-SURFACE FLOW EXPERIMENTAL WETLANDS OF IARI****Poonam, Ravinder Kaur, Ashutosh Tripathi, Jagdish Prasad and Ram Kishan**

Heavy metal loads in wastewater streams pose a serious threat to our environment. Hence there is an urgent need to develop efficient and cost effective methods for their removal from the freshwater resources and environment. Phytoremediation has long been proposed as one of the eco-friendly technologies for this purpose. However not much studies on the heavy metal removal efficiency of the multi-plant systems have so far been conducted. An investigation was thus carried out in the IARI Farm to screen best macrophyte combinations in terms of their pollutant reduction potential from wastewater streams. The macrophyte combinations comprised of TP(*Typha latifolia* + *Phragmites karka*), PA(*Phragmites karka* + *Arundo donax*) and AT(*Arundo donax* + *Typha latifolia*). The test macrophyte combinations were irrigated monthly with metal spiked wastewaters containing 10 ppm of Nickel(Ni), Chromium(Cr) and Lead(Pb) and their relative pollutant reduction efficiencies were analyzed in terms of Nitrate, BOD and heavy metals (viz. Ni, Pb and Cr). Investigations revealed that average Ni-reduction efficiency of TP was 95.33% while that of PA and AT was 98.31% and 90.71% respectively. Similarly average Pb-reduction efficiency of TP was found to be 95.77% while that of PA was 95.84% and of AT was 95.47%. However average Cr-reduction efficiency was found to be the highest for AT (95.97%), followed by the TP (94.76%) and PA (79.21%). AT-based systems were also found to be associated with the highest BOD (50.74%) and nitrate (35.60%) reduction efficiencies. Thus, in general *Arundo* based combinations were found to be the most superior systems for wastewater remediation



MATHEMATICAL MODELING AND ANALYSIS FOR SURFACE FINISHING AND TOOL WEAR DURING TURNING OPERATION BY DETERMINING OPTIMAL PROCESS PARAMETERS

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In any metal cutting operation the features of input work materials, tools, and machine parameter settings will influence the machining quality characteristics. A significant improvement in process may be obtained by process parameter optimization that identifies and determines the regions of critical process control factors leading to desired outputs or responses with acceptable variations ensuring a lower cost of manufacturing. For turning process, the cutting conditions i.e. Speed, Feed and Depth of cut plays an important role in the efficient use of a machine tool. In order to determine the optimum cutting conditions, one has to estimate the tool life and cutting forces with a reasonable degree of accuracy since many of the constraints those are applying on a process are influenced by these parameters. For a practical machining situation, since no adequate machining theory is available to predict the tool life and cutting forces, one is compelled to rely on empirical equations to predict these parameters. However, these empirical equations involve a number of constants which are not readily available. Hence this Paper proposes an alternative approach to determine the optimal process parameters used to predict cutting forces, tool life and surface finish with the help of developing a mathematical model for surface finishing and tool wear for different machining parameters named as speed feed depth of cut and cutting forces.

ISSUES IN NATURAL RESOURCE CONSERVATION AND SUSTAINABLE DEVELOPMENT

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Higher economic growth is necessary to reduce the level of poverty and improve the living standard of population. But higher economic growth requires greater use of natural resources and environment which in turn leads to their degradation and eventual decay. Increased population pressure on natural resources also contributes to their degradation. Hence, higher growth may not necessarily lead to sustainable development unless it is accompanied by environmental protection. An efficient demand management policy by emphasizing conservation and prudent use of environment can also increase the supply of reserves. One alternative is to attempt to conserve resources via community management of such resources. But community management cannot succeed in absence of appropriate property rights of the community and of women and appropriate institutions to enforce such rights. These in turn require the presence of an activist developmental state which can engage in a participatory system of environmental conservation and management.

Keywords: Natural resources; Sustainable development; Conservation; Environment

EFFECT OF GLOBAL CLIMATE CHANGE ON INSECT LIFE

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Climate change and extreme weather conditions directly affect plants (Parmesan, 2006) and insects. As a consequence of recent human activities and its effects on global climate, plants will face new environmental conditions in the near future, such as elevated CO₂ and O₃ concentrations, elevated temperature and changes in rainfall patterns over the seasons. Elevated CO₂ condition decline the insect abundance of almost 22.0% in elevated as compared to ambient CO₂ conditions, an increase of almost 17.0% in consumption rates, an increase of almost 4.0% in development time, a decrease of 9.0% in relative growth rate and of 5.0% in pupal weight. Temperature alters insect life-cycle duration, voltinism, population density, size, genetic composition, extent of host plant exploitation (both in time and space) and geographical distribution. Effect of elevated CO₂ on the rice brown plant hopper (BPH), *Nilaparvata lugens* (Stal.) population and rice yield was assessed in open-top chambers during kharif, brachypterous females laid more eggs (324.3 ± 112.3 eggs/female) on the rice plants exposed to elevated CO₂ (570 ± 25 ppm) than 380 ppm ambient CO₂ (231.7 ± 31.8 eggs). Larvae of *H. armigera* on milky grains of spring wheat grown in ambient CO₂ concentration, at 550 ppm and 750 ppm, larvae developed quite similarly under all CO₂ concentrations but larvae consume more than those ambient CO₂ while emerged adult moths lived longer but laid significantly less eggs. Insects play important roles in ecosystem services, acting as herbivores, pollinators, predators and parasitoids, and changes in their abundance and diversity have the potential to alter the services they provide. Therefore, there is a need to generate information on the likely effects of climate change on pests to develop robust technologies that will be effective in future under global warming and climate change.

CONSERVATION AGRICULTURE (CA) IN MAIZE BASED CROPPING SYSTEMS

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Traditionally, maize, wheat and other crops in maize based crop sequence are grown either in row geometry or by random broadcasting, mostly after thoroughly tilling the field till proper tillage is obtained for good seedling emergence. At present, the real challenge in Indian Agriculture is to produce more quality food for burgeoning population from the same land and water resources, besides sustaining soil health and environmental quality. India alone needs to produce additional 64 million tonnes of food over the next decade to achieve targeted 294 million tonnes by 2020. Incidentally these are the areas where single cross maize hybrid based technology in combination with improved natural resource management practices viz., conservation agriculture based resource conservation technologies (RCTs) act as a driver in enhancing the crop productivity and farm profitability. The efforts by researchers made since mid 1990's on developing, refining, accelerating and enhancing the adoption of CA technologies in the India has brought a "Revolution in tillage techniques.

Conservation agriculture (CA) are three basic principles: minimal soil disturbance, permanent soil cover and suitable crop rotations. It is a way to combine profitable agricultural production with environmental concerns and sustainability and it has been proven to work in a variety of agro-ecological zones and farming systems. The benefits of maintaining crop residue on the soil surface are well documented and include reduced soil loss as a result of water or wind erosion, as well as increased infiltration of water and soil water storage efficiency. Other benefits of conservation tillage (CT) systems include reduced labour, fuel, and machinery wear, improved soil tillage, increased soil organic matter, improved water and air quality, and increased biodiversity.

STUDY OF THERMAL PERFORMANCE FOR PACKED BED SOLAR AIR HEATER USING V-CORRUGATED ABSORBER PLATE

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The packed bed solar air heaters gain advantage over the conventional smooth plate solar collectors owing to the use of packing material that not only helps in the enhancement of insolation absorption and storage capacities, but also assists in reducing the surface top losses. Improved performance hence becomes inevitable in the form of higher thermal efficiency. Likewise, the use of corrugated absorber surface proves to revamp the overall collector performance by escalating the area intercepted under insolation. This communication tends to present the combined effect of packing in the solar air heater along with the use of V-corrugated absorber plate. Experiments conducted using V-corrugated aluminum absorber plate revealed a 68.4% improvement in thermal efficiency as compared to smooth plate collectors. The use of wire screen matrix packing along with V-corrugation shows 24.9 % enhancement in thermal efficiency as compared to that without packing.

Keywords: Solar Collectors, Insolation, V-corrugation, Packing.

IMPACT OF WEATHER FLUCTUATIONS ON FRUIT PRODUCTION

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Climate change is a change of climate over comparable period of time that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere. The established commercial varieties of fruits might perform poorly in an unpredictable manner due to aberration of climate. Melting of ice cap in the Himalayan regions will reduce chilling effect required for the flowering of many of the horticultural crops like Apple, Cherry etc. The global climate change, due to different patterns of abiotic stresses, could occur in varying intensities coinciding with different growth and developmental phases of the crops affecting production, productivity and quality. Under the influence of climate shift, both early and delayed flowering will be characteristic features in mango. Rising temperatures cause desiccation of pollen and poor pollinator activity resulting in low fruit set and, ultimately, a poor crop. Temperatures of 30 °C and higher reduces the anthocyanin synthesis in grape. Recent studies have indicated that in Shimla district of Himachal Pradesh, orchards of high altitude have been replaced from high chilling requiring cultivars of apple (e.g. Royal Delicious) to low-chilling cultivars due to change in temperature. Prolonged and unseasonal rainfall accompanied with high wind velocity during flushing and flowering period affects the cashewnut adversely as large proportion of lateral branches remains as non-flowering laterals. Against the climate change scenario, the impact of increase in temperature and CO₂ on fruit crops is the first step in developing sound adaptation strategies for the sustainable agriculture. Except the above, modification of present horticultural practices, development of cultivars resistant to various biotic and abiotic stresses, adoption of hi-tech horticulture and judicious management of natural resources are some of the other strategies to meet the challenge.

SEASONAL FLUCTUATIONS IN THE MICROBIAL COMPOSITION OF MULBERRY RHIZOSPHERE UNDER KASHMIR CLIMATIC CONDITIONS.

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Mulberry (*Morus* sps.) is the only food to silkworm (*Bombyx mori*, L), a monophagous lepidopteron insect, belonging to family *Bombycidae*. It is grown to produce leaf which has been found to contribute 38% towards the success of silkworm rearing amongst a host of factors. Though the main factor for cocoon production, mulberry does not receive due attention as far as frequent management is concerned. Mulberry plant,



therefore, depends on the soil microflora and the transformations going on in the soil due to these microbes for its growth, development and foliage production. The present study investigated variations in the population and composition of soil microflora in mulberry soils of Kashmir under temperate climatic conditions and these variations were found to be maximum during Spring season and showed a decline towards the Winter season.

Keywords: - Mulberry, rhizosphere, microflora, season.

INFLUENCE OF SEASONS ON PHYSICOCHEMICAL CHARACTERISTICS OF MULBERRY SOILS UNDER TEMPERATE CLIMATIC CONDITIONS OF KASHMIR.

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Mulberry (*Morus* sp.) which grows well under different agroclimatic regions is the only food to silkworm (*Bombyx mori* L). In view of the temperate climatic conditions in Kashmir valley, the mulberry plant produces two flushes of leaf unlike other tree species. In spite of least attention being paid to mulberry plantation in terms of nutrient management and other intercultural operations along with some protective measures, mulberry continues to yield foliage, although plant suffers with the advancement of age thus resulting in reduced quantity and inferior quality of leaf. As such the production of more biomass and its sustenance demands application of nutrients which is never so. The result as such is declined leaf production which is one of the limiting factors for cocoon production in the region. Therefore, the present study investigated variations in the physicochemical characteristics of mulberry soils under temperate climatic conditions and the aim was to observe the probable reasons that lead to such change. However, the variations in present study were found to be maximum during Spring season which receded with the onset of Winter season, though the values in general fell in the range suitable for mulberry cultivation under temperate conditions.

Keywords: - Mulberry, variations, physicochemical, seasons.

PRODUCTION POTENTIAL OF SOYBEAN BASED CROPPING SEQUENCE UNDER RESOURCE CONSERVATION TECHNOLOGIES

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The field investigation was undertaken during *kharif* and *rabi* season of 2014-15 and 2015-16 at the farm of AICRP on Integrated Farming Systems, VNМКV, Parbhani to study effect of tillage and nutrient levels on soybean based cropping sequence. Treatment consists of twelve treatment combinations comprising two tillage practices (minimum tillage, conventional tillage) and two cropping systems (soybean-*rabi* sorghum, soybean-wheat) in main plot, three levels of nutrients (75, 100 and 125 per cent RDF) in sub plot for soybean in *kharif* and after that for *rabi* sorghum and wheat in *rabi* season were assigned in a split-split plot design. Practice of conventional tillage with 125 RDF application to soybean, *rabi* sorghum and wheat improved the yields, soybean equivalent yield, production efficiency of soybean based cropping system. Soybean-wheat cropping systems augmented the soybean equivalent yield and production efficiency of soybean based cropping system while land use efficiency was higher in soybean-*rabi* sorghum cropping systems.

Keywords: -Conventional tillage, minimum tillage, nutrient levels, *rabi* sorghum, soybean, wheat, yield etc.

IMPACT OF CLIMATE CHANGE ON THE POPULATION DYNAMICS OF INSECT-PESTS SPECIES AND THEIR NATURAL ENEMIES

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Climate change may have an effect on all organisms, including plants, insects and their interactions among weather, plants and herbivores. Climate change resulting in increased temperature could impact crop pest insect population in several complex ways. The population dynamics of an insect species is manipulated by the various factors such as host plant, natural enemies and abiotic parameters. Insects are poikilothermic animals and therefore they are highly sensitive to their surrounding climate particularly the temperature. The abiotic parameters are known to have direct impact on insect population dynamics through modulation of insect physiology, behavior, developmental rates, survival, fecundity, voltinism and dispersal. Increasing temperature and elevated CO₂ have substantial impacts on plant-insect interaction and integrated pest management programmes. Rising temperature leading to rapid development of insects and insect voltinism, with the logical assumption that increases in surface temperatures would permit multivoltine species to increase the number of generations per year. Natural enemy and host insect populations may respond differently to changes in temperatures. Parasitism could be reduced if host populations emerge and pass through vulnerable life stages before parasitoids emerge. Hosts may pass through vulnerable life stages more quickly at higher temperature, reducing the window of opportunity for parasitism. Elevated carbon dioxide (CO₂) and fluctuating precipitating patterns as range expansion, increased epizootics (insect outbreaks) and new species introduction in regions where previously these were not reported. The CO₂ is causing indirect effect through host nutrient alteration and it has both positive and negative effects. Climatic change will also reduce the effectiveness of host plant resistance, transgenic plants, natural enemies, bio-pesticides, and synthetic chemicals for pest management.

Keyword: Climate change, Population dynamics, Natural enemies, Carbon dioxide, Temperature



EFFECT OF POTASH MANAGEMENT THROUGH GLIRICIDIA GREEN LEAF MANURING ON SOIL FERTILITY AND NUTRIENT BALANCE IN VERTISOLS OF MAHARASHTRA**V. H. Jadhao and V.V. Gabhane**

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A field experiment was conducted to assess the effect of potash management through gliricidia green leaf manuring on soil fertility and nutrient balance during Kharif 2016 at Research field of AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The soil of the experimental site was Vertisol which was moderately alkaline in reaction, low in available nitrogen, medium in available phosphorus and high in available potassium. The six treatments replicated four times in randomized block design comprised of control, 100% RDF (30:75:30 NPK kg ha⁻¹), 75% and 50% N and 100% P through chemical fertilizers and the combinations of 15 and 30 kg K ha⁻¹ through gliricidia green leaf manure at 30 DAS and remaining recommended dose of potassium as basal dose through inorganic fertilizers. The results indicated that the significant improvement in soil fertility was recorded with application of 75% N +100% P+15 kg K through chemical fertilizers +15 kg K through gliricidia green leaf manuring and the data on nutrient balance indicated the higher gain of available phosphorus with application of 100 % RDF (30:75:30 NPK kg ha⁻¹), while higher gain of available nitrogen and potassium was observed with application of 75% N +100%P+15 kg K (inorganic)+15 kg K through gliricidia green leaf manuring, indicating the important role of gliricidia green manuring in nutrient dynamics.

In view of the above, it can be stated that the use of gliricidia green leaf manuring at 30 DAS in conjunction with chemical fertilizers recorded improvement in soil fertility and higher nutrient balance. Hence, it is concluded that conjunctive application of 75% N +100% P+15 kg K through chemical fertilizers +15 kg K through gliricidia green leaf manuring at 30 DAS resulted in improvement in soil fertility and higher nutrient balance in Vertisols under rainfed conditions of Maharashtra.

Keywords: Gliricidia green leaf manure, nutrient balance, potash management, Vertisols.

“SUPERIMPOSITION OF ORGANIC SOURCES TO ENHANCE YIELD AND QUALITY PARAMETERS OF SCENTED RICE (ORYZAS SATIVA L.) IN INDO-GANGETIC PLAIN ZONE.”**Mohammad Saquib, M.P. Yadav, Ripudaman Singh, Hemant Kumar and Ruchi Yadav.**

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A field experiment was conducted during *kharif* season of 2012 and 2013 to study the “**Superimposition of organic sources to enhance yield and quality parameters of scented rice (*Oryza sativa* L.) in Indo-Gangetic Plain zone.**” Data revealed that superimposition of organic sources on RDF significantly increased growth and yield attributing characters viz., plant height, number of tillers per plant, dry weight per plant and leaf area and length of panicle, panicle weight, number of grains per panicle, number of filled grain, spikelet fertility, 1000 grain weight of scented rice than control (RDF). Superimposition of neem cake @ 3 t ha⁻¹ over RDF produced significantly higher grain (53.60 and 54.76 q ha⁻¹) and straw (83.33 and 84.20 q ha⁻¹) yield and than all other treatments except T₈ (RDF + FYM @ 12 t ha⁻¹) and T₉ (RDF + Vermicompost @ 6 t ha⁻¹) where it showed at par with each others during both the years. The superimposition of organic sources significantly enhanced quality parameters viz., kernel length, kernel breadth, length and breadth ratio and hulling (%), milling (%) and head rice recovery (%) than the control. The aroma was not estimated owing to non-availability of such sophisticated tactic.

Nitrogen, phosphorous and potassium content in grain and straw was found higher by superimposed treatments with neem cake, vermicompost and FYM than RDF alone (control). The NPK uptake by grain and straw was maximum with RDF + neem cake @ 3 t ha⁻¹ than all other treatments except T₈ and T₉ where it showed statistically at par with each others. Soil analysis viz., pH, EC, OC and available NPK in soil influenced by superimposition of organic sources which showed significantly higher than the control. The significantly higher available NPK in soil after harvest of scented rice was recorded by RDF + neem cake @ 3 t ha⁻¹ which followed by T₈ (RDF + FYM @ 12 t ha⁻¹) and T₉ (RDF + Vermicompost @ 6 t ha⁻¹). The significantly higher gross monetary return was recorded by RDF + neem cake @ 3 t ha⁻¹ followed by T₉ (RDF + Vermicompost @ 6 t ha⁻¹). However, significantly higher net monetary returns (77466 and 83473 Rs. ha⁻¹) and benefit-cost ratio (2.24 and 2.34) recorded with superimposed treatment of T₈ (RDF + FYM @ 12 t ha⁻¹).

CONSERVATION AGRICULTURE BASED PRACTICES FOR IMPROVING RESOURCE USE EFFICIENCY- REVIEW**A.V. Dahiphale*, Sanjeev Kumar Kashyap, Hari Singh, Sandeep Kumar, Vikram Kumar**

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Conservation agriculture (CA) practices are recognized as a powerful tool to address the issues related to land and environmental degradation. CA has great relevance to restore the degraded ecologies where farm income and fatigue in yield have become major concern. Conservation technologies involve minimum soil disturbance, providing a soil cover through crop residues or other cover crops and crop rotations for achieving higher productivity. This has emerged as way for transition to the sustainability of intensive cropping systems. Hence, several long-term studies have been conducted globally to introduce conservation agriculture technologies in selected cropping systems as a main-ways of improving crop yields, soil health, water use efficiency and income, while reducing requirement of energy and environmental degradation with special emphasis on irrigated cropping system in South Asia and elsewhere have been a success. Conservation tillage systems are systems of managing crop residues on the soil surface with minimum tillage. Retaining crop residues on the soil surface provides a source of plant nutrients, improves organic matter level in the soil and increased soil water content by reducing evaporation and increasing infiltration rate (Chastinet *et al.*, 1995). Conservation tillage systems not only reduce erosion and improve the soil environment for crop growth, but also conserve energy and decrease the labour cost of farming (Triplett and Van Doran, 1977). The use of herbicides to control weeds, high costs of fuel in tractor-dominated agriculture and public awareness of the environmental consequences of soil erosion have led to adoption of modified tillage methods for cultivation of different crops.



SOLID WASTE MANAGEMENT IN INDIA: RECENT SCENARIO**Dr.ALKA VYAS*, Dr.RAKHI DWIVEDI****

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Industrialization becomes very significant for developing countries like India having large number of population. Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. In recent times, E-waste and plastic waste also contribute considerably to total waste stream due to utilization of electronic and other items. Solid waste is defined as discarded solid fractions, arising from domestic, trade, commercial, industrial, agricultural, institutional, public services and mining activities. The term waste refers to useless, unwanted or discarded material. These wastes may cause a potential hazard to human health or environment if any of the aspects of solid waste management is not managed effectively. In India, approach towards Solid waste management is still unscientific. Solid Waste collection efficiency in India is around 70%, while same is almost 100% in the developed countries. Even today, large portion of solid waste is dumped indiscriminately on outskirts of towns or cities without any prior treatment. This leads to groundwater contamination and increase in air pollution due to leachate percolation and release of gases respectively. Various study reveals that out of total solid waste, 80% can be utilized again either by recycling or reusing. Like other developing countries in India, also the common man's perception about solid waste management suffer "not in my backyard" syndrome and leave waste to be taken care by urban local municipal bodies only. There is complete lack of at-source segregation and management of solid waste. Thus it becomes really difficult to manage burgeoning waste without active participation of the people. Awareness towards safe disposal of waste, public-private partnership, and selection of appropriate technology according to waste characteristics is important. This paper gives a picture about the municipal solid waste management scenario in India including challenges and possible solutions.

Key Words : solid waste, urbanisation, pollution, human health, safe disposal,

AGRONOMIC BIO-FORTIFICATION OF CEREALS WITH ZINC AND IRON FOR MICRONUTRIENTS MINERAL NUTRITIONAL SECURITY**Todar Mal^{1*}, Kaluram Kumawat² and Devendra Dambiwal²**

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Cereals are staple food in most developing low-income countries of Asia and Africa, where they may contribute as much as 60 % of the dietary energy. Rice, the main staple food of Asia, is inherently very low in Zn and its high consumption relative to other foods contributes to high incidence of Zn deficiency in human populations in Asia. Billions of people in developing countries suffer from an insidious form of hunger known as micronutrient malnutrition. Micronutrient malnutrition affects over 2 billion people in the developing world. Iron (Fe) deficiency alone affects more than 47% of all preschool aged children globally, often leading to impaired physical growth, mental development, and learning capacity. Zinc (Zn) deficiency, like iron, is thought to affect billions of people, hampering growth and development, and destroying immune systems. Mineral malnutrition can be addressed through dietary diversification, mineral supplementation, food fortification and/or increasing mineral concentrations in edible crops (bio-fortification). Genetic bio-fortification using plant breeding techniques offers a sustainable solution to malnutrition problems by exploiting natural genetic variation to develop mineral rich crop varieties. However, development of genetic bio-fortified food crops requires heavy funding, needs time may be several years. Cultivars developed may not be high yielding, differ in quality and consumers may not accept it. As compared to breeding approach, agronomic bio-fortification (ferti-fortification) offers an immediate and short terms solution to problem of micro mineral nutrients deficiency. Agronomic bio-fortification is of great importance in enriching seeds with Zn and Fe. Enrichment of cereal grains through application of mineral fertilizers promises to be a relevant and practical approach to improve Fe and Zn concentrations of staple food crops. Agronomic bio-fortification seems to be an effective approach to increase the concentration of Zn and Fe in grains and complementary of breeding approach. Methods and timing of fertilizer application are important in determining the effectiveness to increase the concentration in grain. From the bio-fortification viewpoint, foliar application is better and requires lesser amount of Fe and Zn fertilizers than their soil application. Soil + foliar methods of application are most effective in increasing the Zn concentration. Foliar application of micronutrients fertilizers during reproductive stage is better than application at earlier growth stages. Seed priming with Zn-containing solutions is also an alternate way to increase the Zn concentration in seed. Seed priming ensures better root growth and better protection against soil borne pathogens. Foliar uptake of Zn is also stimulated when Zn fertilizer is mixed with urea. Urea fertilizers containing Zn (e.g., zincated urea) may represent a good foliar N fertilizer to improve both grain Zn and protein concentrations. Agronomic bio-fortification is the easiest and fastest way for bio-fortification of cereal grains with micro mineral nutrients in developing Asian and African countries to improve the nutritional health and to reach the poorest of poor rural masses.

Key word: Bio-fortification, Cereals, Zinc, Iron, Foliar spray

EFFECTS OF FOLIAR SPRAY OF GA_3 , Zn^{2+} AND MH(MALEIC HYDRAZIDE) ON GROWTH COMPONENTS OF CAJANUS CAJAN CV MANIK (PIGEON PEA) AND VIGNA UNGUICULATA CV PUSA KOMAL**Dr.SaritaRani**

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The experiments were conducted at the botanical garden of Botany Department, Meerut College, Meerut, Uttar Pradesh in Kharif season in the year 2003-2004. The effect of foliar spray of different concentrations (50ppm, 100ppm, 200ppm) of Gibberellic Acid GA_3 , Zn^{2+} and Maleic Hydrazide (MH) on *CajanusCajanhad* been studied . Weekly treatment of foliar spray solutions were given till flowering. It is clear from the results of the present study that the weekly foliar applications of GA_3 and Zn^{2+} concentrations (50ppm, 100ppm, 200ppm) had promoting



effect on growth in terms of parameters like plant height, number of branches, number of leaves per plant and number of root nodules per plant. But the gradual decrease in all these parameters were recorded in MH treated plants as concentration increase from 50ppm to 200 ppm. The maximum productivity was recorded in 200ppm of GA_3 and Zn^{2+} treated plants.

BENEFITS OR ADVANTAGES OF SOIL HEALTH CARD IN INDIA

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Soil Health Card Scheme has been supported and accepted by the farmers all over the country as it is informative for the kind of soil and crops grown in different regions. Farmers from various states are benefited by this scheme as they can decide the suitability of the land for the crops and fertilizers. The Soil Health Cards tops the important components of a particular patch of land according to the detailed and thorough analysis. Various information like the presence of minerals on the land, suitable crops, fertilizers to be used as well as information about the land being acidic or alkaline can also be gathered. These cards that are allotted on the principle of the ration card, give perpetual recognition and position to the farmers which is derived after examining the samples of soil collected from land by the farmers themselves. An analysis of the water content, presence of elements such as potassium, nitrogen, phosphorous, iron and zinc, as well as pH and salinity levels and moreover clay content along with water retention is done by the scientists. With the help and assistance of the details and advice, this type of soil is then entrusted to the farmers to help them as a guiding tool at the time of sowing. The agricultural productivity and the quality of the crop have been increased considerably due to the Soil Health Card Scheme since its inception in November 2003. As per the statement of our agricultural minister, the farmers have knowledge about the growth of a new crop, as prior to this scheme; they were ignorant about it and thus would land up in damaging the land's fertility and wastage of fertilizer. According to this scheme the farmers are provided with the information about the exact type and quantity of manure to be used as well as the crops for the land having above 60% clay content. This new scheme has been a boon for the farmers as they have been provided with the vast knowledge about the type of soil and its utility. The Soil Health Cards have been provided to 12, 70,000 farmers of the state till now and soil health cards of 5.55 lacs has been envisaged to be provided to the farmers during the current year. The information of nature of soil will be available to the farmers from computer installed in Gram Panchayats under E-gram project. All in all, this scheme has put a smile on the farmers for which they will remain indebted.

Keywords: Soil Health Card, Farmer, Government, Land, Productivity etc.

CONSERVATION AGRICULTURE BASED PRACTICES FOR IMPROVING RESOURCE USE EFFICIENCY- REVIEW

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Conservation agriculture (CA) practices are recognized as a powerful tool to address the issues related to land and environmental degradation. CA has great relevance to restore the degraded ecologies where farm income and fatigue in yield have become major concern. Conservation technologies involve minimum soil disturbance, providing a soil cover through crop residues or other cover crops and crop rotations for achieving higher productivity. This has emerged as way for transition to the sustainability of intensive cropping systems. Hence, several long-term studies have been conducted globally to introduce conservation agriculture technologies in selected cropping systems as a main-ways of improving crop yields, soil health, water use efficiency and income, while reducing requirement of energy and environmental degradation with special emphasis on irrigated cropping system in South Asia and elsewhere have been a success. Conservation tillage systems are systems of managing crop residues on the soil surface with minimum tillage. Retaining crop residues on the soil surface provides a source of plant nutrients, improves organic matter level in the soil and increased soil water content by reducing evaporation and increasing infiltration rate (Chastinet *et al.*, 1995). Conservation tillage systems not only reduce erosion and improve the soil environment for crop growth, but also conserve energy and decrease the labour cost of farming (Triplett and Van Doran, 1977). The use of herbicides to control weeds, high costs of fuel in tractor-dominated agriculture and public awareness of the environmental consequences of soil erosion have led to adoption of modified tillage methods for cultivation of different crops.

DEVELOPMENT AND MANAGEMENT OF ECOLOGICAL NICHE

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In ecology, a niche is a term with a variety of meanings related to the behaviour of a species living under specific environmental conditions. The ecological niche describes how an organism or population responds to the distribution of resources and competitors. The ecological niche describe the functional position of an organism in its environment. An ecological niche is a role of an organism or population plays in an ecosystem. Each species has different adaptations called unique adaptations so they don't able to compete for all the resources of the species so they have their own niches. For example Giraff, Gazelle and Beetles live in the same habitate for occupying their own niche. Like wise Rain forest provided more number of niches because they have more diversity. When two species use the same resource they are said to compete. No two organisms can occupy exactly the same niche at the same time. Grinnellian, Eltonian and Hutchinsonian are types of niches present in the environment. Niche construction is the process in which an organism alters its own environment, often but not always in a manner that increases its chances of survival. Niche construction is that the organisms have changed the environment on which they live. Niche construction is as



important to evolution as natural selection i.e., not only does an environment cause changes in species through selection, but species also cause changes in their environment through niche construction.

Keywords: Ecology , Ecological Niches , Diversity , Habitate

EFFECTS OF ENVIRONMENTAL CARBON DIOXIDE IN INSECT LIFE

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Carbon dioxide (CO₂) is a ubiquitous sensory cue that plays multiple roles in insect behaviour. The global atmospheric concentration of CO₂ is rising markedly as a result of anthropogenic activities. The average level has increased from about 280 ppm immediately before the industrial revolution to a daily average of 403 ppm in 2017 and is increasing at a rate of about 2 ppm per year. So, this changes influence the normal life of insect. It has greater impact on oviposition and foraging behaviour of major lepidopterous insect in both short and long range conditions. It alone activates and modulates the host-seeking behaviour of blood sucking insects like mosquitoes. Under natural conditions, there is a positive temporal correlation between CO₂ levels in the hive and the number of fanning honey bees. Increases in atmospheric levels of CO₂ can cause increases in plant growth rates and changes in the physical and chemical defences of plants and the chemical composition of their tissues and phytophagous insects are indirectly affected by those changes in their host plants. Observed decreases in the protein content and increases of the C/N ratio in leaves under elevated CO₂ imply a reduction in food quality. So, it causes increase in feeding rates, larval duration and pupal weight. Directly it affects the physiology of insect by decrease in fecundity, altering neuro transmitter and biogenic amines level and arresting heart beat which ultimately leads to mortality. Finally better understanding of the changes we expect the decades to come is crucial to making wise decisions about present and future conservation efforts in our rapidly changing environment and may lead to improved strategies for surveillance and control of harmful insects.

Keywords: CO₂, Phytophagous insect, life

FOOD IRRADIATION AND IT'S APPLICATIONS

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Food irradiation is a technology that can be safely used to reduce food losses due to deterioration and to control contamination causing illness and death. Radiation is energy in transit either as electromagnetic waves or high-speed particles. The type of radiation used in modern processing of materials, including foods, is limited to high-energy gamma rays, X-rays, and accelerated electrons. Irradiation can kill microorganisms, insects and parasites and this is a fundamental reason for applying the technology to improve the safety and quality of many foods and food products. The irradiation dose applied to a food product is measured in terms of kilograys (kGy). Food irradiation is the process of briefly exposing food to a highly penetrating and controlled amount of ionizing radiation (energy) in the form of high-speed particles or rays. Gamma rays and X-rays (like radiowaves, microwaves, ultraviolet, and visible light rays) form part of the electromagnetic spectrum, occurring in the short wavelength, high-energy region of the spectrum. Gamma rays and X-rays have the same properties and effects on materials, their origin being the main difference between them. Food irradiation can give a wide variety of beneficial effects including the inhibition of post-harvest sprouting of tuber and bulb crops, delay in ripening of fruits and vegetables and the destruction of insects, parasites, pathogenic and non-pathogenic bacteria, yeasts and moulds. This paper will focus mainly on the inactivation of microorganisms for the purposes of improving food safety. Irradiation can be effect direct, caused by reactive oxygen-centred radicals originating from the radiolysis of water or indirect on organisms and food products.

Keyword: bacteria, spores, yeasts, moulds, insects, parasites.

EFFECT OF AIR POLLUTION ON HUMAN HEALTH

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Air pollution both indoors and outdoors is a main threat to human health, man-made structures, plants and animals and to the general environment at large in both developed and developing nations. Air pollution could be defined as the release of harmful substances, chemicals, particulates, biological materials and gases with varying constituents based on the origin and weather conditions into the atmosphere that can cause diseases, discomfort or death of humans as well as damage other living things such as food crops and the natural environment at large. Air pollutants are material and gases that have adverse effects on humans, animals, plants and structures. Air pollution from traffic and industry is leading to the premature death of more than three million people a year. Globally, that's more than malaria and HIV/Aids combined. Various sources of primary air pollutants, nitrogen oxides (NO_x), Carbon monoxide (CO), Particulate material (PM), Sulphur dioxide (SO₂), Volatile organic compounds (VOCs), Radon (Rn) and Lead (Pb) and their upon human health that range from cardiovascular diseases, cancer, emphysema, asthma and so on. Pollutants including nitrogen dioxide and particulate matter from road traffic and sulphur dioxide, from the burning of fossil fuels, have been linked to suppressed lung growth in children, asthma, heart disease and the onset of type 2 diabetes.. The oxides of nitrogen are toxic gases which enter the human body during breathing. High concentration of NO₂ may increase susceptibility to respiratory pathogens and also increases risk of acute respiratory diseases like bronchitis, chronic fibrosis, emphysema and



bronchopneumonia. Control of air pollutants is likewise discussed from legislative view points and by use of instruments that lessen the quantities of pollutants released by motor vehicles, industries and so on.

Keywords: Air pollution, health, industries, control, primary, air index

NATURAL RESOURCES CONSERVATION

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Nature provides us the basic needs like food, shelter, clothes, etc. for our survival. We use air, water, soil, minerals, coal, petroleum, animals, plants etc. in our daily life. However, overuse of these resources in our modern society is resulting in fast depletion of these resources and several related problems. If we want mankind to flourish there is a strong need to conserve these natural resources. As the human population is continuously growing the consumption of natural resources is also increasing. With the increasing industrialisation and urbanisation of the modern human society, the use of all the resources is rising. If they are not properly used and well managed, a serious scarcity will result. Therefore we need to conserve the natural resources. This will also upset the ecological balance. *Conservation is the proper management of a natural resource to prevent its exploitation, destruction or degradation.* Conservation is the sum total of activities, which can derive benefits from natural resources but at the same time prevent excessive use leading to destruction or degradation. We know that nature provides us all our basic needs but we tend to overexploit it. If we go on exploiting the nature, there will be no more resources available in future. There is an urgent need to conserve the nature. Some of the needs are :

- a. to maintain ecological balance for supporting life.
- b. to preserve different kinds of species (biodiversity).
- c. to make the resources available for present and future generation.
- d. to ensure the survival of human race.

DAIRY FARMERS PERCEPTION TOWARDS CLIMATE VARIABILITY IN KARNATAKA STATE

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Dairy farming plays a prominent role in strengthening India's rural economy. It has the potential to act as an instrument to bring about socio-economic transformation, but in recent days climate variability affects the dairy farming and it became the serious consideration. Climate variability refers to the way climate fluctuates yearly above or below a long-term average value. It has been considered as one of the most serious long-term challenge faced by the dairy farmers, in this context it is important to know about the perception of dairy farmers towards climate variability. The present study was conducted in purposively selected Northern dry zone of Karnataka with 120 dairy farmers, Kant *et al.*, (2013) perception scale was used with modification, Reliability and validity was checked before conducting the study, finally the scale is of fourteen statements, (nine positive and five negative) and the response for each statements was rated over a five point continuum and weighted mean rank was assigned, All (100%) of the respondents (69.17% SA and 30.83% A) perceived that "there is changes in environmental temperature" and they have assigned first rank to it with weighted mean score of 93.33. This might be due to the frequent variation in temperature results in decline of farm productivity. There is change in timing of precipitation (80.17) ranks second and as follows. Perception of farmers about climate changes need to be managed with using effective extension approaches like campaigns, handout distribution, mass media as well as field demonstrations. A large scale climate change literacy programmes should be developed to prepare farmers in which farmers can participate learn and adapt effective coping strategies to increase farm yield as well as their livelihood.

Keywords: Perception, climate variability, dairy farmers, northern dry of Karnataka

CHEMICAL WEED MANAGEMENT UNDER CLIMATE CHANGE

Arun kumar, Vivak kumar and Robin Kumar

Effectiveness of weed management is also hypothesized to change along with environmental conditions. Weeds that are under moisture stress can respond by thickening their leaf cuticles, slowing down vegetative growth and flowering rapidly. Drought stressed weeds are more difficult to control with post-emergent herbicides than plants that are actively growing for example, systemic herbicides that are translocate within the weed need active plant growth stage to be effective. Pre-emergent herbicides or herbicides absorbed by plant roots need soil moisture and actively growing roots to reach their target sites. Occurrence of drought has the potential to reduce the effectiveness of pre-emergent herbicides. In general effects of climate change on chemical weed these are: Greater root to shoot ratio leading to subsequent dilution effect on glyphosate when grown at elevated CO₂ (e.g. Canada thistle), Decreased stomatal aperture or number, cuticle thickening, development or increased leaf pubescence with subsequent reductions in herbicide entry into the leaf, Altered transpiration leading to reduced uptake of soil herbicides, Changes to the wetting and drying of soil profiles affecting microbial activity and herbicide degradation, Increased temperatures affecting the efficacy and selectivity of herbicides, Increased growth rate implying narrower temporal windows in which to apply herbicides before crop yield losses from weed competition and before weed set and High temperatures, low relative humidity and unsuitable wind conditions reducing the window of spraying opportunity.

Key word: Herbicides, growth, weed management and climate



EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON NUTRIENT REMOVAL UNDER RICE WHEAT ROTATION**Robin kumar, Vivak kumar and Ashish dwivedi**

A 2 year field trial was conducted during *kharif* 2012 and 2013 to investigate fertigation and residue management on performance of direct seeded rice and soil biological health. To this effect ten treatments consisting irrigation techniques as a main plot (5) and residue management sub plot (2) were tested in a split plot design with three replication. The soil of experimental field was alkaline in reaction, with 0.33 percent organic carbon, 180 kg ha⁻¹ available nitrogen and 47 kg ha⁻¹ available phosphorous and 346 kg ha⁻¹ potassium. Hybrid rice variety Arize 6129 was sown as a test crop. Remarkable effect was noted where N, P and K uptake by grain and straw was significantly higher with drip fertigation as compared to other combination. Furthermore, nutrient uptake increased significantly with residue incorporation. Thus, the study reveal that drip irrigation coupled with fertilizer application could be option of precise nutrient and water management of direct seeded rice since it removed more nutrient by plant.

HEAT SHOCK PROTEIN: MASTER PLAYERS FOR HEAT STRESS TOLERANCE IN PLANTS DURING CLIMATE CHANGE**Anu Yadav, Madhuri gupta and Shivani Khanna**

High temperature (HT) stress is one of the major environmental stresses that affect the plant growth, metabolism, and productivity. HT stress usually cause protein dysfunction therefore maintaining proteins in their functional conformations and preventing the aggregation of non-native proteins are particularly important for cell survival under stress. Plants have evolved a wide array of mechanisms for adapting to stressful environments and one of the most closely studied of these is the induction of heat shock proteins (HSPs). Heat shock proteins are of various types according to the molecular weight. like HSP 100, HSP90, HSP70, HSP60 and small heat shock proteins (smHSP). All of the major HSPs have related functions: they ameliorate problems caused by protein misfolding and aggregation. However, each major HSP family has a unique mechanism of action. Some promote the degradation of misfolded proteins (Lon, ubiquitin, and various ubiquitin-conjugating enzymes); others bind to different types of folding intermediates and prevent them from aggregating (Hsp70 and Hsp60); and still another (Hsp100) promotes the reactivation of proteins that have already aggregated. These are responsible for protein folding, assembly, translocation, reestablishing normal protein conformation, and can assist in protein refolding under stress conditions. Here, we summarize the classification of Hsps their structures, mode of action and their role under heat stress.

Keywords: High temperature, heat shock proteins, native protein, aggregation, stress, physiological

CALIBRATION AND VALIDATION APSIM-WHEAT MODEL FOR SUB HUMID REGION OF WESTERN HIMALAYAS FOR CLIMATE CHANGE STUDY**SMITA GUPTA¹, R.K.Singh¹, AJIT SINGH², SUMANA ROY¹ and U.P.SHAHI²**¹Department of Agrometeorology, College of Agriculture GBPUA&T Pantnagar-263145²Sardar Vallabhbhai Patel University of Agriculture & technology-250011

Various crop models have been widely used over the globe for assessing the effect of climate change on crop yields. The experiment was laid in Randomized Block Design (RBD) replicated three times. The data for calibration and validation were collected from field experiments conducted during *rabi* season of 2014-'15 and 2015-'16. APSIM-Wheat model was calibrated for flowering day, maturity day, leaf area index, biomass, grain yield. The cultivar was wheat cultivar UP2565. Recommended package of practices were carried out for the crop raised during both the years of the study. It was found that model was able to accurately simulate anthesis, maturity date, maximum leaf area index, biomass, grain yield with root mean square error of less than 10 per cent. There was a good agreement between the observed grain and biomass yield of wheat as compared to the predicted ones. The error in prediction on days to flowering and date to physiological maturity for both seasonal crops was within one day. The measured grain yield of wheat at harvest was 4.1 t ha⁻¹ compared to the simulated grain yield of 4.3 t ha⁻¹. The measured total biomass and the predicted biomass values were also comparable.

Key words : calibration, RBD, management, anthesis, maturity

DIVERSITY THROUGH GENETIC VARIABILITY AND CORRELATION IN CHRYSANTHEMUM (CHRYSANTHEMUM MORIFOLIUM RAMAT) GENOTYPES**Sunil kumar and Niki dewan**

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Evaluation of diversity through genetic variability and correlation studies on vegetative and floral characters of chrysanthemum genotypes were undertaken at experimental farm, Department of Horticulture, NEHU, Tura Campus, Tura, West Garo Hills District, Meghalaya during 2015-2017. Fifteen varieties namely, Korean Red, Korean Yellow, Solan Shringar, Rambored, Yellow Star, Calabria, Ajay, AAU Yellow, White Star, Korean Bicolour, Charming, Lysid, Safin, Shayana and Gambit were selected for their evaluation. The range of variation was high for number of leaves (38.24-125.11) followed by days to bud initiation (34.60-94.66). Highest phenotypic and genotypic variances were observed for number of leaves (699.74 and 699.70), respectively. The estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the traits. Maximum PCV and GCV was observed for dry weight (89.73 and 89.17) followed by number of flowers per spray per plant (78.10 and 78.08). However, maximum heritability were observed in number of leaves (99.98 per cent), number of flowers per spray per plant (99.98 per cent) and flower longevity (99.97 per cent) followed by days to bud initiation (99.95 per cent) and plant height (99.94 per cent), whereas, maximum genetic advance was noticed in number of leaves (54.49). The high heritability with genetic advance as



percentage of mean for number of branches and number of flowers per spray per plant indicates the possible role of additive gene action. The magnitude of genotypic correlation was higher than their corresponding phenotypic correlation for most of the traits, indicating a strong inherent linkage between various traits under study. At genotypic and phenotypic level, number of leaves exhibited highly significant and positive correlation with number of branches (0.889), number of flower head per plant (0.498), number of sprays per plant (0.497) and number of flowers per spray per plant (0.419), while, vase life showed significant and positive correlation with number of flower head per plant (0.315), number of sprays per plant (0.339) and flower diameter (0.311).

Keywords: Chrysanthemum, Genetic Variability, Heritability, Genetic Advance, Correlation

BIODIVERSITY OF ANIMAL BREED AND THEIR CONSERVATION

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Growing awareness of the importance of conserving the biodiversity of animal breeds is parallel by genetic advance that will help in planning of conservation. The breeds thus conserved will provide valuable resource for the future of agriculture, especially in the developing country. Where indigenous peoples have depended, for long period of time on local environments for the provision of a breed of resources, they have developed a stake in conserving, and in some cases, enhancing, and biodiversity. Their practices for the conservation of biodiversity were grounded in series of rule of thumb which are apparently arrived of through a trial and error process over a long historical time period. It is vital, however, that the value of the knowledge – practice belief complex of indigenous people relating to conservation of biodiversity is fully recognized if ecosystem and biodiversity and to managed sustainably. The biological distinctiveness of each eco- region is also defined and used, together with the conservation, status, to suggest geographic priorities for conservation in the region. Many Conservation efforts for genetic resources are motivated by the desire to preserve a diverse gene pool that can serve as a source for future breed.

Keywords: Resource, Breed, People, Ecosystem, Conservation

GENETIC DIVERSITY ANALYSIS FOR YIELD CONTRIBUTING AND QUALITY TRAITS IN ADVANCE BREEDING LINES OF RICE (*ORYZA SATIVA* L.)

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The study was carried out with 42 genotypes of rice representing diversity for yield contributing and quality traits in advance breeding lines of rice including 3 check varieties. Nature and magnitude of genetic divergence was assessed using Mahalanobis D^2 statistics through which the 42 genotypes were grouped into seven clusters. Cluster IV having 17 genotypes was largest, whereas cluster I and VII were found mono-genotypic clusters. The maximum inter-cluster distance was found between cluster II and VII (98.237) indicating suitability of genotypes from these clusters for hybridization. The parental lines selected from cluster VI (UPR 3837-2-2-1-3, UPRI 2013-10, UPR 3912-21-2-1, UPR 3926-12-1-1, UPR 3837-7-2-1-1, UPRI 2013-4, Pant Dhan-4) for panicle length, number of panicles per plant and grain yield per plot, from cluster VII (UPR 3929-8-1-1) for number of grains per panicle, filled grains per panicle, grain length, alkali spreading value and amylose content could be used in hybridization programme to obtain desirable segregants for yield and quality traits. The two desirable traits namely, alkali spreading value (12.12) and filled grain per panicle (10.12) contributed maximum towards genetic divergence.

Keywords: Divergence, Tocher's method, Cluster, Cluster distance, Hybridization, Rice.

ALLELIC VARIATION AT LOCI CONTROLLING STRIPE RUST RESISTANCE IN ADVANCED LINES AND GENOTYPES OF WHEAT

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Stripe rust of wheat (*Triticum aestivum* L.) or yellow rust caused by *Puccinia striiformis* Westend. f. sp. *tritici* is major yield limiting factor in wheat cultivation throughout the world. Wheat yield losses caused by *P. striiformis* f. sp. *tritici* range from 10–70% in different wheat producing areas. In India, 46S119 and 78S84 are the major prevalent pathotypes which are avirulent to yellow rust resistance genes *Yr5*, *Yr10*, *Yr11*, *Yr12*, *Yr13*, *Yr14*, *Yr15*, *Yr24*, *Yr26*, *YrSp* and *Yrsk*. Due to evolving nature of virulent races most race specific resistant genes become inactive over a period of time when extensively used in production. Therefore, there is a need of cultivation of resistant cultivars with multiple resistance genes for stripe rust management. The present study was undertaken to assess allelic variation of 37 major *Yr* genes at loci controlling stripe rust resistance in 67 advanced wheat lines and genotypes and to measure the genetic diversity and relatedness among them. Genomic DNA was isolated and PCR amplification was carried out using seventy primer sets consisting of SSR, STS, RGAP and CAPS markers specific for yellow rust resistance genes viz. *Yr2*, *Yr5*, *Yr7*, *Yr9*, *Yr10*, *Yr15*, *Yr16*, *Yr17*, *Yr18*, *Yr24*, *Yr25*, *Yr26*, *Yr27*, *Yr29*, *Yr30*, *Yr32*, *Yr35*, *Yr36*, *Yr39*, *Yr40*, *Yr45*, *Yr46*, *Yr47*, *Yr48*, *Yr51*, *Yr59*, *Yr60*, *YrCN19*, *YrZH84*, *YrMor*, *YrHua*, *YrExp*, *YrA7*, *YrAlp*, *YrSpp*, *YrH52*, *YrchK*. The electrophoretic pattern for allelic variation was obtained among them on polyacrylamide gel which distinguished the resistant lines from susceptible ones. The allelic loci ranged from 40–500bp and few lines were identified with loci corresponding to major yellow rust resistance genes (*Yr5*, *Yr10*, *Yr15*,



Yr24, Yr26). The identified resistant lines can be useful for the selection of parents as donor in wheat improvement programmes for developing yellow rust resistant varieties through molecular breeding.

EFFECT OF GEO-CLIMATIC VARIABLES, DIFFERENT FOREST TYPES AND POPULATIONS ON DRUPE TRAITS OF TEAK (*TECTONA GRANDIS* L.F.) IN INDIA

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Teak is known as king of timber due to its extraordinary wood qualities and mostly demanded in national and international market. It is native to India and distributed throughout India. Teak wood demand can be fulfilled by plantations with agroforestry system in India. But, teak plantation industries are facing two major problems i.e. low seed yield and low germination in the changing climate. Therefore, drupe traits were studied in different teak forest types, different population and their interaction where tree is growing. Effect of geo-climatic variables was studied on drupe dimensions in the climate change era. Drupes/fruits were collected from 3 different teak forest types i.e. Very Moist Teak Forest (Kerala), Moist Teak Forest (Gujarat) and Dry Teak Forest (Maharashtra) which represent 2 populations in each forest type. In this study, drupe traits such as drupe length, drupe width, drupe weight, stone length, stone width and stone weight were highly influenced by teak forest types and site quality (populations). Higher values for all drupe traits were obtained from Very Moist Teak Forest as compared to Moist Teak Forest and Dry Teak Forest. Overall, Elivaly population performed better than all others and there interaction in which they grow due to light, temperature, water and nutrient availability. Drupe development and fitness was influenced by geo-climatic variables such as latitude and rainfall; however longitude and temperature was showed non-significant effect. Thus, geo-climate variables play a major role in drupe development and seedling establishment.

Keywords: King of timber, Drupe traits, Climate change, Forest types, Geo-climatic variables

IMPORTANCE AND APPLICATION OF PLANT BIOTECHNOLOGY

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In vitro techniques are very useful for conserving plant biodiversity, including (a) genetic resources of recalcitrant seed and vegetatively propagated species, (b) rare and endangered plant species and (c) biotechnology products such as elite genotypes and genetically engineered material. Agrobacterium-mediated genetic transformation is the dominant technology used for the production of genetically modified transgenic plants. A survey of agricultural producers in China demonstrates that *Bacillus thuringiensis* cotton adoption increases production efficiency and improves farmer health. A majority of agronomic traits are controlled by multiple genes that cause minor phenotypic effects, making the identification of these genes difficult. Here we introduce MutMap, a method based on whole-genome resequencing of pooled DNA from a segregating population of plants that show a useful phenotype. Somatic embryogenesis, a powerful tool of plant biotechnology for faster and quality plant production has been successfully applied to regenerate plants in *Jatropha curcas* for the first time. Micro propagation helps in mass multiplication of plants which are difficult to propagate through conventional methods. Some perennial crop plants like ornamental and fruit crops can not be propagated through seeds. The vegetative propagation like grafting, budding are tedious and time consuming. In such crops micro propagation helps in rapid multiplication. Rapid multiplication of rare and elite genotypes such as Aromatic and Medicinal plants. Isolation of in vitro mutants for a large number of desirable character Eg:- Isolation of biochemical mutants and mutants resistant to biotic (pest and disease) abiotic (salt and drought, cold, herbicide etc) stresses through the use of somaclonal variation. Screening of large number of cells in small space. Cross pollinated crops like cordamum, Eucalyptus, coconut, oil palm do not give true to type plants, when multiplied through seed. Development of genetically uniform plants in cross pollinated crops is possible through tissue culture. In case of certain horticultural crops orchids etc seed will not germinate under natural conditions, such seed can be made to germinate in vitro by providing suitable environment. Induction of flowering in some trees that do not flower or delay in flowering. Eg:- Bamboo flowers only once in its life time of 50 years. Virus free plants can be produced through meristem culture

Keywords: In vitro collecting, Slow growth storage, *Jatropha curcas*, Somatic embryogenesis, Germplasm conservation.

ADEQUATE USE OF NANOTECHNOLOGY IN AGRO ECOSYSTEM: IMPLICATIONS ON PLANT PRODUCTIVITY AND ITS SOIL ENVIRONMENT

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Compared to conventional or other contaminants, nanoparticles pose some new environmental challenges for scientists and environmentalists worldwide. Nanotechnology will leave no field untouched including agriculture by its ground breaking scientific innovations. So far, the use of nanotechnology in agriculture has been mostly theoretical, but it has begun to have a significant effect in the main areas of the food industry. Nanoparticles finding great potential as delivery systems to specific targets in living organisms and is being used in medical sciences. In plants, the same principles can be applied for a broad range of uses, particularly to tackle psychopathological infections, nutrition supplement and as growth adjuvant. Nanotechnology increases the strengths of many materials and devices, as well as enhances efficiencies of monitoring devices, remediation of environmental pollution, and renewable energy production. While these are considered to be the positive effect of nanotechnology, there are certain negative impacts of nanotechnology on environment in many ways, such as increased toxicological pollution on the environment due to the uncertain shape, size, and chemical compositions of some of the nanotechnology products (or nanomaterial). The



unique properties of nanoscale materials will enable the development of a new generation of environmental sensing systems. Examples include:

- (1) Distributed arrays of smart sensor networks that could be used to quantify the spatial, chemical, and biological dynamics of an ecosystem in real time
- (2) Small inexpensive, low-power multifunctional sensor arrays, distributed in public places, homes, or on individuals that could be used to warn of pollutants and other environmental hazard, and
- (3) Improved characterization of the life cycle of nature and anthropogenic nanoparticles in the environment.

Measurement science and technology will enable the development of a comprehensive understanding of the particles, interaction, and fate of natural and anthropogenic nanoscale and nanostructured materials in the environment. Examples of uses of these measurements include identifying conditions for safe manufacturing, use, and disposal of nanotubes, nanoparticles, and other nanoscale materials; and understanding how morphology, size, composition, surface, reactivity and transport of combustion-generated particles affect human health and the environment, including global climate change. The potential positive & negative Effects of nanotechnology on environment are discussed. Advances in nanotechnology may be able to provide allowing the simultaneous measurement of multiple parameters and real time response capability. It is important to develop an efficient strategy for the recycling & recovery of nanomaterial & methods are needed to assess whether the potential benefits of nanotechnology outweigh the risks. Lifecycle analysis will be a useful tool for assessing the true environmental impacts.

Keywords: Nanoscales, Nanostructure, Sustainability, Nanomaterial, Environmental impacts, Phytotoxicity, Agro-ecosystem, Nanoparticle, Soil microbe, Nanowaste.

IMPACT OF BIOCHAR ON METHANOTROPHS DIVERSITY IN PADDY ECOSYSTEM

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In paddy fields, methanogens are produced 10-30% methane gas which is consumed by aerobic methane oxidizing bacteria (methanotrophs) associated with the rhizospheric region of rice plants, thereby mitigating the rate of CH₄ emission. Biochar is an eco-friendly growth enhancer which increased the methanotrophic diversity in paddy soil and its porosity to attract microbial population and act as microbial habitat in amended soil. Soil microbial diversity being reduced by incorporation of chemical fertilizers but biochar contained high carbon contents which are derived from the pyrolysis of organic materials under limited supply of oxygen (O₂), therefore its potential to be used as an amendment to mitigate soil green house gases (GHG) emissions. Biochar has been declared as soil conditioner in nutrient deprived soil after completing different study in biochar amended soils. Methanotrophy is a phenomenon in which methane oxidation take place by methane consuming bacteria (methanotrophs). They used CH₄ as sole sources of carbon and energy for their growth. The balance of CH₄ emission and oxidation is controlled by methanogens and methanotrophs bacteria in the environment respectively. The particulate methane monooxygenase (pmo) enzyme which found in methanotrophs and play crucial role in methane oxidation and in global warming issue is direct link to this phenomenon. It has been observed, the long term application of biochar in paddy ecosystem is increased the largest methanotrophic diversity therefore biochar is a sustainable agricultural and environmental friendly byproduct of different feedstock.

Keywords: Paddy fields, Methanotrophs, Biochar, PMO, Methane gas

EFFECTS OF DIETARY INCLUSION OF PROBIOTIC ON GROWTH PERFORMANCE OF BROILER CHICKENS

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The purpose of this research work was to evaluate the probiotic (*Lactobacillus* sp.) on the growth performance of broiler chicken. Seventy two, day old broiler chicks were randomly assigned to four treatments T₀, T₁, T₂ and T₃. Each treatment was replicated three times with six chicks per replicate. The control (T₀) groups were fed a basal diet without any probiotic and other groups were fed the diets that consisted of 3 probiotic levels at initial concentrations of 1.0 × 10⁶ cfu · g⁻¹ (T₁), 2.0 × 10⁶ cfu · g⁻¹ (T₂), and 5.0 × 10⁶ cfu · g⁻¹ (T₃). The lowest final weight and daily weight gain were found in control groups ($P < 0.05$) and there were no significant differences among probiotic-treated groups. Significantly lower feed conversion ratio and higher survival rate were observed in T₂ and T₃ than that of the control. It was concluded from this study that the probiotic (*Lactobacillus* sp.) on the growth performance of broiler chicken. From economic point of view feed containing 2.0 × 10⁶ cfu · g⁻¹ (T₂), and 5.0 × 10⁶ cfu · g⁻¹ (T₃) the probiotic (*Lactobacillus* sp.) was better due to significantly lowest feed conversion ratio.

Keywords: Broiler, probiotic, growth performance, feed conversion ratio

CONSERVATION OF AGRICULTURAL BIODIVERSITY IN THE ERA OF CLIMATE CHANGE

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Due to climate change, there is increase in extreme weather conditions, shifting temperatures and changing rain patterns, pose unpredictable risks to biological diversity and to yield security and potential in forest and agricultural management systems. There is a direct relationship



between the dynamics of agricultural biodiversity and the climate change process like variability and adaptability at differing levels (from genotype to the full species spectrum and population size, to ecosystem functions) and factors such as substance input, water supply, temperature amplitudes and radiation, are all directly related to climate change. Agricultural ecosystems that are rich in biodiversity play important role in the era of climate change by providing diversity of foods that can be used to increase food security and improve nutrition by broadening the food base and diversifying diets. Agricultural biodiversity is the result of both human and natural selection. Its conservation depends on proper management and sustainable use. The diversity of crop species and varieties, and of livestock, has both enabled and been borne from human settlement and agricultural production in almost all eco-climatic zones on Earth, bar extreme environments too cold or too dry. This diversity among crops and livestock is also important to enabling balanced and nutritious diet. Sustainable production systems can serve to reduce greenhouse gas emissions in agriculture, long term storage of carbon reserves in forests and in farmed soil harbours potential for emission reductions. Apart from serving climate change mitigation, these measures are environmentally sound and contribute to biodiversity conservation. Agricultural biodiversity involves identifying when and in what ways diversity makes key contribution to sustainable production. It is also important to fully understanding the extent, distribution and functions of genetic diversity, and trends in genetic erosion and vulnerability. The maintenance (and conservation) and use of diversity will need to be addressed in a holistic manner and need to meet the demands of the users of germplasm which does not include only breeders, researchers, but also farmers and rural communities and of those concerned with improving agricultural production and of maintaining healthy ecosystem functions. The identification of specific interventions that can support improved diversity management and agricultural production

DISTRIBUTION DIVERSITY USES OF CULTIVATED AND WILD OKRA

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Okra is growing in tropical and subtropical regions of the world. It belongs to malvaceae family, comprising both cultivated and wild species of considerable importance as value. Its comprises 30 known species of under *Abelmoschus* were distributed in nature throughout the world. Indian Gene centre is considered to be fairly rich distribution and occurrence, the only cultivated is *Abelmoschus esculentus* others species *Abelmoschus manihot* ssp. *manihot* is cultivated on a small scale in India and Africa (*Abelmoschus esculentus* and *Abelmoschus teterphyllus*, is more closely related to *A. esculentus* as compared to *A. manihot*) and wild (*Abelmoschus teterphyllus*, *Abelmoschus crinitus*, *Abelmoschus ficulneus*, *Abelmoschus pungens*, *Abelmoschus radiatus*, *Azanza lampas* and *Hibicus vitifolius*) species: among which about one species is cultivated as major crop as minor. The brief review deals with distribution, diversity and occurrence particularly of wild okra species, along with their distinguishing taxonomical attributes and potential economic uses. The diversity were collected survey and frequent field trips undertaken available information the potential areas were marked. These species breeder should be used after evaluation and characterization for breeding program.

Keywords: Okra, wild, Distribution, Survey, collection and *Abelmoschus* sp

STUDIES ON CHARACTER ASSOCIATION, PATH ANALYSIS AND GENETIC DIVERGENCE IN PEA (*PISUM SATIVUM* L.)

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The present investigation was conducted to assess the genetic variability among 20 genotypes collected from different institutes/SAUs during *rabi* season (2016-2017). At morphological level, ANOVA showed significant variation for all traits indicating greater variability in germplasm. High estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for plant height, number of pods per plant, length of first fruiting node, length of first fruiting node, pod yield per plant, pod yield q/ha, days to 50% flowering, number of seeds per plant and number of first fruiting node which indicated that the expression of these traits are not affected by the environment. High heritability coupled with high genetic advance was recorded for days to plant height, number of pods per plant, length of first fruiting node, pod yield q/ha, pod yield per plant, days to 50% flowering, number of seeds per pod, this indicates a substantial contribution of additive genetic variance in the expression of these characters, resulting it can be more useful in hybridization and selection procedure for getting higher yield. Based on correlation coefficient, pod yield q/ha gave a positive and significant correlations with length of first fruiting node, number of pods per plant, number of first fruiting node, pod yield q/ha and pod yield per plant, plant height, and width of pod at both genotypic and phenotypic level. Therefore, above characters are useful to the breeders for selecting a suitable plant type.

STUDY ON THE EFFECT OF CADMIUM CHLORIDE ON HISTOPATHOLOGICAL CHANGES IN FRESH WATER FISH CHANNA PUNCTATUS

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Channa punctatus is commonly known as snake head fish and carnivore feeding habit. Investigation deals with the effect of cadmium chloride on the histopathological changes in kidney, liver and reproductive organs of a freshwater fish, *Channa punctatus*. Fish was exposed to sub lethal concentrations (6.0 and 9.0 mg/l) of cadmium chloride for a period of forty-five days. Histopathological observation exhibited progressive degenerative changes which are marked by shrinkage of Glomeruli, increase in Bowman's capsule space, damage of hematopoietic tissue and necrosis in cells of tubular parts. (J D Saroch et al. 2014) Similarly in liver and reproductive organs are also shows deterioration tissue and necrosis. In conclusion, these changes observed that histological parameters can be used as indicators of cadmium chloride related stress in fish exposed to elevated cadmium chloride levels in the water bodies as the deleterious effects of heavy metals affect fishes on one hand and



the other hand which can affect the respective population consuming the fishes exposed to the lethal heavy metal. Hence a need of check is utmost in the liberation of cadmium chloride into the water bodies.

Keywords: Histopathological, *Channa Punctatus*, Cadmium chloride.

ROLE OF HONEY BEES IN POLLINATION OF MUSTARD PRODUCTION

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Bee visits plants for its food, nectar and pollen. This floral fidelity of bees is due to their preference for nectars having sugar contents and pollens with higher nutritive values. Besides getting food for the bees as a result of their visit pollinate a number of crops. Mustard (*Brassica* spp.), family cruciferae are the major oilseed crop grow throughout India for edible oil. It is an open pollinated crop and honeybees are effective pollinators for open pollinated crops because of a lot of nectar and pollens are available on the flowers of mustard. The experiment were conducted during *rabi* 2015-16 and 2016-17 at Agronomy farm, JVWU to increase the yield of mustard through honey bee pollinator. Mustard variety "Bio-902" was grown following all recommended agronomic practices without spraying through the crop season. The colonies of honeybee (*Apis mellifera*) were placed in cage measuring 10X10 sq. meters before the initiation of flowering. The present study contained three pollination treatments viz., Plants caged Pollinator Exclusion (PE), Plants caged with bee hive (BP) and Plants kept open to all pollinators (OP). The comparative data pertaining to modes of pollination in mustard crop revealed that highest values of mean no. of silique/plant (146.11), no. of seeds/ silique (15.63) and seed yield (22.08q/ha) were obtained from OP followed by BP and it was recorded lowest in PE. The introduction of honeybees in agricultural crops plays a vital role in pollination which in turn resulted in higher production of seed yield as well as honey production.

Keywords: Pollen, Nector, Flower, *Apis mellifera* and Bio-902.

PHENOTYPING AND GENETIC ANALYSIS OF JNPT LINES IN RICE FOR YIELD AND QUALITY TRAITS.

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The investigation was carried out with 97 JNPT lines of rice for thirty morphological traits. JNPT lines showed sufficient variation among the lines for the traits under study for morphological characterization as well as other traits studied. Based on morphological characterization, the more prominent differential lines in relation to various traits observed in genotypes namely JNPT 94-1, 94-4, 95-16, 95-17 and 95-19. These lines should be used in future breeding programme. The values of PCV for all the traits were found to be more than GCV and very small difference was present in between GCV and PCV revealing very little influence of environment for their expression. Analysis of variance indicate that the mean sum of square due to genotypes were highly significant for all the traits. Maximum variability was observed for spikelet density and lowest for culm thickness. The characters i.e. number of tillers / plant, number of productive tillers / plant, flag leaf width, flag leaf length, culm thickness, culm length and number of panicle / plant have high heritability with high genetic advance. This indicates the preponderance of additive gene action in the inheritance of these traits. On the basis of correlation and path coefficient analysis it is suggested to improve the seed yield, emphasis should be given number of spikelet / panicle exhibited maximum positive effect followed by plant height, panicle index, panicle weight / plant number of tillers / plant, spikelet fertility, decorticated grain length and 1000 grain weight. This indicates the preponderance of additive gene action in the inheritance of these traits. PCA study revealed that genotypes JNPT 94-1, 94-4, 95-16, 95-17 and 95-19 were promising lines for yield as well as quality traits and might be utilized in the hybridization programme to improve the good rice lines for the development of new varieties.

Keywords: Variability, PCA, Genotypes etc.

DEVELOPMENT AND CHARACTERIZATION OF TRANSGENIC PIGEON PEA (*CAJNUS CAJAN* L.) PLANTS WITH MARKER FREE *PS P68* GENE FOR SALINITY TOLERANCE

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Pigeon pea (*Cajanus cajan* L.), also known as toor or red gram, is an edible legume (pulse). It is a self pollinating diploid ($2n=2x=22$), often cross pollinated with genome size of 852 Mb (Varshney *et al.*, 2013). Pigeonpea is cultivated mostly in the arid and semiarid regions of the world. In India, it ranks second among pulses and is producing a total of 2.74 million tons with an average yield of 765 kg / ha. 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. Pigeonpea 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. The p68 is a prototype member of DEAD-box family and it plays a very important role in cell/organ development and also participates in a variety of biological processes in animal system including pre-rRNA processing, RNA-induced gene silencing, transcription initiation and alternative splicing processes. p68 also interacts with Ca^{2+} -CaM. In plants it is well established that Ca^{2+} -CaM regulates diverse signalling pathway. Therefore, p68 protein is also termed as a multifunctional



protein. . We have developed transgenic pigeonpea plants with marker free gene *Ps p68* for salinity tolerance by using in planta transformation method for which patent has been granted (Kharb *et al.*, 2012). The putative T₀ plants were screened by PCR analysis and the PCR positive plants with transformation efficiency of 16% were observed. The plants are further being characterized for integration, expression and transgene copy number using suitable molecular techniques. The physiological parameters associated with salt stress (Relative water content, Chlorophyll content, Proline content, Membrane injury index, Lipid peroxidation and total sugar estimation) are estimated which showed a considerable difference between transgenics and control.

COMPOSITIONAL QUALITIES OF FRESH RAW MILK AS INFLUENCED BY STAGE OF LACTATION AND MILK PRODUCTION OF CROSSBREED COWS AT SHUATS DAIRY FARM

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The experiment was to investigate the “Compositional qualities of fresh raw milk as influenced by stage of lactation and milk production of crossbreed cows at SHUATS Dairy farm”. The period of experiment was three months. Cows in herd were subjected to Califor Mastitis Test (CMT) and only healthy cows free from any noticeable injury on the udder showing negative CMT were selected in the experiment. Samples were collected from the milking pail after milking of cows to lactation stage 1 to 3 month, 3 to 6 month and 6 to 9 month and milk production 2.5 to 5 liter, 5 to 7.5 liter and 7.5 liter to above in sterile 250 ml conical flasks and immediately plugged aseptically with cotton plugs. Then samples were brought immediately to laboratory for determination of chemical constituents of raw milk. The results revealed that except lactose and SNF all the ingredients of milk were significantly influenced by lactation stage. Acidity was more in milk (1-3 month). Ash was more in milk (3-6 month). Fat, total solid, sp. gr. and water were more in milk (6-9 month) respectively and the results revealed that except fat and acidity all the ingredients of milk were significantly influenced by milk production. Protein, ash and water were more in milk (2.5-5 liters). Total solids were more in milk (5-7.5 liters) and SNF; specific gravities were more in milk (7.5-above) respectively.

Keywords: CMT (coliform Mastitis Test), SNF (solid not fat), Sp.gr. (Specific gravity)

ASSESSMENT OF GENETIC DIVERSITY USING MICROSATELLITE (SSR) MARKERS IN *LABEO ROHITA* (HAMILTON, 1822) FROM TWO HATCHERIES LOCATED IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND

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The present study deals with genetic diversity analysis of *Labeo rohita* (Hamilton, 1822) collected from Pantnagar fish hatchery and swapan private hatchery in Dineshpur through microsatellite marker. Twelve microsatellite primers (DAN-PL-01, DAN-PL-02, DAN-PL-03, DAN-PL-08, DAN-PL-10, DAN-PL-11, DAN-PL-13, DAN-PL-14, DAN-PL-15, DAN-PL-16, DAN-PL-17 and DAN- PL-20) were used in the present study. After performing native PAGE using amplified 50 DNA samples each, POP GENE Version 1.32 was used to calculate microsatellite variation. The average expected Nei's genetic diversity ranged from 0.328 to 0.529 with mean value of 0.458 for *L. rohita* across all loci from Pantnagar fish hatchery whereas it ranged from 0.430 to 0.493 with mean value of 0.467 for *L. rohita* from Swapan fish hatchery. The observed and expected heterozygosity ranged from 0.2237 to 0.3326 (mean value- 0.2864) and 0.2786 to 0.3763 (mean value- 0.3238) respectively for *L. rohita* from Pantnagar fish hatchery. The observed and expected heterozygosity ranged from 0.2620 to 0.3798 (mean value- 0.3143) and 0.2824 to 0.3860 (mean value- 0.3426) respectively for *L. rohita* from Swapan fish hatchery. The mean Fis value for *L. rohita* was found to be 0.193 whereas mean Fis values for *L. rohita* from Swapan fish hatchery were found to be 0.187. Values of Gene flow (Nm) and Nei's genetic distance among hatchery populations of *L. rohita* were found to be 3.115 and 0.0895 respectively. Values of coefficients of genetic differentiation (Fst & Gst) observed were 0.040 and 0.2417 respectively for overall population of *L. rohita*. Total genetic diversity in overall population (Ht) and within sample genetic diversity (Hs) was 0.4345 and 0.3295, respectively. Microsatellite data in present study shows better germplasm status of rohu of swapan fish hatchery as compared to rohu obtained from Pantnagar fish hatchery which might be due to regular germplasm exchange and better brood stock management practices

Keywords: Genetic Diversity, Microsatellites, Primers, *Labeo rohita*

STANDARDIZATION OF EMBRYO RESCUE TECHNIQUE FOR SHORTENING OF BREEDING CYCLE IN MANGO

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Mango (*Mangifera indica* L.) is one of the most popular fruits of tropical and sub-tropical regions of the world and commonly known as ‘King of fruits’. Because of its delicious taste and appealing aroma, the fruit has gained popularity in national and international market. In addition mango fruit has great export demand, but it is very difficult to meet the demand due to the non-availability of export quality varieties. Moreover, mango is highly susceptible to different biotic and abiotic stresses which hinder the quality production each and every year. Hence, it is the urgent need of the hours to give emphasis on mango improvement programme. However, high heterozygosity, long juvenility, self incompatibility are the major hindrance in mango improvement programme which ultimately increase the breeding cycle to develop a single variety in this crop. In addition, fruit drop is a major concern in mango improvement programme. After initial fruit setting, more than 99% fruits drop down at different times of fruit growth which may cause the non-availability of hybrid seeds even after controlled pollination and fertilization. Therefore, it is very important to develop such technique which has the potentiality to recover hybrids embryo at early stage of fruit development but well



before fruit drop. *In vitro* culture of immature embryos has long been considered useful technique to increase the recovery rate of hybrid seedlings. It would also offer an advance to the recovery of embryo of interploid crosses that generally fail to complete their development under *in vivo* condition. Although literature on mango somatic embryogenesis are abundant and embryo rescue has been successfully applied in plant breeding for raising hybrids in other species, little work has been done on *in vitro* culture of mango zygotic embryos. Probable reasons are the generalized recalcitrance of mango tissues derived from adult plants to *in vitro* procedures, in which the chief obstacles are the inherently slow *in vitro* response and phenolic oxidation giving rise to media browning and more importantly, explants necrosis. Although there are lots of literature available on the somatic embryogenesis in mango but literature on zygotic embryo development technique is very scanty. Recent experience gained in the culture of somatic embryos could be used now for the successful culture of zygotic mango embryos. Effectively controlled browning of nucellar explants by adding coconut water to the embryogenesis induction medium. In addition, maturation of somatic embryos is routinely carried out on solid medium, although culture under liquid medium agitation has been shown to improve elongation of underdeveloped somatic embryos. With regard to sucrose content, different concentrations have been used for the maturation of mango somatic embryos, but reports on its influence on zygotic embryo maturation are absent. Hence it is most important to develop technique for higher recovery of zygotic seedlings of mango through embryo rescue technique.

GENETIC VARIATION FOR SEEDLING CHARACTERS IN LENTIL GENOTYPES UNDER SALINITY STRESS

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A laboratory experiment was conducted to study genetic variation for salt tolerance in 10 genotypes of lentil (*Lens culinaris* M.) using RBD with three replications. Seeds were grown in laboratory condition with four levels of salinity (0, 20, 40 and 60 mM NaCl) for 8 days. 15 seeds of each genotype were placed in sterilized petridishes layered with autoclaved germination papers and watered daily with 3 ml of test solutions at $24 \pm 2^\circ\text{C}$ in the culture room. The set was maintained in dark for the first two days. Observations on various seedling characters were recorded on 8th day. The Pooled ANOVA revealed significant variation among genotypes, salinity levels and their interactions for all the characters except germination percentage. The reductions in mean values were severe in germination percentage, plumule length, radicle fresh weight, plumule dry weight, radicle dry weight, and seedling vigour index under high salinity. However, an increase in mean radicle length was observed under higher salinity levels as compared to lower salinity level. The highest GCV, PCV and genetic advance was observed in plumule to radicle length ratio followed by radicle length and heritability in broad sense was generally high for plumule fresh weight, radicle length and seedling length across the salinity levels, indicating that variation was highest for these characters among the genotypes.

Keywords: Lentil, Salinity, Variation, GCV, Seedling.

ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.)

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An experiment was conducted during Rabi 2016-17 at Agronomy Farm, S.K.N. College of Agriculture, Jobner with 48 genotypes of fenugreek in randomized block design with three replications to estimate the genetic variability, heritability, genetic advance and character association for nine quantitative characters. The analysis of variance showed mean squares due to genotypes were highly significant for all the characters indicated that considerable amount of genetic variability was present in the experimental material. In general, the PCV were higher than the corresponding GCV for all the characters studied, which indicated effect of environments on the character expression. High estimates of GCV and PCV were observed for pods per plant, seed yield per plant and plant height. The estimates of broad sense heritability were high for seeds per pod followed by plant height, pods per plant, pod length, days to maturity and seed yield per plant. Genetic advance as percentage of mean was high for pods per plant and seed yield per plant. High estimates of PCV, GCV, heritability and genetic advance were found for pods per plant and seed yield per plant indicating additive gene action in the inheritance of these characters. The association analysis revealed that seed yield per plant was positively and significantly correlated with plant height, pods per plant and 1000-seed weight. On the basis of the present study, it is suggested that in breeding programmes major emphasis should be given during selection for pods per plant and 1000-seed weight as these had good positive correlation with seed yield per plant.

Keywords: Variability, Heritability, Genetic advance, Character association, Fenugreek.

GENETIC DIVERSITY FOR YIELD AND ITS CONTRIBUTING TRAITS IN GUAR (*CYAMOPSIS TETRAGONOLOBA* (L.)TAUB.)

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A set of thirty genotype of cluster bean were studied for genetic divergence analysis utilizing Mahalanobis D^2 technique. The analysis of data revealed that significant difference was observed among the genotypes for all the traits. Based on the genetic distance (D^2 value), the thirty genotypes were grouped into 8 clusters. Of the 8 clusters, cluster I was largest with 14 genotype followed by cluster IV with 7 genotypes while Cluster II, Cluster III, Cluster V and Cluster VI had solitary genotype. Therefore, selection and intercrossing of genotypes involved in these clusters would be useful for inducing variability in the respective characters. Average intra and inter-cluster D^2 values among 30



genotypes revealed that cluster I recorded maximum intra cluster distance followed by cluster II revealing thereby the existence of diverse genotypes in these clusters. Minimum inter-cluster distance was present between clusters I and cluster VII. The intra-cluster distance was maximum in cluster III followed by cluster II and cluster IV.

Keywords: Cluster bean, D² technique, Genetic divergence, Cluster.

GENETIC DIVERSITY ANALYSIS IN LENTIL (*LENS CULINARIS* MEDIK.) GERMPLASM

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An experiment was carried out during *rabi* (winter) season of 2013-14 at Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur and Agriculture Research Station, Kota to assess the genetic diversity in 30 genotypes (25 tested genotypes + 5 check varieties) morphologically diverse accession of lentil (*Lens culinaris* Medik.) for ten quantitative characters days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of pod clusters per plant, number of pods per plant, 100-seed weight, biological yield per plant, harvest index seed yield per plant and one biochemical analysis for seed protein content. The composition of various clusters varied from 1 to 12 at each location and pooled basis. Members of cluster VI and VII were highly diverse from each other as these clusters showed maximum inter-cluster distance at each location and over pooled basis. Hence, genotypes belonging to the cluster VI and VII can be used as parents for hybridization programme for the development of high yielding lentil genotypes. Cluster II (RKL 1003-40E) had high seed yield, 100-seed weight, early maturity and most of yield related trait except biological yield and pods/plant while cluster VI (RKL 603-1, IPL 406 and RKL 606-09) had high pods/plant and biological yield and cluster V (RKL 1003-36E) had maximum protein content. On the basis cluster mean and genetic divergence these crosses RKL 1003-40E x RKL 603-1, RKL 1003-40E x IPL 406 and RKL 1003-40E x RKL 606-09 recommended for high seed yield and early maturity while cross RKL 1003-40E x RKL 1003-36E high yield, early maturity and protein content. Thus, hybridization among these genotypes can generate desirable transgressive segregants.

Keywords: Clusters, Germplasm, Lentil, Diversity.

EXPLOITATION OF GENETIC VARIABILITY FOR YIELD AND QUALITY PARAMETERS IN QUALITY PROTEIN MAIZE (QPM) GERMPLASM (*Zea mays* L.)

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Studies on genetic variability parameters were carried out in QPM genotypes at AICRP on maize Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan and in kharif 2014 for 15 various traits like days to 50 per cent tasseling, days to 50 per cent silking, anthesis silking interval, days to 75 per cent brown husk, plant height, ear height, ear length, 100-grain weight, grain yield per plant, harvest index, oil content, starch content, protein content, tryptophan content and lysine content in QPM genotypes. The experimental material consisting of 18 lines and four standard checks viz., Pratap QPM hybrid-1, Vivek QPM-9, HQPM-1 and HQPM-5 was raised in randomized block design in three replications. In the present investigation significant differences between the test entries were observed for all the yield and yield contributing traits and quality parameters. The narrow difference between genotypic and phenotypic co-efficient of variation (GCV and PCV) values were observed for all the traits. The heritability estimates ranged from 46.5 per cent (for anthesis silking interval) to 99.36 per cent (for grain yield per plant). The estimates of genetic advance as percent over mean were found to vary from 9.32 per cent (for Starch content) to 78.82 per cent (for Grain yield per plant). Grain yield per plant expressed high heritability coupled with high genetic advance. This situation indicates that the genetic variances for this trait are probably owing to their high additive gene effects. Moderate heritability and low genetic advance were exhibited by Days to 75 per cent brown husk and plant height indicating the predominant role of non-additive gene action.

Keywords: QPM, Non-additive gene action, Additive gene action, GCV, PCV.

ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN CORIANDER (*CORIANDRUM SATIVUM* L.) GENOTYPES

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The present investigation was undertaken to assess the genetic parameters and association analysis among yield and yield contributing characters. The 30 genotypes of coriander taken from germplasm collection of AICRP on Spices located at S.K.N. College of Agriculture, Jobner, was evaluated at Agronomy Farm of S.K.N. College of Agriculture, Jobner during *rabi* 2016-2017 in RBD with three replications. High significance differences due to genotypes were observed for all the characters studied indicating sufficient genetic variability among the genotypes. The estimates of phenotypic coefficient of variation (PCV) were also higher than genotypic coefficient of variation for all the characters studied, indicated effect of environment on the characters expression. The maximum GCV and PCV were observed for umbellets per umbel (13.20 and 16.67) followed by branches per plant (11.91 and 14.54), seeds per umbel (11.74 and 13.22) and umbels per plant (11.53 and 13.08). High broad sense heritability and genetic advance as percentage of mean were obtained for seed per umbel (78.93 and 21.49 per cent) and umbels per plant (77.69 and 20.94 per cent). Association analysis indicated that seed yield per plant was positively and significantly associated with branches per plant, umbels per plant, seeds per umbels and test weight both at genotypic and phenotypic level indicated these characters were most important as they have positive and significant association with seed yield.



Keywords: GCV, PCV, Heritability, Genetic Advance, Association, Coriander

E-LEARNING FOR AGRICULTURE EDUCATION IN INDIA

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E-learning is a modern way of learning now days. It refers to the delivery of learning, training or education programme by electronic means. E-learning is a type of education where the medium of instruction is computer technology or (ICT) information and communication technology. Now a day, In every field like learning in medical or learning in agriculture, e-learning is going popular to use. E-learning covers a wide set of applications and processes such as web based learning, virtual classroom & digital collaboration. It includes the delivery of content via the internet, Intranet/Extranet, Audio/Video tape, Satellite broadcast, Interactive TV and CD ROM. This article explores the time when the concept of e-learning was introduced, mentions its basic principles, discuss the ways in which it is superior to the traditional educational system. E-Agriculture is a rising field that specialize in the improvement of agricultural and rural development through improved and updated information and communication processes. Specifically, e-Agriculture involves the conceptualization, design, development, analysis and application of innovative ways in which to use information and communication technologies (ICT) within the rural domain, with a primary specialize in agriculture. E-Agriculture may be a comparatively new term and that we totally expect its scope to alter and evolve as our understanding of the realm grows.

Keywords: E-learning, ICT, E-learning, Internet-Education, Information revolution, Knowledge society.

ROLE OF INFORMATION & COMMUNICATION TECHNOLOGY (ICT) IN AGRICULTURAL EXTENSION OF INDIA

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The economy of India depends chiefly on agriculture. The challenge of feeding the increasing population from the shrinking land and water resources is a great task. Many agencies are working to support the farmers to produce food materials and related products. A number of approaches are taken to provide farmers required information to support their farming operation. The agricultural system of India has a long history of coping with the challenges. The system has experienced remarkable development over time. Inclusion of Information and Communication Technologies (ICT) enhanced the capacity of the system to face the challenges. Agricultural technologies generated by State Agricultural Universities, Research Institutes are now being disseminated to the farmers by the Agricultural Extension agencies. The use of ICT technologies for disseminating agricultural technologies has been proved to be useful for enhancement of production. Its can help to meet the farmers information need. The application of ICT can change the system of delivering knowledge to farmers. Agricultural extension system will be rejuvenated its vigour by the application of ICT and its improve the linkage between research sub system and farmer sub system.

Keywords: ICT, Agricultural extension, Farmers

STUDIES ON EFFECT OF CLONAL MULTIPLICATION OF GUAVA THROUGH SOFTWOOD GRAFTING UNDER CONTROLLED CONDITION

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An experiment was conducted to standardization the optimum season for softwood grafting in guava (*Psidium guajava* L.) cv. Lalit. The investigation will be carried out at Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut (Uttar Pradesh) during 2015-16 Softwood grafting was performed at monthly interval from July to December months under shadehouse ecosystem significantly highest percentage of graft success was recorded in grafting performed during December (69.00 %) and July months (65.50 %) with maximum survival percentage noted in July month (94.88 %). Growth attributes like, number of sprouts, length of sprout, percent sprouting and number of leaves also registered maximum values in graft prepared in the month of December.

SKILL DEVELOPMENT IN INDIAN AGRICULTURE: OPPORTUNITIES FOR JOBS

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Agriculture and allied activities accounts for about 15.7 % of country's GDP and is estimated to employ about 124.7 million people as cultivators and 106.8 million as agricultural labour. Besides this Agriculture Industry employs a large number of people in the organized and the unorganized sector, the data pertaining to the same is however not available. Based on the assumptions of Food Grain Production and Manpower required to handle the total produced, the same is derived at (0.20 Million) for organized and (1.95 Million) for unorganized sector. India has about 161 million hectares of arable land of which 55 million is irrigated. With the increase in population the demand for food and agriculture produce is increasing, but the supply is constant due to low agricultural productivity. This is predominantly due to improper farm management practices and loss in post-harvest handling. **With 98% of the sector being predominantly unorganized, training interventions in agriculture call for creating awareness about the need for skilling and upskilling among rural youth.** There is a requirement for specific set of skills in the field of agriculture. Considering the above factors, Agriculture Skill Council of India (ASCI) was set up in January, 2013 as a



Section 25 company under Companies act of Ministry of Company Affairs. The endeavor of ASCI is to work towards building capacity in the Agriculture Industry and bridge the gap between laboratories and farms. ASCI envisions to touch/upgrade skills of cultivators, agricultural labours and direct & indirect labour engaged in organized and unorganized agriculture and allied industry.

Keywords: Skill, development, agriculture, labours, jobs, organized, unorganized

SOME HORMONAL FISH REPRODUCTIVE BIOMARKERS

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A measureable indicator of some biological state or condition of an organism, also known as biomarker or biological markers could really help us understand the organism may it be in terms of reproduction. A comprehensive study of multiple biomarkers could help quantify the overall biological effects related to multiple stressors (Nunes *et al.*, 2015). Reproductive biomarkers like sex steroid hormone, MIH (Maturation Inducing Hormone) are important indicators which can cite the relative reproduction and physiological status having a cascading effect and also feedback the reproduction system. Fish testes synthesize the androgenic hormones among which the role of T and 11-KT on fish reproduction with testosterone having an effect on some spermatogenesis pathways like spermatogonial multiplication and spermatocyte formation (Gazolla & Borella, 1997). Also, testosterone is equally important in both male and female counterpart as it is a precursor of estrogenic biosynthesis which further implicate female reproductive processes. The most important fish estrogenic hormone, 17 β -estradiol produce from testosterone leads to the production of vitellogenin, a yolk pre-cursor, which are further deposited in the oocyte through vitellogenesis (Lee & Yang 2002). Oocyte maturation in fish is regulated by three mediators viz. gonadotropin (GTH; luteinizing hormone, LH), maturation-inducing hormone (MIH) and maturation-promoting factor (MPF) (Nagahama, 2008). 17 α , 20 β -dihydroxy, 4-pregnen-3-one (DHP) is known as the main maturation inducing hormone for most of the teleost. These hormonal biomarker has a seasonal surge and correlation to change in gonadal maturation thus playing an important role for reproduction study of the species.

Keywords: biomarkers, fish reproduction

E – LEARNING

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The term e-learning covers wide sets of applications and processes such as network or web based learning, virtual class room & digital collaboration. It includes the delivery of content via the internet, intranet/extranet, audio and video satellite broadcast, interactive TV and CD ROM. As the letter “e” in e-learning stands for the word electronics. E-Learning commonly referred to the intentional use of networked information and communication technology in teaching and learning. It is the use of technology to enable people to learn anytime and anywhere & deliver a broad array of solution that enhances knowledge and performance of people. E-Learning can include training, the delivery of the just-in-time information and guidance from experts. Type of e-learning activity like as online e-learning consisting synchronously online e-learning, e.g. relay chat, audio/video conferencing and asynchronously online e-learning, e.g. e-mail, www etc. and in the off line e-learning including CD/DVD, SD cards, Pen drives etc. In Asia only 55.20% population with 49.60 % internet user as compare to rest world 44.80% population with 55.70 % internet users are used in internet.

Keywords: e-learning, online, offline, satellite

TELOMERES: THE STRANDS OF TIME

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Telomeres are caps of repeated DNA sequences at the ends of chromosomes. A little telomere length is lost every time a cell divides and its DNA is replicated, and this is one portion of the limiting mechanism that causes the somatic cells that make up the overwhelming majority of tissues to divide only a set number of times and they destroy themselves (Shay and Wright, 2009). Immortal cells on the other hand, make use of the enzyme telomerase to add repeated DNA sections to the ends of their telomeres as needed. Telomerase, a ribonucleoprotein (RNP) complex, contains both essential RNA and a protein reverse transcriptase subunit. By reverse transcription, the telomerase RNP maintains telomere length stability in almost all cancer cells. The components and cofactors of the holoenzyme telomerase and its substrate telomeric DNA are attractive targets for anticancer agents that act by inhibiting the activity of telomerase (Greider and Blackburn, 1985). This review outlines recent advances in telomerase inhibition that have been achieved using antisense oligonucleotides that target the telomerase mRNA or its hTR RNA template. Although these are potent catalytic inhibitors of telomerase, they are challenging to implement in the clinic due to their delayed effectiveness. Drugs that directly bind to the telomeres, the complex structures that are associated at the telomeric ends, and stabilize secondary DNA structures such as G-quadruplexes are also potent inhibitors of telomerase (Lifeng *et al.*, 2013).

Keywords: Telomerase, holoenzyme, hTR(human telomerase RNA), G-Quadruplex, ribozymes



PRECISION BREEDING AND SUSTAINABLE CROP IMPROVEMENT**Banshidhar and Priyanka Jaiswal***

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Civilisation flourishes with agriculture. The knowledge of producing food through cultivation of crop allowed for stable living as against to hunting and gathering and this served as main source of livelihood for humanity. Since immemorial times, agriculture has been meeting the general and specific needs of mankind and time to time development of new agricultural techniques and improved package of practices has revolutionised the whole production system. However, it has also posed some alarming threats on natural resources viz. land degradation, contamination of ground water, loss of genetic diversity, environmental deterioration and serious health hazards. Thus for sustainability, an efficient system of production is required which not only meets the growing demands of this minute but also takes care for the same in future. In line to this, precision breeding techniques that use tools of genetic engineering and molecular biology for crop improvement and use of markers for screening the desired genotype has proven their worth towards sustenance of crop production. This innovative technology has allowed breeders to target specific portion of genome for crop improvement at a much faster rate while utilising minimum of resources. Moreover the end products of this technology are more returning in terms of food and nutritional security as well as environmental suitability. Breeding better crops that promise higher production through increased response to added input resources, and show resilience to dramatically changing climate paves way for sustainability. Thus to cope up the rising demands for food, fibre and fuel on one hand and conserving the natural resources on other, precision breeding qualifies as a better choice.

SDS-PAGE BASED PROTEIN PROFILING AND DIVERSITY ASSESSMENT OF INDIGENOUS GERMPLASMS OF CUCUMBER (*CUCUMIS SATIVUS* L.)**Chandan Singh Ahirwar and D. K. Singh**

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The objective of this study was to determine the relationships among genotypes categorization of seed storage proteins profiles of 44 genotypes with two checks Pant Khira-1 and Pointsette of cucumber (*Cucumis sativus* L.) was performed by Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE) at NAIP, Laboratory of Department of Vegetable Science, G.B. Pant University of Agriculture and Technology, Pantnagar, (Uttarakhand) during July-October, 2014 and February-June, 2015. The entire profile comprised of 15 protein bands, distributed into three major zones A, B and C in increasing order of electrophoretic mobility i.e. Zone A was nearest and Zone C was farthest from the point of protein sample application. Among 15 bands maximum number of bands were observed in PCUC-193 (9 bands), PCPGR-6762 (8bands), PCPGR-7013 (8bands) and PCPGR-7795 (8bands) followed by PCUC-199 (7 bands), PCUC-832 (7 bands), PCUC-44 (7 bands), PCUC-23 (6 bands). Minimum bands were shown by PCPGR-7795 (1 band). The unweighed pair group method using arithmetic average (UPGMA) analysis of 46 cucumber genotypes was done and two major clusters obtained through seed protein analysis expressed better grouping of genotypes.

Keywords: Cucumber, SDS-PAGE, Similarity Index (S.I.) and UPGMA Cluster Analysis**IDENTIFICATION OF ADULTERATION IN GENETICALLY MODIFIED SEED USING BIOTECHNOLOGICAL PRACTICES****Yogendra Singh**

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Seeds are the product of the ripened ovule, after fertilization by pollen and some growth within the mother plant. Genetically modified (GM) seeds are a significant step forward in the production of agricultural crops. GM seeds are seeds that have been modified to contain specific characteristics, but the method of modification used with GM seeds varies from the traditional method in an important respect: the genes have not been modified over generations of cross-fertilization, but rather inserted directly into the DNA of the seed. Transformation of plants is done by inserting DNA into a single cell, which is then regrown into a complete organism, the plant. DNA is the blueprint of each cell that is transcribed into the messenger RNA (mRNA), which is then translated into a protein. A seed company needs to certify that it is producing and marketing pure inbred or hybrid seed, or GM seed. The quarantine stations need to test for GMOs in commodities under trade and also germplasm and research material under exchange. The deliberate or inadvertent mixing of GM seed with non-GM seed lots carries the risk of adversely affecting international seed trade. Already several such cases, causing economic losses to seed companies, have come to light. In addition to exasperating discussions over permissible threshold of GMOs in non-GM seed lots, the establishment of reliable, efficient and cost-effective techniques for detection, identification and quantification of GMOs in non-GM seed lots present significant challenges. The mixing of Non GM seed in GM seed can be identified using biotechnological practices in most appropriate and reliable manner. There are two broad methods one depending on proteins (Immuno assays) and other one on DNA (PCR based) both have their specific advantages regarding input cost, time, technical superiority. The details will be presented

Keywords: PCR, Immuno assays, Genetically Modified seed, Biotechnological Practices, Adulteration

KISAN CALL CENTRE IN INDIA**Satendra Kumar, Gaurav Kumar and Anurag Verma**

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In order to harness the potential of ICT in Agriculture, Ministry of Agriculture launched the scheme "Kisan Call Centres (KCCs)" on January 21, 2004. Main aim of the project is to answer farmers' queries on a telephone call in their own dialect. These call Centres are working in 14 different locations covering all the States and UTs. A countrywide common eleven digit Toll Free number 1800-180-1551 has been allotted for Kisan Call Centre. This number is accessible through mobile phones and landlines of all telecom networks including private service providers. Replies to the farmers' queries are given in 22 local languages. Call center services are available from 6.00 am to 10.00 pm on all seven days of the week at each KCC location. Kisan Call Centre agents known as Farm Tele Advisor (FTAs), are graduates or above (i.e. PG or Doctorate) in Agriculture or allied (Horticulture, Animal Husbandry, Fisheries, Poultry, Bee-keeping, Sericulture, Aquaculture, Agricultural Engineering, Agricultural Marketing, Bio-technology, Home Science etc. and possess excellent communication skills in respective local language. Queries which cannot be answered by Farm Tele Advisor (FTAs) are transferred to higher level experts in a call conferencing mode. These experts are subject matter specialists of State Agriculture Departments, ICAR and State Agricultural Universities. A Kisan Knowledge Management System (KKMS) to facilitate correct, consistent and quick replies to the queries of farmers and capture all the details of their calls, has been developed. Kisan Knowledge Management System (KKMS) has its independent web site <http://dackkms.gov.in>. The Kisan Call Centre (KCC) Agents working at various KCC locations throughout the country have access to this web site through their specific ID's & Pass-Word provided to them.

Keywords: ICT, Kisan Call Centre, Agricultural Information**CYTOLOGICAL STUDIES IN HYBRID BETWEEN *C. AQUATICA* ROXB. AND *C. GIGANTEA* (2N =14)****Shrimant D. Raut and Chamle D. R***

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Coix aquatica (2n =10) and *C. gigantea* (2n =20) are the two ill defined species in the genus *Coix* L. occurring in Maharashtra. The detailed meiotic behavior, chromosome number, and pollen fertility was studied in three distantly located populations of *Coix aquatica* Roxb and one of the *C. gigantea*. The progeny has been studied as single plant cytology for three consecutive generations. All the three years populations were having the diploid chromosome number as 2n = 10 (Diploid), 2n =20 (Diploid) and 2=18 (Nullisomic) along with one the hybrid having 2n =14 (9G + 5A). Morphologically all the plants were very similar except some minor differences like height of the plant, number of tillers, shape and size of seed. The behavior of the chromosome during meiosis was normal in normal diploids but in hybrids it was very different. While screening the plants of hybrid 2n=14 the behavior of the gigantea and aquatica chromosome was interesting. The chromosomes were behaving as normal diploids in the early stages of meiosis and it was completely different in meiosis two. The chromosomes were identifying and were segregating species wise that large sized aquatica chromosomes moving to one pole and small gigantea chromosomes on opposite in many pollen mother cells. It results in to various abnormalities like, univalents at diakinesis, precocious movement at metaphase, laggards and early segregation in to chromatids during anaphase-I etc. Therefore, the plants has been deeply investigated for its results at the end of meiosis-II, and it is presented in the present communication.

Keywords: Cytological, *Coix aquatica*, *C. gigantea*, meiosis, hybrid.**BIONANOTECHNOLOGY AND ITS RELEVANT TO AGRICULTURE****Brij B. Pandey, Nidhi Tyagi* and Nutan Singh**

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This article reviews some of the potential applications of nanotechnology in the field of agriculture, cosmetics, medicinal, pharmaceutical and recommends many strategies for the advancement of scientific and technological knowledge currently being examined. Plant physiology and nanotechnology create new tools for studying how plants function and enhance plant productivity. Effective nanoengineering of plant function requires targeted and controlled delivery of nanoparticles with their cargoes to organelles and tissues of interest. To date the effect of nanoparticle structure and composition on the absorption, transport and distribution of nanomaterials in plants is poorly understood. Small biomolecules such as synthetic elicitors, drug-like compounds that are induce natural immune responses in plants contributing to efficient regulation of plant protection against pathogens. Ultimately, integrate plant nanobiotechnology approach with precision agriculture to enhance crop yields. Article has demonstrated that nanosensors can detect changes in analyte concentration in living plants and report them to a commercially available near infrared camera. Implementation of this plant nanobiotechnology approach will transform the field of plant physiology research and enable new nanotechnologies for crop yield enhancement in precision agriculture.

Keywords: nanotechnology, agriculture, applications, nanoscience**APPLICATION OF GENOMICS IN PLANT BREEDING****Ramraj Sen and Rohit Kumar Saini**

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Crop production needs to increase to secure future food supplies, while reducing its impact on ecosystems. Genetic improvements of crop plants through conventional plant breeding has made tremendous contributions in the global Agriculture production. Genomics is opening up vast new areas of study. Researchers are only beginning to discover how plant genomics can play a significant role in enhancing the quality and quantity of agricultural production in order to feed more of the world's population. Beginning with the discovery of the chromatin, the study of genome moved from the genetic mapping to complete sequencing and functioning analysis of the whole genome, thereby bringing genomics to the forefront of biology. The study of structure and function of whole the hereditary material contained in a genome of a living organism. Genomics has various practical applications in crop improvements. The genome mapping is useful in the following ways-Genome size, Gene number, Gene mapping, Gene sequencing, Evolution of crop plants, Gene cloning, Identification of DNA markers, Marker assisted selection, Transgenic breeding, Construction of linkage maps. Agricultural genomics is the application of genomics in agriculture to improve the production of crops and livestock. Agriculture looks to genomics for the next "green revolution".

IMPACT OF GENETICALLY MODIFIED CROPS AND SOME OTHER STRATEGIES IN AGRICULTURAL BIOTECHNOLOGY

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The full benefit of Agriculture Biotechnology will only be realized when consumers and food manufacturers considered it safe and beneficial. Fighting against the global hunger in adverse climatic condition is major concern of the environment around the world. The Genetically Modified (GM) varieties of major economic crop specifically maize, cotton, rape (canola) soybean were first grown in 1996. In 2012 they were grown in 170 million hectare representing six percent increase. A similar approach is also taken to examine GM crops and other strategies e.g., wealth generation, production of plants, health aspects and employment. Overall, the impact of GM crops and other strategies in agricultural field has been positive in both developed and developing world. Genetic engineering is best method and artificial method for growth of plants. In genetic engineering *Bacillus thuringiensis* is used for crop like cotton, brinjal, make them resistant to pests. In tissue culture anther culture is used for the growth of the cell or plants. With the help tissue culture artificially plant can be grown. Somatic hybridization can be used to grow a mixing gene organism by the help of DNA of the organisms. Embryo rescue helps the plant grow and protect from excision in this culture can be grown in medium and germination will take place after that with hardening a new off spring will grow normally. Marker aided genetic analysis is study by its DNA sequencing in this QTLs (qualitative trait loci) and other marker gene. This paper is basically review of the impact of GM crops and other strategies in agricultural biotechnology. Overall the impact of GM crops and other strategies have proved positive result to the many technologies which comprise modern agriculture.

Keywords: Agricultural Biotechnology, Tissue Culture, Genetically Modified Crops.

GENE PYRAMIDING IN VEGETABLE CROPS

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The development of molecular genetics and associated technology like MAS has led to the emergence of a new field in plant breeding namely Gene pyramiding. Pyramiding entails stacking multiple genes leading to the simultaneous expression of more than one gene in a genotype to develop durable resistance expression. Gene pyramiding holds greater prospects to attain durable resistance against biotic and abiotic stresses in crops. Gene pyramiding can be done by conventional and molecular techniques. Tomatoes represent a major contribution to nutrition worldwide and are a reservoir of diverse antioxidant molecules, in addition, tomato also represents an excellent model system for both basic and applied research for many reasons, including ease of growth in a wide range of environments, a short life-cycle, and well-developed genetic and genomic tools. Tomato (yellow) leaf curl disease is a very destructive disease on tomato caused by whitefly transmitted begomoviruses. In many geographical regions, several species of begomovirus infect tomato and cause TYLCD/ToLCD, leading up to 100% yield loss. Resistance to tomato-infecting begomoviruses has been successfully introgressed from *Solanum pimpinellifolium*, *Solanum peruvianum*, *Solanum chilense* and *Solanum habrochaites*. Pyramiding multiple Ty resistance genes may improve the spectrum, durability and level of resistance, thereby providing resistance to diverse tomato-infecting begomoviruses. Gene pyramiding in tomato is mainly done for TyLCV, drought and quality characters. Marker-assisted selection for TyLCV resistance genes offers many advantages, including the possibility of eliminating susceptible plants in a segregating population before transplanting, and the identification of plants homozygous for Ty-2 and Ty-3 or other combinations in early generations so that selection in later generations could focus on horticultural, fruit quality or nutritional traits. The combination of multiple wild introgressions is likely to bring negative horticultural traits caused by linked genes. Therefore it would be useful to generate and use minimal introgression lines for pyramiding of different specific genes.

DEVELOPMENT OF HYBRID RICE IN INDIA: CURRENT STATUS AND FUTURE STRATEGIES

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Rice (*Oryza sativa* L. $2n = 2x = 24$) is the world's most important food crop after wheat and maize. First hybrid rice combination were put into commercial production in China in 1976. More than 50% area of rice covered by hybrid rice in China. The father of hybrid rice "Prof. Yuan Longping". India is the first country after China to exploit the hybrid rice technology on a commercial scale. India's hybrid rice project was started in the late 1980's. Hybrid rice research conducted in 12 rice research centers of India. In India APRH-1 is the first hybrid rice variety released in 1994. More than 78 hybrid rice varieties released in India till now. Hybrid rice cultivation in India in 2016 which is around 7% of the



total rice cropped area in India. About 20% yield advantage of hybrid rice than commercial varieties. Rice is strictly self-pollinated crop. Therefore for developing commercial rice hybrids, use of a male sterility system is essential. Male sterility by genetic or non-genetic makes the pollen unviable and such rice spikelets are incapable of setting seeds through selfing. Thus a male sterile line can be used as a female parent of a hybrid. The seed set on male sterile parents is the hybrid seed which is used for growing the commercial hybrid crop. Hybrid rice is the commercial rice crop grown from F1 seeds of cross between two genetically dissimilar parents. To exploit the benefits of hybrid rice, farmers have to buy fresh seeds every cropping season. Male sterility systems in rice-(1) Cytoplasmic-genetic male sterility, (2) Environmental-sensitive genetic male sterility-(a) PGMS (b) TGMS, (3) Chemical-induced male sterility. Requirements for 3 Lines in CMS System-A-line: Male sterile line, B-line: Maintainer line, R-line: Restorer line. The most common used cyto-sterility sources are WA, BT, DT, DA and IP. Most widely cultivated rice hybrids are: PHB 71, KRH 2, Sahyadri, Saruchi 5401, Pant SankarDhan 1 and DRR 1. The first superfine grained aromatic hybrid Pusa RH 10 is becoming popular in basmati belt of north-western India. NarendraUsar SankarDhan -3 is the first hybrid released for saline-alkaline soils of Uttar Pradesh. DRR 2 and pant Sankar Dhan-3 are the promising early hybrids.

STUDIES ON THE DIRECT AND INDIRECT EFFECT OF DIFFERENT CHARACTERS ON YIELD IN CORIANDER (*CORIANDRUM SATIVUM* L.) GENOTYPES

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The present study was conducted with the objective to know the extent of variation and characters inheritance in coriander. The study was comprised 73 genotypes (including three checks) in augmented design during *Rabi* seasons of 2014-15 and 2015-16. The observations were recorded on growth attributes viz., days to 50% flowering, branches/plant, plant height and yield attributes viz., fruiting node per plant, umbels per plant, umbellets per umbel, fruits per umbellets, fruits per umbel, umbel diameter (cm), plant height (cm), test weight (g) and yield per plant (g). The present study revealed the wide range of variation was observed for all the traits among the genotypes during both the years. The analysis of path coefficient revealed the highest positive direct effect on yield per plant (g) was exhibited by umbellets per umbel, followed by umbel diameter and fruits per umbel. Whereas, negative direct effect on yield per plant exhibited by branches per plant followed by test weight and umbels per plant in 2014-15. The heights positive direct effect on seed yield per plant (g) was exhibited by fruits per umbel and followed by test weight. Whereas, negative direct effect on yield per plant exhibited by umbel diameter followed by umbellets per umbel in 2015-16. Analysis of variance for the design of experiment indicated highly significant differences among genotypes for all the characters. Based on mean performance for yield and yield components, the NDcor-63, NDcor-33, NDcor-53, NDcor-12 and NDcor-46 during Y_1 and NDcor-39, NDcor-53, NDcor-67, NDcor-63 and NDcor-33 during Y_2 were identified as most promising genotypes for seed yield per plant.

GENETIC VARIABILITY AND PATH ANALYSIS IN CARROT (*DAUCUS CAROTA* L.)

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The present investigation, "Genetic variability and path analysis in carrot (*Daucus carota* L.)" was carried out on thirty genotypes of *Daucus carota*. These genotypes were evaluated in a Randomized Block Design (RBD) with three replications during *Rabi* season, 2015-2016 at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. Observations were recorded on fourteen economic characters. The data were subjected to statistical analysis for parameters of variability viz., mean, PCV, GCV, heritability, genetic gain, correlation and path coefficient. Analysis of variance exhibited significant difference for all the characters suggesting the presence of good deal of variability in the material under study. The estimation of GCV, PCV, heritability and genetic gain were of higher order for fresh weight per plant, root: shoot ratio, flesh thickness, root weight per plant and carotene content. These characters were governed by the additive gene action. Hence, selection would be effective for their improvement. Correlation study revealed that genotypic correlation coefficient was slightly higher than corresponding value of phenotypic correlation for majority of the characters. Total yield per hectare exhibited significant and positive correlation both at genotypic and phenotypic levels with fresh weight per plant, root diameter, root: shoot ratio, flesh thickness and plant height (60DAS), while negative association was observed with plant height (30 DAS) and number of leaves per plant. Path coefficient analysis revealed that root weight, fresh weight per plant, root: shoot ratio, leaf length, flesh thickness and number of leaves per plant had positive direct effect on total yield per hectare. On the basis of present study it could be concluded that the genotypes RAJC-11, RAJC-7, HRC-1 and RAJC-5 were found superior for total yield per hectare, which could be gainfully utilized in further breeding improvement programme. Further, for improvement of total yield per hectare plant selection should be practiced primarily for fresh weight per plant, root: shoot ratio, flesh thickness and root weight.

INTEGRATED AQUACULTURE: A BETTER WAY TO UTILIZE AVAILABLE RESOURCES

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Integrated aquaculture is combination of two or more agriculture related production system in which one system play a major role. In case of integrated aquaculture our main emphasis is on fish production. This system refer to the production, integrated management and comprehensive use of aquaculture, agriculture and livestock, with an emphasis on aquaculture. Integrated aquaculture is divided into two systems: Agri-aquaculture based system (paddy-fish system, horticulture-fish system, mushroom-fish system, sericulture-fish system, aquatic weed-fish



system) and Animal husbandry-fish based system (cattle-fish system, pig-fish system, goat-fish system, poultry-fish system, duck-fish system). The system mainly based on re-utilization of waste produce from one system to another i.e. agriculture based waste (rice polish, bran from paddy, flour from wheat) directly used as feed and livestock based waste (excreta, urine, dung, left over feed) used as fertilizer or as a direct feed. The main criteria for fish selection for integrated aquaculture are: herbivores or omnivores, tolerate water quality fluctuation, highly nutritional and marketable value, faster growth. The benefits of integrated aquaculture are reviewed from an economic point of view, particularly with respect to reduction in cost of production, improvement in efficiency of resource utilization and increase in profit of operation. Integrated aquaculture could be regarded as an alternative for efficient utilization of available resources, waste recycling and energy saving, and for maintaining ecological balance and circulation.

Keywords: Integrated aquaculture, duck-fish system, paddy-fish system, re-utilization.

GENETIC DIVERSITY ASSESSMENT IN CHERRY TOMATO (*SOLANUM LYCOPERSICUM* L.VAR. *CERASIFORME*) GENOTYPES USING SSR MARKERS

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The present investigation regarding study of genetic variation of 15 genotypes including Pusa Ruby of cherry tomato (*Solanum lycopersicum* L.var. *cerasiforme*) started with the screening of polymorphic microsatellite markers. From the identified 10 polymorphic SSR markers, a total of 142 polymorphic amplified fragments were obtained. The average polymorphism information content (PIC) was 0.987 and ranging from 0.958 (SSR-47) to 0.996 (SLM6-18). One hundred forty two SSR loci were used to calculate Jaccard's distance coefficients for UPGMA cluster analysis. The generated dendrogram of 15 cherry tomato genotypes showed low level of similarity among these genotypes. Two major clusters were generated at 23% level of similarity level. The major cluster A consists of five genotypes whereas major cluster B consists of rest of 10 genotypes. The result also showed that, maximum, 89% of similarity was found between Cherry T.1×Co -3-2 and Cherry T.4 × Pant T. -3 genotypes. The present study demonstrated that SSR markers are effective for obtaining unique fingerprints and assessing genetic diversity among, tomato wild relatives and would be used for wide range of practical application including varietal identification and pre-screening for distinctiveness of tomato genotypes.

A REVIEW: FISH BIODIVERSITY AND ITS CONSERVATION

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Fishes are the most diverse group of vertebrates with 32,447 species. In India, the National Bureau of Fish Genetic Resources (NBFGRR) has developed a strong database on fish genetic resources of the country. Fishes exhibit enormous diversity in size, shape, biology and in the habitats they occupy. The great majority comprises bony fishes, mainly teleosts. In addition, there are around 800 species of cartilaginous and 70 of jawless fishes (lampreys and hagfishes). As per the report more than 24500 fin fish species exist throughout the world. However, there is prediction of around 32,447 fish species representing more half of the vertebrate diversity. They surveys emphasized that there could well be at least 5000 species more to be discovered. In India 2200 species of finfish have been recorded from upland cold, warm waters of the plain, brackish water and marine environment.

Keywords: Biodiversity, Conservation, Hot spot, Fin fish, Eco friendly

BIOFORTIFICATION IN MAIZE: DEVELOPING A ROADMAP FOR REDUCING HIDDEN HUNGER AND DELIVERING NUTRIENT-RICH FOOD

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Biofortification of staple crops is an effective option to minimised hidden hunger , malnutrition and poverty worldwide. Various strategies are utilised for improvement the nutritional quality of food crops include: agronomic practices, conventional plant breeding, or modern biotechnology. Deficiencies in micronutrients such as zinc, iron and vitamin- A can cause profound and irreparable damage to the body-blindness, growth stunting, mental retardation, learning disabilities, low work capacity, and even premature death. Biofortification of staple crops is a cost-effective method to reach tens of millions of people on a sustainable basis. The advantages of biofortification are many. First, biofortification is built on what poor households grow and eat-staple foods. Second, the one-time investment to develop seeds that fortify themselves keep recurrent costs low and the germplasm-the living tissue from which plants can be grown-can be shared globally, making it highly cost-effective. Third, biofortification is sustainable. Long after people stop thinking about biofortification, farmers continue to grow and eat their biofortified crops-now thought of as just "crops." Fourth, biofortification reaches the country's most vulnerable people, living in remote rural areas with no access or money for commercially marketed fortified foods. Fifth, biofortification produces higher yields in an environmentally friendly way. Sixth, overcome the mal-nutritions in human beings. Seventh increment of nutritional quality in daily diets. Eighth, improvement of plant or crop quality and increment of variability in germplasm. and finally, biofortification for important crop plants through biotechnological applications is a cost-effective and sustainable solution for alleviating VAD etc.

Keywords: Biofortification, Maize, hidden Hunger, Provitamin A carotenoids , Nutrient-Rich Food• Nutrition and health.



BIOTECHNOLOGICAL METHODS UTILIZED IN CUCUMIS RESEARCH**P. R. Panchbhai and P. L. Deshmukh**

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The cucurbit family includes a number of valuable crop species (melon, cucumber, squash/pumpkin, watermelon). Much of this review is concerned with transgenic resistance to viruses, shown to be the major application of biotechnology in the cucurbit family. Biotechnological research on selected cucumis species has encompassed interspecific hybridization via embryorescue, in vitro pollination, somatic hybridization and cytogenetics of protoplasts. Embryo-rescue and in vitro pollination are suitable in vitro techniques for production of hybrid embryos. These methods were tested and optimized for cucurbits. Protoplast culture is another valuable tool for biotechnological applications, such as somatic hybridization and genetic transformation. We study protoplast dedifferentiation not only as a biotechnological application in breeding systems, but mainly to describe mechanisms of obtaining totipotency. Protoplasts of cucurbits were studied cytogenetically to observe changes in nuclear architecture during protoplastization and regeneration and for comparison with the expression profile obtained using cDNA-AFLP techniques and reverse transcription for the specific genes involved. For the first time a detailed analysis has been made of world-wide and US field test applications for cucurbit crops. World-wide, most field test applications conducted for melon (54%), followed by squash (32%). World-wide most field test applications were for virus resistance (84%), and most applications (77%) were in the USA. Two transgenic multiple virus-resistant squash crops have been deregulated (released for sale). Additionally, the analysis shows that there are transgenic multiple virus-resistant crops in all major cucurbit species already available, for which several different companies have applied for field tests. This would imply that such crops are ready to be marketed should conditions permit, which would have an impact world-wide in reduction of ecological damage due to chemical control of the insect viral vectors.

ROLE OF BIOTECHNOLOGICAL TOOLS FOR GENETIC IMPROVEMENT IN HORTICULTURAL CROPS**P. R. Panchbhai*, P. L. Deshmukh and S. D. Deshmukh**

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Biotechnology has offered tremendous scope and potential to conventional methods of crop improvement, crop protection, crop quality management and other horticultural traits. Biotechnology extends tremendous opportunities in fruit production, there is need to integrate the biotechnology with classical breeding as an aid to molecular marker assisted selection of potential parents, germplasm conservation and micro propagation, reduction of the duration of breeding programme and early production of homozygous lines by making use of tissue culture technique which also creates the new genetic variation for achieving useful varieties. It widens the area of hybridization through embryo rescue, culture and somatic hybridization. The protoplast fusion not only expands the possibility for increasing genetic divergence but also assists in inducing male sterility and self incompatibility for controlling pollination and production of hybrids. Transgenic plants have been developed by recombinant DNA techniques for resistance to diseases, insect pests, drought, salinity, herbicide, nutritional quality and other desirable traits *i.e.*, altered flavor and colour of produce and regulation of flowering, ripening and plant architecture.

ROLE OF BIOTECHNOLOGY IN GERMPLASM CONSERVATION OF HORTICULTURAL CROPS - AN OVERVIEW**P. L. Deshmukh, P. R. Panchbhai*, S. D. Patil**, S. D. Deshmukh, N. R. Kadge and B. J. Patle**

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Biotechnology is currently playing a vital role in the improvement of horticultural crops. Biotechnology extends tremendous opportunities in fruit production by providing new genotypes after exploration, collection and evaluation for breeding purpose, supply of healthy and disease free planting material, improvement in fruit quality attributes, enhancing shelf-life of horticultural crops. Biotechnological approaches have made it easy to collect and conserve plant genetic resources in the form of traditional varieties, modern cultivars, wild relatives and other wild species, especially of those species which are quite difficult to conserve through seeds. Mostly the tissue culture techniques have been adopted to conserve germplasm of wild, endangered, threatened species as well as selected elite varieties. Advances in biotechnology, especially in the area of *in vitro* culture techniques and molecular biology provide some important tools for improved conservation and management of plant genetic resources. Cryopreservation is one of the ex-situ conservation methods which is functioning on the basis of removal of all freezable water from tissues by physical or osmotic dehydration, followed by ultra-rapid freezing. Cryopreservation has been successfully applied to callus, protoplast, pollen, meristem, zygotic and somatic embryos and suspension cultures of around 42 crop species including various horticultural crops. The DNA sequences in the genomes of germplasm accessions are the sources of the genes required in breeding programmes. When identified and isolated by cloning, these genes may be used to prepare transgenic organisms that express them.

SCREENING AND EVALUATION OF UNRIPE MANGO GENOTYPES FROM TRIBAL AREAS OF SATPUDA HILLS FOR VALUE ADDED PRODUCT-AMCHUR**P. L. Deshmukh*, S. D. Patil**, B. B. Dhakare and Laxmipriya swain**

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Nandurbar is one of the 'Tribal District' of Maharashtra which is known as "Mining Industry of Amchur". Tribal community of Nandurbar district especially of Dhadgaon tahsil under the jurisdiction of *Satpuda* hilly area had chosen and opted Summer Season livelihood option of amchur making. Almost all unripe mango fruits are used for preparation of amchur. Amchur is had unique features which is characterized by high acidic taste, fruit weight, pulp weight, light white and whitish green colour of pulp, dry matter and their low sugar content, TSS content, peel weight, stone weight which determines quality of amchur. In order to get elite types of mango for amchur making; screening and evaluation of available germplasm of mango of *Satpuda* ranges of Dhadgaon is of prime importance. Hence a preliminary survey and collection of best suited unripe mango genotypes for value added product 'Amchur' was organized during peak period of amchur making. Sixty locally grown genotypes were collected and evaluated on the basis of morphological, qualitative and quantitative attributes in fruiting season of mango 2014. Among that better performance for fruit weight, pulp weight and pulp thickness, recovery percentage was found in unripe mango accession DAM-13, while mango accession DAM-37 was found better in respect of peel weight and pulp/stone ratio. The maximum titrable acidity (10.85%) and minimum T.S.S./acidity (0.59) was showed by mango accession DAM-50. Unripe mango accession DAM-25 recorded highest sugar/acid ratio (1.55), lowest T.S.S. (6.20°Brix) content of fruit pulp was obtained from accession DAM-60. The mango genotypes were better DAM-20 in respect of pulp/peel ratio (2.55), DAM-22 in peel thickness (1.0 mm), DAM-46 in stone weight (37.80 g) and DAM-44 in sugar content (1.06%). After considering overall performance of collected genotypes for amchur preparation, twenty mango genotypes viz., DAM-13, 44, 45, 02, 31, 28, 51, 47, 19, 18, 33, 36, 52, 42, 54, 50, 60, 14, 15 were found suitable exhibiting quality attributes required for amchur. These promising genotypes had medium to high fruit weight, pulp weight, pulp thickness, titrable acidity, light to dark green peel colour, thick skin, low to medium stone percentage, peel percentage, T.S.S., total sugar percentage, T.S.S.: acidity ratio, Acid: sugar ratio. Hence, twenty genotypes viz. DAM-13, 44, 45, 02, 31, 28, 51, 47, 19, 18, 33, 36, 52, 42, 54, 50, 60, 14, 15 and 23 are found to be most promising for amchur which could be recommended for Amchur making on ad-hoc basis with due continuation of further studies.

NANOTECHNOLOGIES IN AGRICULTURE – NEW TOOLS

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Nanotechnology: Coming to a Supermarket or Farm near You, has a great potential to enhance the quality of life through its applications in various fields like agriculture and the food system. It has become the future of any nation around the world. But any new technology to be introduced should be used very carefully regarding its possible unforeseen related risks that may come through its positive potential. The potential benefits of nanotechnology in agriculture are significant, producing greater quantities of food with lower cost, energy, and waste. A robust literature assessing the toxicity of engineered nanomaterials to terrestrial agricultural plant species has begun to develop. However, now a systems-level approach is needed investigating more subtle yet potentially more significant impacts of nanomaterial exposure in agricultural systems, including the use of a range of more sensitive endpoints that can mechanistically characterize toxicity. National economy has been significantly contributed by agriculture sector and S&T has played a significant role in increasing agricultural productivity over the years. An agricultural research system with a government policy and widespread extension machinery and has enabled the agriculture sector to respond to the increasing demand for agricultural produce. The potential of nanotechnology to revolutionize the health care, textile, materials, information and communication technology, and energy sectors has been well publicized. The application of nanotechnology to agriculture and food industries is also getting attention nowadays. The basis of nanotechnology and balance between nanotechnology applications and implications in agriculture and food production is discussed here. **Keywords:** Nanotechnology, nanomaterials, productivity, toxicity .

ANALYSIS OF GENETIC VARIATION IN DIFFERENT GENOTYPES OF BANANA (*MUSA* SPECIES) USING RANDOM AMPLIFIED POLYMORPHIC DNAs (RAPDs)

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The banana (*Musa acuminata* Colla) is considered as an important crop plant due to its high economic value as good dietary source. Here, we analyze the genetic relationship of six different banana varieties that are cultivated for commercial purposes. Random amplified polymorphic DNAs (RAPDs) fingerprinting of these banana varieties (Grand Naine, Nendran, Monthan, Dwarf cavendish, Robusta and *Musa balbisiana*) were carried out by sixteen primers leading to DNA amplification. Total 111 amplicons were found to be present in all genotypes. It can be concluded from the PCR product that 0.75 % of the amplification products were monomorphic , 6.18 % of the amplification products were found to be polymorphic. Polymorphism percentage among the genotypes was calculated as 89.63 which was used to reveal the genetic relationship among the six genotypes taken into study. UPGMA cluster analysis was done to know the genetic similarities among the genotypes. The knowledge of genetic diversity among the banana cultivars can be applied in future breeding program for the improvement of the crop.

Keywords: DNA fingerprinting, RAPD analysis, primers, UPGMA, polymorphism

GREEN SYNTHESIS OF NANOPARTICLES USING DIFFERENT PLANT LEAF EXTRACT

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'Green' eco friendly processes are becoming increasingly popular and are much needed as a result of worldwide problems associated with environmental concern. So development of environmental friendly processes for synthesis of nanoparticles is a significant step in the



field of nanotechnology instead of using chemical methods which are toxic and hazardous to nature. For green synthesis different plants are used such as Tulsi, Neem, Guava, Annona, Papaya, Moringa etc. which can act as a stabilizing and reducing agents. Among all organism plants found to be the best solution for biosynthesis of nanoparticles specially silver nanoparticles. Nanoparticles produced by plants are more stable and the rate of synthesis is faster than other. After synthesis various characterization techniques are employed to identify its size, shape, surface area and dispersity and it can be used in prolonging shelf life of horticultural produce by nanocomposite based packaging, coating, in fertilizers, insecticides, pesticides etc. to increase efficiency.

Keywords: Green synthesis, Tulsi, Nanoparticles, Nano-Coating

IMPORTANCE OF QTLs IN PLANT BREEDING

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A quantitative trait locus (QTL) is a region of DNA which is associated with a phenotypic trait, which varies in degree and which can be attributed to polygenic effects, i.e., the product of two or more genes, and their environment. These QTLs are often found on different chromosomes. The number of QTLs which explain variation in the phenotypic trait indicates the genetic architecture of a trait. It may indicate that plant height is controlled by many genes of small effect, or by a few genes of large effect. Typically, QTLs underlie continuous traits (those traits which vary continuously, e.g. height) as opposed to discrete traits (traits that have two or several character values, e.g. red hair in humans, a recessive trait, or smooth vs. wrinkled peas used by Mendel in his experiments). Moreover, a single phenotypic trait is usually determined by many genes. Consequently, many QTLs are associated with a single trait. Another use of QTLs is to identify candidate genes underlying a trait. Once a region of DNA is identified as contributing to a phenotype, it can be sequenced. The DNA sequence of any genes in this region can then be compared to a database of DNA for genes whose function is already known. Multifactorial inheritance refers to polygenic inheritance that also includes interactions with the environment. Unlike monogenic traits, polygenic traits do not follow patterns of Mendelian inheritance (discrete categories). Instead, their phenotypes typically vary along a continuous gradient depicted by a bell curve. An example of a polygenic trait is human skin colour variation. Several genes factor into determining a person's natural skin colour, so modifying only one of those genes can change skin colour slightly or in some cases, such as for SLC-24A5, moderate. Most phenotypic characteristics are the result of the interaction of multiple genes.

Keywords: QTLs, Plant Breeding.

STATUS OF TEMPERATE FRUITS IN JAMMU & KASHMIR AND THEIR ROLE IN BIODIVERSITY

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The state of Jammu and Kashmir is divided into four agro-climatic zones viz. subtropical, sub-temperate, temperate and cold desert. Fruit production is the back bone of the state economy, providing livelihood to more than 33 lakh people out of total population of 1.25 crore (2011 census). Over 7 Lakh families are involved in this sector. The fruit crops grown in the state are apple, pear, peach, plum, apricot, cherry, grapes, citrus, olive, mango, ber, strawberry among fresh fruits and walnut and almond among dry nuts are important. Total area under different fruit crops in the state is 3.38 lac hectares with a production of 22.34 lac MT (2016-17). Among all these crops apple is leading in area (48.14% of total area under fruits) and production (77.26 % of total fruit production) in the state. In apple, Red Delicious, Royal Delicious, Maharaji, Golden Delicious, Cox's Orange Pippin, in pear, Kashmiri Nakh, William Bartlett and Fertility, in peach July Elberta and Quetta, in plum Santa Rosa, in apricot New Castle, in cherry Double and Misri, in strawberry SengaSengana and Confitura are the major varieties grown in the state. New apple varieties like Super Chief, Starkrimson, Vance Delicious, Oregon Spur, Silver Spur, Fuji Zehn Aztec, Gala RedLum, Red Velox, Gala Must, Golden Delicious Reinders, Golden Clone B, Red Chief Camspur in apple, Merced, Non Pareil, Ne-Plus-Ultra, IXL, Jordanolo, California Paper Shell, Pranyaj, Primoskij in almond, Chandler, Camarosa and Jutogh Special in strawberry are good varieties. The varieties released by SKUAST-Kashmir i.e. LalAmbri, Sunhari, Akbar, Firdous, Shireen, Shalimar Apple-1 and Shalimar Apple-2 in apple, Waris, Parbat, Makhdoom and Shalimar in almond and Hamdan and Sulaiman in walnuts are high yielder with good quality characters. These varieties have different characteristics and are playing a vital role in biodiversity of the state.

ROLE OF NUT CROPS IN THE BIODIVERSITY OF JAMMU AND KASHMIR

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Nut fruit are very popular among the people due to their high nutritive value. Their kernels are rich source of fat, proteins, minerals and vitamins while their kernel oil has high nutritional, medicinal and industrial value. They are also good source of income to the farmers. Walnut is the major nut crop grown in the state of Jammu and Kashmir covering an area of 89339 hectares with a production of 266280 MT (2016-17) followed by almonds. Baramulla district is leading in walnut production however district Pulwama is leading in almond production in the state. Other nuts grown as minor nut on limited scale in some parts of the state are pecan nut, chest nut, hazel nut and pistachio nut which are recognized for successful diversification. There is no regular plantation of these minor nuts in the state and only scattered plantation exist. Selection and introduction of improved germplasm, standardization of agro-techniques and establishment of regular orchards of these nuts can boost the income of the farmers. These nut crops are also playing a vital role in the biodiversity of the state.



PHENOLOGICAL EVALUATION OF EXOTIC PLUM CULTIVARS UNDER KASHMIR CONDITIONS

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Exotic plum cultivars have been introduced at Central Institute of Temperate Horticulture, Srinagar in order to broaden the spectrum of existing germplasm and recommendation of better cultivars for their commercial cultivation. The present study consisted of fourteen different plum cultivars of uniform age replicated thrice in a Randomized Complete Block Design (RCBD). The data recorded revealed that the bud swell and tight cluster stage was first in cultivar Beauty on 30th March and 2nd April, respectively. The early date of first flower bloom was observed in cultivars Frontier, Red Beaut, Tarrol, Au-Rosa, Krassivica Plum and Beauty (7th April), while the date of full bloom (10th April), first petal fall (12th April) and complete petal fall (17th April) was reported late in cultivar Beauty. Maximum duration of flowering (15 days) was recorded in cultivars Frontier and Au-Rosa whereas minimum duration of flowering (9 days) was registered in cultivar Red Plum. Highest number of flower per branch was recorded in cultivar Au-Rosa (104.83) whereas, highest percentage of fruit set was recorded in cultivar Krassivica Plum (52.85 %). Highest percentage of fruit drop was observed in cultivar Frontier (44.21 %). Cultivar Red Plum matured earliest among all the cultivars whereas cultivar Grand Duke matured late. Maximum fruit yield (52.5 kg/tree) was registered in cultivar Frontier while minimum (18.07 kg/tree) was recorded in cultivar Kubio Plum. The study conclude on the note that cultivars “Frontier”, “Au- Rosa” and “Grand Duke” were of vital importance in relation to their maturity and yield and recommended for used in breeding programme for further improvement of plum.

BIODIVERSITY CONSERVATION OF UNDERUTILIZED VEGETABLE CROPS FOR THEIR GENETIC IMPROVEMENT

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Biodiversity of plant species serve as a lake of genes for the genetic improvement of cultivated species. With modernization of agricultural practices and adoption of advance varieties, many plant species have become neglected that genetic erosion of their gene pools has become so severe that they are often regarded as lost crops. Due to changing climate and increasing population, natural resources are depleting very rapidly and as a consequence it has become necessary to explore indigenous plant biodiversity. Nature has bestowed India with great biodiversity of many unexplored potentially rich vegetable species. Around 80 species of major and minor vegetables apart from wild type occur in Indian region. It is primary centre of origin for Amaranth, Basella, Sword bean, Winged bean, Kundru, Dolichos bean, lettuce and Drumstick. There is a tremendous diversity within the family, genera and even within the species. For the genetic improvement program of any vegetable crop the very first step is conservation of its genetic diversity which may be present in various sources like wild races, cultivated species etc. Most of the population in developing world is suffering from hunger and malnutrition. Consumption and the medicinal potential of underutilized vegetables in the world can play an important role in improving human health because underutilized crops are an essential source of vitamins, micronutrients, protein and antioxidants. These crops mainly include various legumes, leafy vegetables, cucurbits, solanaceous crops, tree vegetables, root crops, tuber crops etc. A major problem in promotion of underutilized vegetable is the non availability of improved varieties and seed of planting material. Enhancement in the quality, value and availability of planting material needs systematic collection, characterization, conservation, documentation and utilization of available plant genetic resources. The increase in area and production of underutilized vegetables crops will not only provide nutritional security but also give stable income to the rural poor.

INDUCED MUTAGENESIS INCREASED CAPSAICIN IN MUTANTS OF *CAPSICUM ANNUUM* L.

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Globally, the changing environmental conditions negatively affected the growth and development of different crop that results in a sharp decline in the food production for the world population increasing day by day. To meet this challenge, existing and new appropriate technologies need to be integrated for global crop improvement programme. Among the different approaches for crop improvement, induced mutagenesis played a pivotal role and developed mutant varieties endowed with new and desirable characteristics/traits in different crop plants. In the present study, *Capsicum annum* L. seeds, treated with different concentrations of methyl methane sulphonate (MMS), were grown and in M3 generation three mutant plants, based on deviated morphological characters, were selected from a population of 200 plants. The yield of these plants was higher than the normal ones i.e., untreated plants, and other plants in the same population. These three mutants were subjected to HPLC analysis for capsaicin, an alkaloid responsible for bitterness of *capsicum*, and the result showed an increased level of capsaicin in all the three plants as compared to the untreated and other M3 population of *capsicum*.

STUDIES ON GENETIC DIVERGENCE FOR QUANTITATIVE TRAITS IN RICE (*ORYZA SATIVA*)

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Rice (*Oryza sativa*) is one of the most important staple food crop therefore its continuous crop improvement programmes is the need to fulfil the demands of present increasing population. The success of any crop improvement programme depends upon the presence of genetic diversity in the available germplasm. Genetic divergence for 57 F_1 hybrids and their 21 parents of rice have been assessed through Mahalanobis D^2 analysis at the experimental farm of NDUA&T Kumarganj, Faizabad. The experimental genotypes were grouped into nine clusters on the basis of D^2 values. Maximum 19 genotypes were present in cluster VIII followed by cluster I having 16 genotypes. The inter-cluster distance ranged from 283.04 (cluster I and II) to 2690.25 (cluster VII and IX) and the intra cluster distance ranged from 138.16 (cluster II) to 351.27 (cluster IX). The cluster VII had highest mean for panicle bearing tillers per plant, spikelets per panicle, grains per panicle, spikelets fertility, biological yield per plant, harvest index and grain yield per plant. Maximum contribution towards divergence is done by plant height (31%) followed by flag leaf area (18%), spikelets per panicle (17%) and grains per panicle (12%). Genotypes of cluster VII and IX having highest intercluster distance (2690.25) will show maximum genetic diversity. Selection of genotypes from these cluster as parents in hybridization would give superior recombinants.

Keywords: rice, D^2 , cluster, Genetic diversity.

EFFECT OF MAGNETIC FIELD AND DIETS ON *CORCYRA CEPHALONICA*

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An experiment was conducted during the year 2016-17, to find out the “Effect of magnetic field and different diets on *Corcyra cephalonica*”. The experiment was conducted in, Entomology Section, College of Agriculture, Dr. PDKV, Akola with four main and four sub treatments with seven replications in Factorial Complete Randomized Design. The four main treatments were exposure of *Corcyra* larvae to magnetic field for 0 hrs, 2 hrs, 4 hrs and 6 hrs duration and four sub treatments were rearing of the larvae on different diets that is sorghum, sorghum and bajra, sorghum and maize and sorghum and wheat diet. Observations were recorded on larval length, weight, fecundity of *Corcyra*. The results indicate, rearing of *Corcyra* in magnetic field for two hrs had positive effect on *Corcyra* larvae on the parameters under study and was at par with control. The interaction effect of magnetic field and diet also indicates that there was good effect of 2hrs magnetic field and sorghum diet on *Corcyra*. The study also indicates that exposure period to magnetic field plays an important role on biology of *Corcyra*.

DIVERSITY OF GUT BACTERIA ASSOCIATED WITH THE GUT OF *ANTHERAEA ASSAMENSIS* (MUGA SILKWORM)

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Antheraea assamensis Helfer, the golden-yellow silk producer, a polyphagous which survive well on several species of plants. The diversity and evolution of insects have depended in part on their myriad relationships with beneficial microorganisms, which are known to upgrade nutrient poor diets; aid digestion of recalcitrant food components; protect from predators, parasites, and pathogens; contribute to interspecific and intraspecific communications. The gut microbiotas are associated with several physiological functions including digestion, absorption, degradation of toxic metabolites, semiochemical production and resisting the colonization of entomopathogens (Dillon and Dillon, 2004). The aim of this study is to deploy the culture dependent techniques for profiling the gut bacterial cultures of the muga silkworm; to report the diversity of bacteria as reflected by diversity indices viz. Shannon and Simpson index, generic characterization by using 16S rDNA gene which would unravel the possibility of developing probiotics consortia for enhancement of sustainable productivity of *A. assamensis*. The culturable component of the bacterial community was assessed, revealing *Bacillus* (54%) as the predominant bacteria followed by *Serratia* (24%), *Pseudomonas* (10%) and *Alcaligenes* (6%). The diversity index such as Shannon wiener index value was found to be in the range of ($H = 4.73 \pm 0.43$ to $H = 2.1 \pm 0.05$) and Simpson index value was found to be in the range of ($D = 13.6 \pm 0.16$ to $D = 5.26 \pm 0.13$). Our results demonstrated that a core bacterial community exist in the insect gut with diverse community of gut bacteria, which may contribute to the host physiology and could play a role in conferring host resistance to diseases.

DIVERSITY FOUND IN BLACK GRAM'S GENOTYPES IN MADHYA PRADESH CLIMATIC CONDITION USING D^2 – STATISTIC

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Based on the estimates of genetic divergence through Mahalanobis' D^2 – statistic, total forty six genotypes of black gram were grouped into 12 different clusters grown at College of Agriculture, Indore (M.P.). Cluster II which contained one genotype, had lowest intra-cluster distance. The maximum inter-cluster distance of 9.900 was recorded between cluster V and cluster II. A cross between these two inter-cluster's genotypes is expected to give a heterotic hybrid and wide spectrum of variability. Highest intra-cluster distance of 2.148 was observed for cluster I which comprises of five genotypes. The lowest inter-cluster distance of 2.333 was recorded between cluster IX and VIII. Highest intra-cluster distance & lowest inter-cluster distance indicates that the genotypes of these clusters were genetically less diverse and were almost with same genetic makeup or follows more or less same evolutionary phases during development. The cluster I (KU7-522, KU7-619, KU7-626, KU7-608 and IVU-486) had lowest mean value for earliness flower initiation, 50% flowering and maturity could be used to develop short duration black gram varieties; cluster III (KU7-632, KU8-611, KU8-612 and KU8-532) for dwarf plant type; cluster X (KU3-62, JU-840 and TPU-4) for tall



plant type; cluster II (KU8-632) and cluster IV (KU7-320 and KU8-278) for more number of primary branches per plant, number of seeds per plant, number of pods per plant, biological yield per plant and seed yield per plant; cluster VI (RBU-466-D, KU8-476, JU-86, TYPE-9 and IVU-466-D) for seed weight that may be used as bold seeds. To improve any particular trait donor may be selected from these clusters for hybridization program to evolve high yielding strains. It may be inferred from the present study that the genotypes with high genetic divergence are likely to produce potential crosses for exploitation of hybrid vigour for commercial production.

STUDY OF GENETIC VARIABILITY IN BREAD WHEAT (*TRITICUM AESTIVUM* L.) THROUGH INDUCED MUTAGENESIS BY GAMMA RADIATION.

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Genetic improvement of any crop depends upon variability present in that crop. By hybridization and conventional breeding method variability of wheat crop is being exhausted hence mutation breeding the alternative and potential source to create variability may be utilized for further improvement. An experiment was conducted to evaluate bread wheat (*Triticum aestivum* L) variety RAJ-4037 in 9 different doses of gamma ray (5KR, 10KR, 15KR, 20KR, 25KR, 30KR, 35KR and 40KR) including control during Rabi 2010-11 (M_1 generation) and Rabi 2011-12 (M_2 generation). The data were recorded on 14 characters to study the analysis of variance, family mean, progeny mean, co-efficient of variation and heritability. It was observed that higher doses (35 and 40 KR) of gamma rays reduces the germination%, root length, shoot length and seedling height as compared to lower doses in M_1 generation. Higher magnitude of GCV and PCV was recorded for number of tillers per plant and canopy temperature depression and flag leaf width while other characters plant height and test weight show high heritability in M_2 generation. The mutant line such as F_1P_{12} , F_4P_{13} , F_5P_{12} and F_5P_{13} were identified as the best progeny for grain yield per plant and test weight among all the progeny of different families.

NUCLEIC ACID-BASED PATHOGEN DETECTION IN APPLIED PLANT PATHOLOGY

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Nucleic acid-based (NA-based) detection techniques are becoming fundamental for the applied plant pathologist. Their speed, sensitivity, specificity, versatility have resulted in the use of these tools to address an increasing number of applied questions and hypotheses. In order to use based detection techniques to best advantage, it is important to recognize only their advantages but also their limitations, such as the possibility particular NA-based tests may not have complete specificity for the of interest and only for that organism. The distinction between detection and disease diagnosis must also be recognized, and we believe NA-based tools are techniques for the former and not the latter. Several pathogen detection technologies are also discussed.

ROLE OF ICT IN RURAL AREAS FOR WOMEN EMPOWERMENT

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Rural women in India have limited access to resources and public spheres due to socio-cultural restrictions. Women suffer from severe discrimination, and it is thought this is heightened due to a lack of access to information. Information communication and technology (ICT) is a potential tool that can reach rural women and enrich their knowledge. This paper discusses women's empowerment in terms of perceptual change in rural villages in India after ICT intervention has been introduced by Non-Government Organizations (NGOs). Since empowerment is a complex phenomenon to measure because of its multidimensional aspects and its relationship with time as a process, the methodology used in this research was an integration of qualitative and quantitative methods. Using a structured questionnaire, data was collected from women in rural villages where ICT projects have been introduced. The change in women's perception after using ICT was compared with changes in women who did not use ICT. The results indicate that ICT intervention changed women's perception in a positive direction in one village but it did not change in the other village.

EFFECT OF PRE-TREATMENTS ON THE PHYSICO-CHEMICAL PROPERTIES AND SENSORY QUALITY OF IMF PAPAYA SLICES

Akanksha Shrivastava, I.N.DoreappaGowda and Anish M.

Papaya (*Carica papaya* L.), is an important fruit crop throughout the tropical and sub-tropical countries and is rapidly becoming an important fruit for fresh and processed products. It is highly perishable and post-harvest loss is one of the most pressing problems of the fruit industry in India. To prevent these losses intermediate moisture (IM) slices were prepared. IMF has a water activity range of 0.65-0.90 which is primary hurdle for to achieve microbial stability and safety by additives such as sugars, salts, nitrites or sulphites. But using any specific additive in high concentration may cause health concern. So, efforts have been made under this research in Division of Postharvest Technology IIHR, Bengaluru during 2014-15, to improve the quality by decreasing sugar/salt without sacrificing the microbial stability by using a novel combination technology i.e. Hurdle technology. Here combination of osmotic removal of water by sugar syrup (60°B) containing different preservatives/additives and their combinations such as $CaCl_2$, citric acid, Sodium metabisulphite or potassium metabisulphite to reduce



water activity. The osmosed slices were surface dried and analysed for initial physico-chemical parameters and sensory attributes. Further the product was stored up to six months at LT (Low Temperature) ($4\pm1^{\circ}\text{C}$) storage and accessed for their composition, stability and sensory attributes. The papaya slices which were steam blanched, followed by osmosis in sugar solution of 60°Bsyru + Citric Acid 0.5% + CaCl_2 0.5% + NaMs 75ppm + KMS 350ppm was judged as best treatment combination in terms of quality and stability of the product (water activity 0.70, moisture 39.50%, acidity 0.28%, ascorbic acid 36.63 mg/100g, total carotenoids 2.71 mg/100g and total antioxidants 38.76 mg/100g). The findings obtained thus could help in overcoming the consumers' worries related to their health by processed food consumption.

ASSESSMENT OF GENETIC DIVERSITY IN GARLIC GENOTYPES BASED ON SSR MARKERS

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Garlic (*Allium sativum* L.) is one of the most important remunerative bulbous vegetable grown after onion. The present investigation was conducted to assess the genetic diversity among 131 garlic genotypes collected from different parts of India using SSR markers at SVPUAT, Meerut (U.P.). Twenty-one SSR primers produced a total of 42 alleles were obtained, with an average 2.0 alleles per locus. The PIC values ranged from 0.00 (Asa 06, Asa 20 primer) to 0.975 (Asa 14 primer) with an average of 0.439. In addition, resolving power (RP) varied between 0.45 (Asa 14) and 3.81 (Asa 27) with an average value of 2.29. Meanwhile, Marker Index (MI) values for 10 SSR primers ranged from 0.00 (Asa 06 and Asa 20) to 4.31 (Asa 25) with an average value of 1.06. Depending on the PIC, MI and RP values, it may be concluded that Primer Asa-25, Asa-18 and Primer-4 were highly significant in analysis. Based on SSR marker assay, 131 garlic genotypes were grouped into two major groups Group I and Group II. While, Group I includes two genotypes Group-II includes 129 genotypes and was further divided into eleven cluster (GII-1, GII-2, GII-3, GII-4, GII-5, GII-6, GII-7, GII-8, GII-9, GII-10 and GII-11). Clusters GII-2, GII-4 & GII-10 includes single genotypes each and GII-1, GII-3, GII-7, GII-8, GII-9 & GII-11 includes five, six, four, seven, five and three genotypes respectively. Meanwhile, Cluster GII-6 and GII-5 were complex clusters which includes thirty-seven genotypes and sixty-two genotypes respectively. Finally, these studies have given important clues in understanding genotypes relationship, which may further assist in developing and planning breeding strategies.

PLASMA TECHNOLOGY- AN INNOVATION IN FIELD OF FOOD PRESERVATION

Akanksha Shrivastava and Anish M.

Food safety is a major concern for food industry, regulatory agencies as well as consumers. Food-borne pathogens and spoilage microorganisms are problematic microbes in food industry due to its significant public health risks and economic impact. Non-thermal plasma is an electrically energized matter in a gaseous state that can be generated by electrical discharge and comprises highly reactive species (positive ions, negative ions, free radicals, electrons, excited or non-excited molecules and photons). Electrical discharges in atmospheric pressure and low temperature make this process practical, inexpensive and suitable for decontamination of products for which heat is not desirable. Among the different categories of plasma viz. equilibrium, quasi-equilibrium and non-equilibrium, Atmospheric pressure plasma (APP) is an innovative non-thermal technology for food preservation. This technology is being applied recently for the inactivation of microorganisms on the surface of fresh and processed foods. During plasma treatment, killing microorganisms are result of direct contact to antimicrobial active species. Accumulation of charged particles at the surface of the cell membrane can rupture the cell membrane. Oxidation of the lipids, amino acids and nucleic acids with reactive oxygen and nitrogen species cause changes that lead to microbial death or injury. In addition to reactive species, UV photons can modify DNA of microorganisms and as a result disturb cell replication. Combining APP with other non-thermal processes could be a possible breakthrough in this field. The studies related to its effect on physico-chemical properties of food, safety and aspects could help in making this technology more applicable widespread.

CRISPR-CPF1: A NEW TOOL FOR PLANT GENOME EDITING

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Clustered regularly interspaced palindromic repeats (CRISPR)-CRISPR-associated proteins (CRISPR-Cas), a ground breaking genome-engineering tool, has facilitated targeted trait improvement in plants. Recently, CRISPR-CRISPR from *Prevotella* and *Francisella* 1 (Cpf1) has emerged as a new tool for efficient genome editing, including DNA-free editing in plants, with higher efficiency, specificity, and potentially wider applications than CRISPR-Cas9. CRISPR-CAS forms part of the adaptive immune system of prokaryotes, and domestication of this system provided a 550 Trends revolutionary tool for plant genome engineering. Although developed recently, CRISPR-Cas has been established in important model and crop plants. Important traits, such as cold tolerance, drought tolerance, herbicide resistance, yield increase, quality improvement, virus/disease resistance, and fungal disease resistance, can be introduced and/or improved in economically important crops. Moreover, CRISPR-based approaches have produced DNA-free and/or non-genetically modified (GM) crops [1], which have modified traits but lack exogenous DNA; these crops have been approved for commercial production in the USA [2]. To date, most genome editing with the CRISPR system has used Cas9, a type II nuclease from *Streptococcus pyogenes*. In type II CRISPR-Cas in the prokaryote immune system, RNase III and the Cas9 protein are involved in the processing of the precursor CRISPR RNA (pre-crRNA) in the presence of the trans-acting crRNA (tracrRNA). The Cas9/guide RNA ribonucleoprotein complex also recognizes the target site and makes a site-specific double-stranded break (DSB). By contrast, in the type I and type III systems, the recognition and cleavage of target sites involve several Cas proteins. Given the



simplicity and efficiency of the type II system, Cas9 proteins are widely used for genome editing. In the simplified system used for genome editing, the tracrRNA and crRNA are replaced by a single-guide RNA (sgRNA).

FOREST BIODIVERSITY, THREATENED SPECIES AND CONSERVATION IN RAJASTHAN

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Biodiversity is fundamental to the existence of life on the earth. Its significance cannot be underestimated. There are varieties of living things that exist in a given physical environment. These are interdependent and interrelated in the form of an ecosystem. Biodiversity increases as we move from the poles towards the equator. India is located between 8°4' North and 37°6' North latitudes and 68°7' East and 97°25' East longitude. Due to this position India has such rich biodiversity. Although India has only 2.42 % of the world's land area but its contribution to the world's biodiversity is approximately 8 % of all recorded species, including over 45,000 species of plants and 91,000 species of animals of the total number of species which is estimated to be 1.75 million. 45,000 plant species comprising about 12 % of world's flora are found in Indian forests. Of the 34 global biodiversity hotspots, four are present in India (Anonymous, 2015). In Rajasthan, it is estimated that 100 species of plants are threatened in view of their conservation status. There are 23 species of plants that are endemic to the state and, all the 19 endemic species are threatened, so are all the 35 wild relatives of cultivated plants (Sharma and Upadhyay, 2014). Species importance concept can help us understand and quantitatively analyze species roles, then identify and evaluate the keystone species in nature. Indicator species are used to monitor environmental changes, assess the efficiency of management and provide warning signals for impending ecological shifts (Ahmed *et al.*, 2016). As habitat fragmentation, changes in ecological condition, and loss of biodiversity escalate, society turns to science for guidance on dealing with complex environment issues. Unfortunately, there are no simple solutions to many of the environmental problems of today, but clearly a commitment to preservation of natural resources and to understand the implications of resource management and stress impacts is a necessary step towards addressing these complicated issues (Virginia and Suzzane, 2001).

INDIGENOUS TECHNICAL KNOWLEDGE OF FARMERS OF KANDI BELT OF JAMMU REGION

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The term indigenous knowledge, traditional knowledge and ethno science have been used interchangeably to describe the knowledge system of an ethnic rural group that has originated locally and naturally. Indigenous knowledge is an essential cultural and technological element of human society and community which provide valuable insights to sustainable farming process. It is holistic in nature, because it treats the farming system as an interdependent part of the whole environment, nature and bio diversity. Indigenous knowledge systems refer to the ways by which members of a given community define and classify phenomena in the physical, natural and social environment. Examples are local classification of soils, crops, plants, livestock etc. such knowledge provides the background for local level decision making. Every society has stock of knowledge generated within sociocultural system in order to solve the problem unique to it. Such indigenous knowledge is not only economically viable but also locally feasible. Undesirable consequences of new and exogenous technologies have drawn attention of experts to ITK. However wide variety of ITK is highly localized and restricted for outsiders because of indigenous overtones. It is passed on from one generation to another through word of mouth. Such knowledge is product of trial and error, natural selection and keen observations through centuries. Many of the traditional knowledge in agriculture are always targeted for productivity, sustainability, stability and equality. The rural people of Jammu region make traditional uses of natural growing vegetation. Farmers make use of wild grown bushy shrub *Carissa spinarum* locally grown as Gharna as fodder for goat and sheep and for fencing of crop fields beside using it as fruit. *Zizyphus nummularia* and *Z. xylopyra* locally known as Phoakar and Kathi ber are used for fruit, fuel, fodder and fencing purpose. Its wood is used for making agricultural implements like handle of Desi plough, locally known as Dandi. *Acacia nilotica* and *A. modesta* are used for making traditional agricultural implements locally known as Sohaga, Panjali and Sangi. Sohaga is used for planking of fields. Sangi is used for fencing and Panjali is put around the neck of bullocks and ox for ploughing. The flowers of tree species like *Moringa oleifera* (Sohanjana), *Bauhinia variegata* (Karrai) are used as vegetables and for making pickles. As a traditional practice farmers grow marigold on the bunds of maize crop fields to protect it from attack of Blister beetles. Such lots of indigenous practices are carried out by the farmers. Sharing this knowledge with the farmers will help them in restoring the pride in their innovative potential. Farmer to farmer communication and learning would be feasible if ITK of one region is shared in other region.

GENETICALLY MODIFIED VEGETABLE CROPS: NEW ASPECT OF CROP IMPROVEMENT

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Genetically modified (GM) vegetable crops are developing faster world wide. Several desirable traits have been developed in many vegetable crops in India and abroad. GM crops are helpful for increasing production and productivity of vegetable crops and helpful in food



security as well. Basically, its genetic manipulation that uses recombinant DNA to change the genetic makeup of an organism, organisms modified in this way, are called to as being transgenic or genetically modified or genetically engineered. GM technology gives the ability to add, subtract, alter or exchange an individual gene or a group of genes, which are known to influence an individual characteristic. Various fields of application of genetic engineering include; biotic resistance, abiotic resistance, increased nutritional value, altered ripening, improved fruit quality and post-harvest storage. In recent past, research have been performed in some high value vegetable crops wherein, genetically modified technology have worked successfully for future purpose are; high lycopene and flavones (anti-oxidants) in tomato, high quercetin in onion, edible vaccine iron rich lettuce, proteinaceous potatoes and cassava etc. Thus, genetically modified foods have the potential to solve many of the world's hunger and malnutrition problems and to help in protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides. Although, there are many challenges in the areas of safety testing, regulation, international policy and food labeling. However, we must proceed with caution to avoid causing unintended harm to human health and the environment as a result of our enthusiasm for this powerful technology.

THE ROLE OF NANOTECHNOLOGY IN POST-HARVEST MANAGEMENT OF HORTICULTURAL CROPS

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Horticulture science has been defined as science and art of cultivating and handling of fruits, vegetables, flowers and ornamental plants. Human population is increasing rapidly, so providing sufficient and healthy food is becoming a very important problem in the near future. Now, increasing production efficiency and decreasing post harvest wastage with using the findings of novel scientific researches such as biotechnology and nanotechnology in products, could be counted as the best solution to this problem. Nanotechnology using particular characteristics of nanoparticles can be a very useful technology in all science and industry branches. Nowadays, a lot of usages of nanotechnology in agricultural sciences have been established. In relation with extension of horticultural products shelf life, nanotechnology can help us in some grounds, e.g., controlling growth and development of micro organisms, introducing a new generation of packaging coverage's (Films) and controlling influence of gases and the harmful rays (UV), increasing strength, quality and packaging beauty and using the multiple chips (Nanobiosensors) for labeling products that considered as fundamental step to automated control of storages.

IMPORTANCE OF QTLs IN PLANT BREEDING

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Quantitative trait locus (QTL) is a region of DNA which is associated with a phenotypic trait, which varies in degree and which can be attributed to polygenic effects, i.e., the product of two or more genes, and their environment. These QTLs are often found on different chromosomes. The number of QTLs which explain variation in the phenotypic trait indicates the genetic architecture of a trait. It may indicate that plant height is controlled by many genes of small effect, or by a few genes of large effect. Typically, QTLs underlie continuous traits (those traits which vary continuously, e.g. height) as opposed to discrete traits (traits that have two or several character values, e.g. red hair in humans, a recessive trait, or smooth vs. wrinkled peas used by Mendel in his experiments). Moreover, a single phenotypic trait is usually determined by many genes. Consequently, many QTLs are associated with a single trait. Another use of QTLs is to identify candidate genes underlying a trait. Once a region of DNA is identified as contributing to a phenotype, it can be sequenced. The DNA sequence of any genes in this region can then be compared to a database of DNA for genes whose function is already known. Multifactorial inheritance refers to polygenic inheritance that also includes interactions with the environment. Unlike monogenic traits, polygenic traits do not follow patterns of Mendelian inheritance (discrete categories). Instead, their phenotypes typically vary along a continuous gradient depicted by a bell curve. An example of a polygenic trait is human skin colour variation. Several genes factor into determining a person's natural skin colour, so modifying only one of those genes can change skin colour slightly or in some cases, such as for SLC-24A5, moderate. Most phenotypic characteristics are the result of the interaction of multiple genes.

IN VITRO INDUCED POLYPLOIDY IN ACID LIME (*CITRUS AURANTIFOLIA* SWINGLE) SHOOT TIPS USING ANTI-MITOTIC AGENT

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The induction of polyploidy can be highly beneficial in the crop such as citrus which has a very narrow genetic base. The efficacy of *in vitro* polyploidization directly depends on several variables associated with the plant, the anti-microtubule agent used and the interactions between explant and media exposure. A linear reduction in viable plant regenerants was obtained with the increase in colchicine concentration in micro molar (250 μ M, 500 μ M, 750 μ M, 1000 μ M to 2500 μ M). The morphological differences between the tetraploids and diploid plants with respect to the phenotypic traits, glossiness, thickness of leaves, stomatal size and density as well as leaf and shoot characteristics can be a ideal marker to detect them. Based on subjecting data to probit analysis the LD₅₀ value was observed at 500 μ M. The putative mutants and polyploids showing noticeable increase in size of plant parts were selected based on visual screening and subjected to stomatal analysis for assessment of ploidy status. The stomata size and guard cell parameters statistically showed positive correlation with the ploidy level of the regenerants and can be used effectively for preliminary polyploidy screening under *in vitro*. The frequency was higher in 250 μ M (27.27 %) and 500 μ M, 3n (21.42 %), 4n (14.28 %) to obtain polyploids i.e., triploids and tetraploids when the shoot tips were inoculated in and



then retained for duration of 15 days. The results revealed that colchicine at lower dosage could be efficiently utilized for induction of polyploidy in acid lime shoot tips. The obtained triploids/tetraploids strains can be mass multiplied and can serve as a good source of genetic diversity and have a great potential in breeding programs to create seedless/triploid cultivars in future breeding programmes.

DEPLETION OF BIODIVERSITY IN THE COASTAL ZONE OF INDIA

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Biodiversity is the rich and wonderful variety of plants and animals present in the ecosystem. These varieties boost the productivity of the ecosystem in which they thrive. Coastal zones are one of the most important hotspots for biodiversity and provide several unique habitats, such as; estuaries, mangroves, tidal marshes, coral reefs etc. which gives numerous ecological goods and services. India is blessed with 8129 km of coastline which houses a wealth of diverse flora and fauna. Indian coastal zone is used extensively for a large number of activities. These activities are not always compatible and may result in a wide array of problems for biodiversity of that area. We have already depleted many species of turtles, sharks, dolphins, crocodiles, marine molluscs, sea horses, sea cucumbers and manatees. The activities which are mainly responsible for depletion of biodiversity are; rapid urbanization, industrial development, indiscriminate fishing, waste disposal, shore protection works, ports and marine transportation, land transportation infrastructure, water control and supply projects, sea fisheries, aquaculture, coastal forest industries, coastal agriculture, tourism, recreation, etc. For sustainability of coastal zone resources, we need proper study, sound understanding, viable work plans, comprehensive management strategies of coastal water systems and their internal relations. Apart from these, governmental and non-governmental organizations should come forward and take responsibility to aware people, especially coastal communities, for sustainable use and adequate management of coastal zone resources to protect biodiversity. In order to protect the ecologically important areas, Government of India (GOI) initiated action through the state governments to create a network of MPAs under Wildlife (Protection) Act, 1972. In India, there are about 31 Marine Protected Areas (MPA), which cover a total area of about 627.2 Km². The GOI has notified three Biosphere Reserves in 1989 to recognize ecological values and importance for biodiversity conservation in coastal areas viz: Great Nicobar Biosphere Reserves in Andaman and Nicobar (885 Km²), Gulf of Mannar Biosphere. These type of action plans and their implementation is very much required for sustainability of biodiversity.

GENETIC DIVERGENCE ANALYSIS OF CULTIVATED GENOTYPES OF BOTTLE GOURD [*LAGENARIA SICERARIA* (MOL.) STANDL.]

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A field experiment entitled “Genetic divergence analysis of cultivated genotypes of bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]” was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during summer 2016. Thirty seven (37) bottle gourd genotypes were planted in randomized block design with three replications. Diversity analysis was done by using D² statistics analysis. The maximum diversity was observed for the traits like fruit shape and fruit colour. Eight major clusters were formed by grouping all the thirty seven genotypes in such a way that genotypes within each cluster had smaller D² value than those between clusters. Cluster patterns revealed that Cluster I consisting of 12 genotypes and Cluster II consisting of 9 genotypes were the largest group, followed by Cluster VI (7 genotypes), Cluster IV (5 genotypes) and Cluster III, V, VII, VIII each consisting of one genotype. A maximum difference among the genotypes within the same cluster was shown by Cluster VI (14.59) followed by Cluster IV (12.50), Cluster II (11.51), Cluster I (10.53), while the intra cluster distance was zero for remaining four clusters. The range of inter-cluster distance was found to be in between 9.75 to 22.49. Cluster VII and VIII showed maximum inter cluster distance of 21.37, followed by between Cluster III and VIII (18.81). The lowest inter cluster distance was noticed between Cluster II and IV (14.87), followed by Cluster IV and V (14.99). So, it signified that cluster showing highest distance between themselves have greater chances of inter and intra specific hybridization to breed for high yield and for good fruit shape including free from crook neck.

SCANNING ELECTRON MICROSCOPIC STUDIES IN MUTANTS OF PERIWINKLE (*CATHARANTHUS ROSEUS* L.) CV. LOCAL

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The present study was conducted at botanical garden, Medicinal Plants Park, HC & RI, Tamil Nadu Agricultural University, Coimbatore during 2016-17 to determine the variability in leaf structures of periwinkle (*Catharanthus roseus* L.) cv. Local, treated with physical and chemical mutagens through scanning electron microscope. The mutagens utilized for this study were physical mutagen i.e., gamma radiation dose ranging from 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 kR and chemical mutagen i.e., chemical mutagen, Ethyl methanesulphonate (EMS) ranging from 10, 20, 30, 40, 50 and 60 mM. Morphologically different leaves and flower mutant plants were identified in the M₂ generation. The collected samples were subjected to scanning electron microscope. The variability was observed in the morphological characters of leaves, after dehydrating the plant tissues for observation in electron microscopes both in physical and chemical mutagens under the microscope at 10 µm scale. Based on morphological structures, the scanning electron microscopy of leaves at 400 x to 10,000 x magnification of mutants along with control revealed extensive variation. The length of guard cell ranged from 4.73 µm to 4.82 µm, which was 3.88 µm to 5.57 µm in control and in EMS 4.88 µm to 5.95 µm. The surface of leaf had irregular pattern of ridges. The anatomical changes



also occurred which reveals that mutation had a significance effect on changing the internal geometry. The future studies need to be undertaken to study the efficacy of these mutants in future and isolating them based on the SEM studies.

RESYNTHESIS OF *B. JUNCEA* FOR INCREASING THE GENETIC VARIABILITY AND SEARCH FOR NEW PLANT TYPES

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Brassica juncea (AABB, 2n=36) is an amphidiploids oilseed crop that evolved in nature from intercrossing between *B. rapa* (AA, 2n=20) and *B. nigra* (BB, 2n=20). Due to long history of domestication followed by repeated man made selections the existing cultivated germplasms have evolved with limited genetic variability which imposes a limitation in further crop improvement. Resynthesis of *Brassica juncea* is a way forward for creating new genetic variability and broadening the genetic base of this crop. Crosses were attempted between variable accessions of *B. rapa* and *B. nigra* for developing synthetic *B. juncea*. F₁s were sterile amphihaploid with 18 chromosomes (10 from *B. rapa* and 8 from *B. nigra*) but importantly showed variable plant height, branches, leaf and silique traits. Some distorted plant types with deep serrated leaves and stunted height were also produced though could not survive for further generations. Colchicine treated apical meristematic buds produced partially fertile flowers (20-30 percent pollen viability). Bud pollination was performed in such inflorescence and seeds were harvested. In subsequent generations, amphidiploid plants (AABB) with 36 chromosomes (20 from *B. rapa* and 18 from *B. nigra*) with higher fertility (~90%) were selected and selfed for generation advancements. Amid massive F₃ variation for important agronomic traits including plant height, number of silique per plant, number of seeds per silques, number of primary, secondary and tertiary branches etc. a total of 70 individual events (RBJ-1 to RBJ-78) of synthetic *B. juncea* lines was selected. Another few cycle of selections would be able to recover new plant types with desired traits for crop improvement.

MOLECULAR MARKERS AND QTL ANALYSIS IN CROP PLANTS

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Majority of quantitative traits in crop plants are controlled by polygenes; most of them have minor effects and only occasionally some of the genes have major effects. These gene loci are described as quantitative trait loci (QTL) and can be detected with the help of molecular markers, which should also segregate in a Mendelian manner. A QTL actually describes a region of the chromosome defined either by linkage to an individual molecular marker or by two flanking markers which may or may not be linked with the QTL. Molecular markers that are used for QTL analysis largely refer to DNA-based markers, which can be used in plant breeding for various purposes. A variety of methods are available for QTL analysis in crop plants. The earliest and simplest methods for QTL analysis included single-marker regression or tests for independence in segregation of molecular marker and the trait of interest. A serious limitation of this approach is confounding of the effect of one QTL by many others that influence the trait. A milestone in QTL analysis, therefore, was the QTL interval mapping, which had several advantages over the above traditional methods involving regression analysis or tests of independence. It has been shown that some of the markers showing no association through single-marker analysis, were helpful in detecting QTLs through interval mapping. Modifications of simple interval mapping (SIM) have also been suggested in the form of composite interval mapping (CIM) and multiple interval mapping (MIM), which take care of some of the limitations of SIM. Normally in a mapping population consisting of RILs, one needs to examine that all polymorphic markers should segregate in a Mendelian 1 : 1 ratio and those which deviate significantly from this expected segregation are rejected and not used for any further analysis of marker-trait association. Similarly, the phenotypic data on the quantitative trait being examined should be tested for normality of distribution, before they are used for any further QTL analysis and in case normality is not present, the data need to be transformed on a scale that will achieve normality of distribution. Both these conditions need to be fulfilled before embarking upon QTL analysis.

MOLECULAR BREEDING METHOD FOR CROP IMPROVEMENT

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Plant breeding aims at the genetic enhancement of crops through the application of principle of Mendelian Genetics and modern tools and techniques of cell and molecular biology. Molecular markers consist of specific molecules, which show easily detectable differences among different strains of a species or among different species. An ideal Molecular marker have it should exhibit a high degree of polymorphism, an ideal marker should be co-dominant, Marker should be highly reproducible and the detection of the marker system should be rapid, simple and easy. Many advanced Breeding programs such as Marker-Assisted Selection (MAS), Marker-Assisted BackCrossing (MAB), foreground selection, background selection etc, include for the improvements of traits such as high yield, multiple resistance to major disease, insect pests and tolerance to abiotic stresses and improved quality. Recent advances in molecular genetics have opened new opportunities to speed up plant breeding. Molecular markers have become important tools in the hand of plant breeder for enhancing the selection efficiency for various agronomic traits. Plant breeding has infact entered in an era of genomics. Various molecular markers (RFLP, RAPD, AFLP, SNP STS, SCAR, DAF, SPAR, CAPs etc.) used for the tracking the interest gene. Various applications of MAS used in plant breeding for the enhancement of interest traits, some application very useful such as Marker-assisted backcrossing, Pyramiding, Early generation selection, Combined approaches. There are several important use of molecular markers such as for indirect selection increases the effectiveness of selection



as it avoids the confusing effects of the environments, They allow accurate determination of individual plant genotypes, which allows selection of single plants even in early segregating generations, Molecular markers allow mapping of Quantitative trait loci (QTLs).

RESPONSE OF TUBEROSE GENOTYPES TO YIELD AND QUALITY PARAMETERS

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A field experiment was conducted at farm of Horticulture Section, College of Agriculture, Nagpur during *Kharif* season of 2014-2015 with view to study the yield and quality of flowers as influenced by tuberose genotypes. The experiment was laid out in Randomized Block Design with ten different genotypes (NT-1, NT-2, NT-3, NT-4, NT-5, NT-6, Prajwal, Shringar, Hyderabad single, ArkaNirantara) planted in three replications. The results of the experiment revealed that, the genotype Prajwal recorded maximum number of spikes plant⁻¹ (3.44), spikes plot⁻¹ (34.33), spikes ha⁻¹ (4.87 lakhs), and number of florets spike⁻¹ (43.80). As regards quality parameters viz., length of spike (94.33 cm), diameter of spike (1.37 cm), weight of ten florets (12.94 g), length of floret (6.80 cm), diameter of floret (3.85 cm) and vase life of spike (10.33 days) were recorded maximum in genotype Prajwal whereas, genotype ArkaNirantara had recorded significantly maximum length of rachis (32.70).

STUDIES ON GENETIC DIVERGENCE IN PEA (*PISUM SATIVUM* L.)

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The present investigation was conducted to assess the genetic variability among 20 genotypes collected from different institutes/SAUs during *Rabi* season (2016-2017). Mahalanobis D² analysis revealed that a considerable amount of diversity has been found in the pea germplasm and all the germplasm were grouped into four clusters, i.e., cluster III had 10 genotypes, cluster II (5 genotype), cluster IV (3 genotype) and cluster I (2 genotypes). The maximum inter cluster distance was obtained between cluster III and I and the minimum inter cluster distance was noted between clusters IV and III. The maximum inter cluster D² values indicated that genotypes of cluster III and I were not closely related, whereas the genotypes of cluster IV and III were found closely related due to minimum inter cluster D² values. It is apparent therefore, the genotypes of cluster do not differ significantly with regards to their relative genetic distance as indicated from the low variation of D² values. The intra cluster distance among various clusters exhibited maximum intra cluster distance for cluster II followed by cluster III and the lowest intra cluster distance was recorded for cluster IV. The maximum intra cluster distance was because of wide genetic diversity among its genotypes.

EFFECT OF MUTAGENS AND CHEMICALS ON PLANTS

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Food has always been the key to human survival as it was and is and will always be one of the major basic need of humans. Man has always been taking great leaps in field of food production from the domestication of plants during ancient times to the advanced cultivation in practices now. The advanced methods include the breeding techniques, new and effective use of resources and use of different types of agents to improve the present status of food. The different types of agents include various MUTAGENS and chemicals. Mutation breeding and mutagens usage has been in boom since it gave some good results in experiments conducted previously. Mutation breeding and mutagens Some of the varieties developed using mutagens and mutation breeding are *pant mung-2, MA-9 cotton(x-ray radiation drought tolerance), pusa 413, 547(chick pea resistant to ascochyta blight and wilt disease), PNR-381 rice, SHARBATI SONORA wheat, Pant moong-1(black gram resistant to yellow mosaic virus)*. Mutation breeding is one of the most reliable techniques in improving crop plants. Many mutagens are being used in development of resistance against various disease causing pathogens and pests and also to improve their yield characters. We have been trying to produce “ELITE” lines in crops from the very beginning. The ELITE crops are those that can perform well and good under any circumstances and conditions. Mutations have led us into a new way for creating the ELITE crops. Many experiments are under process in creation of a ELITE plant. Mutagens will help in creation of the differential change in the morphological and genetic constitution of an organism. Widely used mutagens include EMS, DES, SA, Gamma rays, Laser radiation etc. In this article one will find about the mutagens and the effects produced by them on various crops under various doses and concentrations considering the other factors too.

PLANKTON DIVERSITY AND THEIR DISTRIBUTION PATTERNS WITH VARIOUS ABIOTIC FACTOR IN NAINITAL LAKE

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Nainital Lake is a natural freshwater limnetic body, which is situated in Nainital, Uttarakhand. It is tectonic in origin and is located in the Kumaon Himalayas at an altitude of 1938 m above sea level. The lake is kidney shaped with its 48.76 hectare's and 42 meters of maximum depth. Nainital lakes are inhabited with a variety of fishes commonly known as carps, both major and minor carps along with aquatic macrophytes, phytoplanktons, zooplanktons and benthic invertebrates. Seasonal replacements of plankton assemblages are related closely to seasonal changes in temperature, external hydraulic and nutrient loads and light availability. Physicochemical parameters can only show water quality at the moment of measurement and these can change over time. Plankton abundance and diversity are widely used as biological indicators of still water quality in the lakes and reservoirs. They are sensitive to watershed conditions and exhibit sufficient stability in assemblage structure over time to make them useful as long-term monitors of lake health and indicators of water quality. The **physico-**



chemical parameters were analyzed by standard method APHA (1998). Phytoplankton samples were collected by towing a plankton net (mouth diameter 0.35 mm) made up of bolting silk (no.30; mesh size 48 μ) for half an hour. Sample were immediately preserved with 4% formalin for quantitative and qualitative analysis. We calculated plankton diversity index (H') by Margalef species richness, Shannon and Weiner (1949). In pre-summer season when temperature is high and dissolved oxygen is low in lentic waters abundant presence of *Chlorella*, *Navicula*, *Euglena* is seen. Among bacillariophyceae, Diatoma and Navicula were found dominant at all the sites, followed by Fragillaria, and Pinnularia.

BACTERIA MEDIATED SYNTHESIS OF MAGNETIC NANOCRYSTALS AND THEIR POTENTIAL AS PLANT MICRONUTRIENT

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The present work reports the biosynthesis of iron oxide and cobalt spherical magnetic nanoparticles by bacterial consortia. Bacteria capable of tolerating high salt concentration stress were used for synthesis of nanoparticles. The samples of metal rich soil near the hot springs in Ratnagiri district were collected and the metal tolerant bacteria were isolated from it. The progress of nanoparticles synthesis was monitored using UV-VIS spectrophotometer and the magnetism was confirmed using the permanent magnets. The cells were then centrifuged and lysed to release the nanoparticles. The partially purified magnetic nanoparticles were then characterized using XRD, VSM, FE-SEM EDS and FT-IR. The size of these both nanoparticles was found in the range of 5 to 10 nm revealed by SEM analysis. VSM analysis revealed the ferromagnetic nature of nanoparticles. The clumping of nanoparticles was very high because of the presence of cell components around them. The effect of precursor concentration, incubation time and pH on synthesis of ferric oxide and cobalt oxide magnetic nanoparticles was also studied. One of the most important micronutrients for plants is iron, and therefore iron oxide nanoparticles have been proposed as future agricultural technology for sustainable development. We are working on the experiments related to possible use of iron oxide nanoparticles as a source of iron.

ANALYSIS OF THE GENETIC DIVERSITY OF CANDIDA ISOLATES OBTAINED FROM CLINICAL SAMPLES FROM A TERTIARY CARE HOSPITAL

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Yeasts of the genus *Candida* have high genetic variability and are the most common opportunistic pathogenic fungi in humans. In this study, we evaluated the biochemical and genetic diversity as well as antibiotic susceptibility testing and virulence factors and their genetic diversity among 266 isolates of *Candida* spp. obtained from various clinical specimens from patients from tertiary care hospital from Pune, Maharashtra state of India. The *Candida* spp. were isolated and identified using conventional methods (such as growth on chrom agar, germ tube production test, tetrazolium reduction test etc.) as well as using automated identification system (Vitek-2). Antifungal susceptibility testing of *Candida* spp. was performed using disc diffusion method. Several virulence factors like, biofilm, proteinase, phospholipase, haemolysin, germ tube etc. contribute to the pathogenicity of *Candida* spp. In the present studies the following tests were performed in order to study virulence factors of *C. albicans*: biofilm formation, haemolysin activity, phospholipase activity, proteinase activity, germ tube formation, chlamydospores formation, growth at 45 °C. Genetic diversity with respect to virulence factors of *Candida albicans* was studied using the virulence factor encoding genes viz., Agglutinin like Sequence (*ALS1*), Hyphal Wall Protein (*HWPI*), Secreted Aspartyl Proteinases (*SAP4*), Phospholipases (*PLB*) were studied using molecular methods in *C. albicans* isolates. In this analysis, we observed a consistent separation of the species *C. albicans*, *C. tropicalis*, *C. glabrata*, *C. parapsilosis*, *C. krusei*, *C. rugosa*, *C. haemulonii*, *C. guilliermondii*, *C. famata* and *C. lusitanae* however with low intraspecific variability. Virulence factor encoding genes expression in *Candida albicans* isolates (n=110) showed diversity with respect to expression of virulence factor genes, *PLB* (94.55%); *SAP4* (85.45%); *HWPI* (83.64%); *ALS1* (90.00%).

ROLE OF POTASSIUM SOLUBILIZING MICROBES IN PLANT NUTRITION

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Potassium (K) is an essential macronutrient and plays important role in growth, metabolism and development of plant. Although, it constitutes about 2.5 per cent of the lithosphere but actual soil concentrations of this nutrient vary widely ranging from 0.04 to 3.0 per cent (Sparks and Huang, 1985). Plants absorb potassium mainly in three forms from the soil and out of these three forms, soil minerals make up more than 90 to 98 per cent of soil potassium (Sparks, 1987). With the introduction of high yielding crop varieties and the imbalanced fertilizer application, soils are getting depleted in potassium reserve at a faster rate. Moreover potassium deficiency is becoming one of the major constraints in crop production forcing to find an alternative indigenous source of K for plant uptake (Supanjani *et al*; 2006; Sindhu *et al*; 2012). In this context, potassium solubilising microorganisms present in the soil could provide an alternative means to make potassium available for plants (Groudev, 1987; Rogers *et al*; 1998). A wide range of microbes i.e. *Pseudomonas*, *Burkholderia*, *Acidithiobacillus ferrooxidans*, *Bacillus mucilaginosus*, *B. edaphicus*, *B. circulans* and *Paenibacillus* sp. etc. release potassium in accessible form from potassium-bearing minerals by secreting the organic acids. Among these, *Bacillus mucilaginosus* strain released large amount of K from different minerals and increased the groundnut crop production (Sugumaran and Janarthnam, 2007). K content in soil and crop shoots was also improved due to the application of KSB (Bagyalakshmi *et al.*, 2012). In addition, KSB also play an important role not only in maintaining soil structure by the formation and



stabilization of water-stable soil aggregates but also produce the substance that stimulate plant growth or inhibit root pathogens (Egamberdiviya, 2006). Therefore, it can be concluded that efficient potassium solubilizing microbial biofertilizers could be further exploited for plant growth and nutrition and reducing the outflow of foreign currency from the country.

BASIC INTENTS, STRATEGIES AND METHODS INVOLVED IN CONSERVATION OF BIODIVERSITY

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Biodiversity has contributed in many ways to the development of human culture and, in turn, human communities have played a major role in shaping the diversity of nature at the genetic, species and ecological levels. It includes the genetic variability (for which different varieties of spices have appeared in the course of evolution) and diversity of life forms such as plants, animal microbes etc. living in a wide range of ecosystems. All species provide at least one function in an ecosystem. Each function is an integral part of regulating the species balance, species diversity and species health: all aspects which are intrinsic for the ecosystem as a whole to survive and prosper. Conservation of biodiversity is protection, upliftment and scientific management of biodiversity so as to maintain it at its threshold level and derive sustainable benefits for the present and future generation. In other words, conservation of bio-diversity is the proper management of the biosphere by human beings in such a way that it gives maximum benefits for the present generation and also develops its potential so as to meet the needs of the future generations.

Keywords: Biodiversity, Conservation, Ecosystem, Species

FEEDING PRACTICE OF DAIRY ANIMALS

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In India, the common feeding practice is to let animals graze on pastures besides feeding them a mixture of cake grains by-products and other filler ingredients. The concept of compound cattle feed is also catching up, though slowly. There is tremendous scope for innovation to meet nutritional demands of high-yielding crossbred animals and even low-yielders. Economical production of milk, however, depends largely upon three main factors- the efficiency of an animal, its nutrition, and management. The efficient cow/buffalo is the result of inheritance and improved breeding. Its productivity, however, depends upon the adequate inputs in terms of feed and care.

Where dairy animals are kept under required desired conditions, more than half of the total expense goes on feed, While the remainder represents housing, labour, depreciation, interest and other miscellaneous items. The labour and other items are practically the same regardless of the total milk production. Therefore, by increasing the milk production of a cow or buffalo, the profit per unit of milk produced is increased.

The production pattern is simply the picture of yield over one whole lactation period and is called the lactation curve. These patterns are useful for comparing performance under several different feed and management systems. They help checking a feed programme for its relative strength and weakness. The lactation curve is obtained by plotting the production in litres of milk at regular intervals, say weekly, from calving to drying off.

This particular lactation curve represents the production pattern of a group of cows that produce, say about 3,000 litres each over 300 days of lactation. its three main characteristics are: The starting yield is 15 litres or more a day: The yield increases for about two months so that a peak of 30 litres or more is reached; The rest of the curve for the remaining eight months displays a steady decline in yield as the lactation proceeds. This decline in yield occurs at about 10 per cent per month. Hence, the yield in any one month is about 90 per cent of the yield in the previous month.

PLANT BREEDING IN ORGANIC AGRICULTURE

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Organic agriculture claim it is too low-yielding to be a viable alternative to conventional agriculture. However, part of that poor performance may be the result of growing poorly adapted varieties. Organic agriculture is based on conventionally adapted varieties, even though the production environments found in organic vs. conventional farming systems are vastly different due to their distinctive management practices. Breeding varieties specifically adapted to the unique conditions of organic agriculture is critical for this sector to realize its full potential. This requires selection for traits such as water use efficiency, nutrient use efficiency, weed competitiveness, pest and disease resistance early maturity, abiotic stress tolerance. Difference between organic and conventional environments is large a given genotype may perform very differently in each environment due to an interaction between genes and the environment. If this interaction is severe enough, an important trait required for the organic environment may not be revealed in the conventional environment, which can result in the selection of poorly adapted individuals. There are many classical and modern breeding techniques that can be utilized for crop improvement in organic agriculture despite the ban on genetically modified organisms. For instance, controlled crosses between individuals allow desirable genetic variation to be recombined and transferred to seed progeny via natural processes. Marker assisted selection can also be employed as a diagnostics tool to facilitate selection of progeny who possess the desired traits, greatly speeding up the breeding process. This technique has proven particularly useful for the introgression of resistance genes into new backgrounds, as well as the efficient selection of many resistance genes pyramided into a single individual. Unfortunately, molecular markers are not currently available for many important traits, especially complex ones controlled by many genes.

Keyword- Plant Breeding, Organic agriculture, organic vs. conventional farming.



EFFICIENCY OF DIFFERENT LIGHT SOURCES IN LIGHT TRAPS IN MONITORING INSECT DIVERSITY

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Collections of a light trap provide significant clue to the diversity of insects active at night (south wood and Henderson, 2000), their respective affinity to different wavelengths of light and to understand and predict how populations function (south wood and Henderson, 2000). Such information, if properly documented, could be put to multi-dimensional use by field- researchers, such as, selection of light-traps for attracting specific order of insects. In spite of the market being flooded with different models of light traps with light sources varying in their intensity and wavelengths, no scientific data on the trap collection, diversity, number and its efficacy is available for ready use. Such a data could shed light on the insects attracted to specific range of light. In this regard, a comparative analysis of different light trap collections becomes mandatory in order to study the efficacy of different wavelengths of light in attracting insects of specific orders viz., Coleoptera (sushil et al., 2004), Hemiptera (rai and khan, 2002; manimaran and manickavasagam, 2000), Lepidoptera (rose et al., 2004), hymenoptera and Diptera (Nair et al., 2004). Further correlating this data with weather parameters could help to predict the period of maximum insect diversity and activity. In order to make such information available, a complete segregation of the individual trap collection over a period of time on the basis of order and total catch, and simultaneously correlating it with the prevalent weather conditions becomes necessary. Hence, a comparative analysis of the light-trap collections using three different light sources and different agro ecosystem was carried out correlating with weather conditions. The results of the preliminary observations obtained over two years are presented herein.

Keywords: Light Traps, Insect Diversity, Agro ecosystem

ESTIMATION OF GENETIC VARIANCE ON QUALITATIVE AND QUANTITATIVE IMPROVEMENT THROUGH BIOMETRICAL APPROACH HALF DIALLEL ANALYSIS IN (*TRITICUM AESTIVUM*. L)

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The present investigation entitled “Genetic studies for yield and its contributing character in bread wheat (*Triticum aestivum* L.)” was undertaken involving 100 genotypes (**10 parents +45 F₁s +45F₂s**) of a 10- parent-diallel to study the genetic parameters for some quality and quantity attributes along with its contributing traits. The diverse wheat cultivars/genotypes and their first as well as second filial generation was studied by resolving them in genetic component analysis and selection parameters (direct and indirect parameters). The observations were recorded on 13 characters namely, days to 75% flowering, plant height, number of reproductive tiller per plant, number of spikelets per spike, spike length, number of grain per spike, days to maturity, 1000-seed weight, ear density, duration of reproductive phase, seed hardness, protein content and yield per plant. The data recorded were subjected to different analysis. Forty five crosses in F₁ generation of wheat (*Triticum aestivum* L.) were used for studying the character association among grain yield and its related characters. The results showed that the number of grains per spike, grain weight per spike and number of productive tillers per plant were significantly and positively associated with grain yield per plant in parents and F₁ cross combinations. **Dickson and Jinks (1956)** extended the above methods of diallel analysis, which estimated both the degree of parental heterozygosity and comparable genetic components of variation

Keywords: Diallel analysis, Yields attributes, genetic parameters, Bread wheat

ROLE OF BIOTECHNOLOGY IN VEGETABLE CROPS

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The role of biotechnological tools like micropropagation, molecular markers, anther culture, cybridization, induced male sterility and transgenics in the production of specific parental lines or hybrids in vegetables. Micropropagation can be used for maintenance of male sterile lines either controlled by recessive genes tomato, muskmelon, chilli or dominant genes cabbage, maintenance of self-incompatible lines in cole crops and maintenance of hybrids as such through tissue culture. Molecular markers can be used for assessment of genetic diversity, construction of linkage maps, varietal and marker assisted selection for traits of interest. Anther culture techniques can be utilized for development of self-incompatible lines in cole vegetables and also to develop inbred lines in cross-pollinated vegetables. A genetically modified tomato, or transgenic tomato, is a tomato that has had its genes modified, using genetic engineering. The first commercially available genetically modified food was a tomato engineered to have a longer shelf life the Flavr Savr tomato in 1994. The cry1Ac gene is source from the soil bacterium *Bacillus thuringiensis* Bt. Several other research institutions, both public and private have also been developing Bt brinjal using different genes. Meristem culture *in vitro* provides a reproducible and economically viable method for producing pathogen free plants than the conventional propagation which lead to virus transmission to new generation. As meristem tips are free from viruses, elimination and generation of virus free plants are possible through *in vitro* meristem culture (Jha and Ghosh, 2005). *In vitro* micropropagation is an alternative to conventional propagation of potatoes (Chandra and Birhman, 1994) that generally occurred vegetatively by tubers and segments of tubers and rarely by seeds



NANOTECHNOLOGY: TRENDS AND APPLICATION FOR INSECT PEST MANAGEMENT

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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. This art is focused on traditional strategies used for the management of insect pests and potential of nanomaterials in insect pest control as modern approaches of nanotechnology. The advances in science and technology in the last decades were made in several areas of insecticide usage. It includes either development of more effective and non-persistent pesticides and new ways of application, which includes controlled release formulation (CRF). The endeavors are direct towards the successful application of those compounds on crops and their efficacy and availability improvement and reduction of environmental contamination and workers exposure (Savary et al., 2006). In that line, new types of formulation were developed. One of the most promising is the use of micro and nanotechnology to promote a more efficient assembly of the active compound in a matrix in order to protect core materials from adverse reactions due to factors like air or light. An outcry is exhibited against the use of pesticides due to their hazardous effects on human as well as environment (Sparks et al., 2012). There is a great concern regarding the nanomaterials 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, insect control, nanopesticides, formulation.

GENE PYRAMIDING: AN ADVANCE STRATEGIES FOR DEVELOPMENT OF DISEASE RESISTANCE IN CROPS

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The development of molecular genetics and associated technology like MAS has led to the emergence of a new field in plant breeding-Gene pyramiding. Pyramiding entails stacking multiple genes leading to the simultaneous expression of more than one gene in a variety to develop durable resistance expression. Gene pyramiding is gaining considerable importance as it would improve the efficiency of plant breeding leading to the development of genetic stocks and precise development of broad spectrum resistance capabilities. The success of gene pyramiding depends upon several critical factors, including the number of genes to be transferred, the distance between the target genes and flanking markers, the number of genotype selected in each breeding generation, the nature of germplasm etc. Innovative tools such as DNA chips, micro arrays, SNPs are making rapid strides, aiming towards assessing the gene functions through genome wide experimental approaches. The power and efficiency of genotyping are expected to improve in the coming decades. The present review discusses the design parameters in a gene pyramiding scheme, potential application of gene pyramiding in crop plant improvement, and the prospect and challenges in integrating MAS based gene pyramiding with conventional plant breeding programmes.

Keywords: Gene pyramiding, marker-assisted selection, durable resistance.

COMPARATIVE PERFORMANCE OF DIFFERENT VARIETIES OF CHICKEN (VANRAJA AND GRAMPRIYA) UNDER BACKYARD SYSTEM OF REARING IN TRIBAL AND RURAL AREA OF BIJAPUR DISTRICT, C.G.

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Rural families rear *Desi* type chicken with low egg and meat production in backyard system. For developing the rural poultry farming, improved backyard poultry birds rearing is of utmost important. These improved birds can rear in both intensive and free ranging system. The growth performance of vanraja and grampriya varieties were evaluated in the present study by KVK Bijapur in rural and tribal areas. The 21 days old 1000 chicks of these two breeds were supplied to rural and tribal families as demonstration and for nutritional security among the rural and tribal families during 2013-14. They were trained about the minimal management practice, vaccination, feeding etc. The body weights were significantly varied in Vanaraja and Gramapriya varieties. The body weights were significantly higher in Vanaraja than Gramapriya chicken. The net income was recorded 4942/- and 3438/- for Vanaraja and Gramapriya, respectively. The benefit and cost ratio in Vanaraja and Gramapriya recorded as 3.47 and 2.71 respectively in Bijapur. Performance of Vanaraja was better than Gramapriya under tropical condition and the birds are well adapted to local agro-climatic condition under free range system of production. The backyard poultry farming with improved birds provide a



solution to food security to the needy villagers paving a way for sustainable livestock in rural areas of India. There is huge scope & perspective in the improved poultry farming in the district.

Keywords: Vanraja, Gramapriya, Body weight, Tribal farmers, Performance.

MARKER ASSISTED RECURRENT SELECTION: AN INNOVATIVE APPROACH

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Recurrent selection is considered as one of the selection approaches to combine favourable alleles distributed among different sources of germplasm. There are various new versions of recurrent selection available with which molecular marker information is incorporated. The key advantages of these new versions are the availability of genetic data for all progeny at each generation of selection, the integration of genotypic and phenotypic data and the rapid cycling of generations of selection and information-directed mating at continuous nurseries. Marker-assisted recurrent selection (MARS) was proposed by Edwards and Johnson, 1994. It uses markers at each generation to target all traits of importance and for which genetic information can be obtained. Genetic information is usually obtained from QTL analyses performed on experimental populations, which includes QTL locations and effects. MARS has a clear breeding objective, as opposed to QTL discovery conducted in good by bad crosses. The concept is to identify QTL effects for polygenic traits (usually minor) that are specific to that population and to recombine them via genotypic selection to generate superior progenies for variety development. To do this, *de novo* QTL detection is performed with each population of interest and the best lines are recombined to obtain, at the end of the selection, germplasm that performs better than either of the two parents. In Marker-assisted recurrent selection (MARS), the breeders take advantage of QTL information generated on their populations of interest to develop superior lines with an optimum combination of favourable alleles originating from both parents. QTL alleles impacting the major traits of interest to the breeders are identified within breeding populations and accumulated through successive inter-crossing using only genotypic selection. Recombined lines are then subjected to a final phenotypic screen to select the best varieties to release. This allows the generation of progenies with an optimum combination of key alleles from both parents that could never be obtained by chance recombination alone.

FOOD IRRADIATION AND ITS APPLICATIONS

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Food irradiation is a technology that can be safely used to reduce food losses due to deterioration and to control contamination causing illness and death. Radiation is energy in transit either as electromagnetic waves or high-speed particles. The type of radiation used in modern processing of materials, including foods, is limited to high-energy gamma rays, X-rays, and accelerated electrons. Irradiation can kill microorganisms, insects and parasites and this is a fundamental reason for applying the technology to improve the safety and quality of many foods and food products. The irradiation dose applied to a food product is measured in terms of kilograys (kGy). Food irradiation is the process of briefly exposing food to a highly penetrating and controlled amount of ionizing radiation (energy) in the form of high-speed particles or rays. Gamma rays and X-rays (like radiowaves, microwaves, ultraviolet, and visible light rays) form part of the electromagnetic spectrum, occurring in the short wavelength, high-energy region of the spectrum. Gamma rays and X-rays have the same properties and effects on materials, their origin being the main difference between them. X-rays with varying energies are generated by electron interactions produced by machines.

Keyword: bacteria, spores, yeasts, moulds, insects, parasites

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE STUDIES FOR DIFFERENT CHARACTERS ON GREEN FODDER YIELD IN OAT (*AVENA SATIVA* L.)

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The present investigation was carried out on 50 genotypes of dual purpose oat to select the superior lines for fodder and seed yield as well as fodder yielding components in Randomized Complete Block Design with three replications at Seed Breeding Farm, JNKVV, Jabalpur. The genotypes were analysed for genetic variability, heritability and genetic advance. Analysis of variance revealed that the mean sum of squares due to genotypes showed significant differences for all the 22 characters studied. The magnitude of PCV as expected was greater than the corresponding GCV for all the characters indicating importance of environment in expression of characters. Upon analysing the result of 22 traits under study, highest GCV and PCV was dry matter yield, peduncle length and spikelet per panicle. High heritability along with high genetic advance was recorded for number of leaves per plant, intermodal length (cm), peduncle length (cm), panicle weight (g), axis branch number, spikelet per panicle, dry matter yield (q/ha), 1000 seed weight (g) and green fodder yield (q/ha) indicating the role of additive genes in governing the inheritance of these traits which could be improved through simple selection.

Keywords: genetic variability, heritability, genetic advance, oat (*Avena sativa*), green fodder yield, dual purpose oat

PRODUCTION, REPRODUCTION AND NUTRITIONAL STATUS OF CROSS-BRED COWS AND MURRAH BUFFALOES IN ACHHANERA BLOCK OF AGRA DISTRICT (U.P.)



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A study was conducted in six villages of Achhnera block of Agra district on 95 animals (55 cross-bred cows and 40 Murrah buffaloes) reared by 50 families (25 each) during the year 2014-15. The lactation milk yield of cross-bred cows (2482 ± 38.6 liters) was significantly ($p \leq 0.01$) greater than Murrah buffaloes (2123 ± 31.4 litres). The cross-bred cows had significantly ($p \leq 0.01$) longer lactation period (332 ± 5.1 , days) than Murrah buffaloes (311 ± 4.8 days). While dry period was shorter in cows (94.3 ± 2.1) than buffaloes (123 ± 3.8 days). Contrary to it, the fat percentage in the milk of cross-bred cows (3.86 ± 0.12) was also lower than Murrah buffaloes (6.90 ± 0.19). The body weight of cross-bred cows (421.60 ± 5.80 Kg) was significantly ($p \leq 0.01$) lower than Murrah buffaloes (508.30 ± 8.4 Kg.). The nutritional requirement and its availability was also assessed and found that the requirement and availability of dry matter was 10.54 ± 0.19 and 9.53 ± 0.22 Kg. in cross-bred cows and 15.25 ± 0.28 and 14.31 ± 0.40 Kg in Murrah buffaloes, respectively. The DCP requirement and availability was 0.609 ± 0.011 and 0.576 ± 0.010 Kg. in cross-bred cows whereas in case of Murrah buffaloes it was 0.706 ± 0.012 and 0.659 ± 0.01 Kg., respectively. The TDN requirement and availability of cross-bred cows was 5.51 ± 0.10 and 5.03 ± 0.11 Kg. However, in case of Murrah buffaloes it was 6.62 ± 0.12 and 5.88 ± 0.13 Kg., respectively. The DM, DCP and TDN status of these ruminants was significantly poor. The animals did not get the requirement amount of DM, DCP and TDN through this ration. Thus, it is observed from the present study that the cross-bred cows have better production performance, longer lactation period and shorter dry period than Murrah buffaloes. The nutritional status of both ruminants was also poor, which results poor production performance.

BIOSAFETY OF FEED INGREDIENTS AND ITS IMPACT ON MILK QUALITY

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The milk producers should realize that they are not only in business of animal keeping and milk production, but also in business to provide safest food to people. Milk is very complex liquid. Its primary purpose is to provide nutrients and protection to the young mammal until it is capable of consuming solid foods. The milk processors should realize that the milk is processed to; eliminate health risks and spoilage; remove remaining contaminant particles; maintain the flavor of the product; reduce the fat content if it necessary and stabilize the fat content to stop separation; and, to make various products. The milk once produced should be promptly cooled and held at 40C till processing to preserve it against microbial deterioration. Once the milk leaves the cow, nothing can be done to enhance the value of the milk, but much can be done to prevent loss of value before the milk reaches to the consumer. It must be handled correctly from the moment of milking. Protection from contamination before, during and after milking; holding time for milk at any temperature or stage in the storage and transportation chain critically affect the rate of bacterial multiplication, and temperature strongly affects the rate of bacterial growth. The milk once produced should be promptly cooled and held at 40C till processing to preserve it against microbial deterioration. The following data shows the importance of chilling of milk to a temperature below 50 C. Milk Contaminants Water, Bacteria and other microorganisms; Antibiotics and other drugs used to treat cows; Pesticides or insecticides applied to cow or her environment; Products of fungi (mycotoxins) in the feed; Chemicals used in cleaning the equipment; Others. It is illegal to add water in milk in any country. Antibiotic residues in milk should be minimized as Some people are allergic; Antibiotics interfere with preparation of some dairy products like cheese and yoghurt; Low levels of antibiotics in food contribute to the emergence of antibiotic resistant strains of bacteria; Aesthetic: Consumers assume that milk they purchase comes from healthy cows.

Pesticide and Insecticide residues in milk, They appear through feed or as a result of contamination after milking, They are carcinogenic for consumers, The pesticides are DDT, BHC and their isomers and chlorinated compounds like aldrin, dieldrin, heptachlor etc. There are many reports that the pesticide levels are many times more than prescribed PFA limits, Mycotoxins and other feed contaminants are Through mould contaminated feed, Aflatoxins and toxins are reported to be mutagenic, carcinogenic, teratogenic and hepatotoxic most animals and human beings. Regular monitoring of mycotoxins is essential, Aflatoxin from *Aspergillus flavus*.

It is estimated that as much as 25 per cent on the world's cereals are contaminated with known mycotoxins. Common fungi are *Aspergillus*, *Fusarium* and *Penicillia*. Fungi can grow at any stage- Crops in field, at harvest, in storage or during feed processing. These silent killer have negative impact on animal productivity and human health. In colder temperate climates, vomitoxin, zearalenone, ochratoxin, DAS, T-2 Toxin, etc, are common. In winter, vomitoxin, zearalenone, ochratoxin, DAS, T-2 Toxin, etc can create problems. About 1-4 percent of Aflatoxins present in feed can be excreted through milk. Aflatoxin B1, B2, G1, G2, are converted to hydroxyl derivatives. These toxins can appear in milk within 48 hours of their intake of contaminated feed and continue for 3-4 day after the withdrawal of feed. Various methods of milk processing only partially destroy aflatoxin M1 in milk.

Effect of mycotoxicosis on health and production performance include: Poor feed efficiency, Reproductive problem caused by zearalenone, swelling of mammary glands, Atrophy of the ovaries and Increased susceptibility to diseases.

Mycotoxin residues in milk: Presence of aflatoxin m1, The ratio of transfer from feed to milk is 65- 100:1. Recent trends in mycotoxin control include Nutritional modifications, Use of mineral clays, activated charcoal, zeolites, aluminosilicates etc., Use of new generation products like yeast cell wall contents and mannan oligosaccharides (Adsorbents) and Mould inhibitors.

Other feed contaminants include wild onion and kale can impart flavours, Heavy metals like lead, mercury, cadmium, arsenic etc. have been reported in milk and milk products. The production of milk with less residues and contaminants within permissible limit and achieving low bacterial load in raw milk when received at a dairy plant will greatly help in producing safe and quality dairy product. This will improve the value chain both at domestic and international level. To ensure biosafety at the dairy farm, no animal protein sources should be used in feed. Like in poultry farms bio security measures should be followed in dairy farm also. Biosecurity refers to practices intended to make herd more secure against biologic risk, meaning contagious diseases. The most significant risk factor for introducing a new disease into dairy farm in purchasing new animals.



GENETICS OF SOME YIELD AND QUALITY TRAITS IN BASMATI RICE (*ORYZA SATIVA* L.) TO IDENTIFY HETEROTIC COMBINATIONS, USING DIALLEL MATING DESIGN

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The present investigation was undertaken to determine the extent of variability, combined ability effects, and heterosis for different quantitative and qualitative characters in scented Basmati rice (*Oryza sativa* L.) accessions collected from diverse sources. The experimental material consisted of 6 parents and 15 crosses which were planted in Randomized Block Design with two replications during *kharif* 2015 at Research Farm, Institute of Agricultural Sciences, B.H.U, Varanasi. The observations were recorded on eight yield traits viz., days to 50% flowering, days to maturity, plant height, main panicle length, effective tillers per plant, number of seeds per panicle, 100 seed weight, and grain yield per plant. Furthermore, the observations on seven quality parameters viz., kernel length, kernel breadth, kernel length after cooking, kernel breadth after cooking, Alkali Spread Value (ASV), and amylose content were also made. Analysis of Variance (ANOVA) for all the eight yield traits showed significant differences among treatments, parents, hybrids and parent vs. hybrids. Similarly, ANOVA for six quality traits revealed significant differences among all the above-mentioned sources except parent vs. hybrids group for kernel breadth after cooking and ASV. The crosses also exhibited considerable variability for all the traits studied, ranging from 2.06 to 2.82 g for 100 grain weight, 104.21 to 151.09 cm for plant height, 14.09 to 36.70 for effective tillers per plant, 23.87 to 36.96 cm panicle length, 102 to 244.26 seeds per panicle, 28.29 to 89.88 g grain yield, 7.04 to 8.79 mm for kernel length, 1.57 to 1.97 mm for kernel breadth, 11.95 to 16.85 mm for kernel length after cooking, 2 to 2.55 mm for kernel breadth after cooking, 3.36 to 6 for ASV, and 19.72 to 27.78 for amylose content. These results indicate that there is ample scope for selection of promising genotypes from the materials under study for yield and quality improvement. Based on the Specific Combining Ability effects (SCA), HUBR10-9 x B 370 was the best specific cross for seeds per panicle, grain yield, amylose content and days to 50% flowering. Maximum significant better parent heterosis values for different characters viz., days to 50% flowering was shown for plant height by HUBR10-9 x Type 3 (47.65**), for effective tillers by HUBR 10-9 x Sanowal Basmati (94.08**), for panicle length by B 370 x T.basmati (13.98**), for seeds per panicle by HUBR 10-9 x B 370 (56.59**), for 100 grain wt. by Type 3 x Sanowal Basmati (21.96**), and for grain yield per plant by HUBR 10-9 x B 370 (141.50**). In the case of quality characters, for kernel length maximum significant better parent heterosis values was shown by B 370 x Sanowal Basmati (22.34**), for kernel length after cooking by B 370 x Sanowal Basmati (15.57**), and for amylose content by HUBR 16 x Type 3 (8.92**). Thus it can be said that the uniqueness of this study lies in crosses having higher positive significant value of SCA effect showed higher heterosis value for all the characters. Careful development of such crosses can be extremely beneficial as it may help to sustain our ever-growing population and reflect India as a major producer of quality rice all over the world.

Keywords: Rice, grain characteristics, cooking quality, general and specific combining ability, heterosis.

ANALYSIS OF GENE EFFECTS UNDER NORMAL AND LATE SOWN IRRIGATED CONDITION FOR GRAIN YIELD AND ITS COMPONENTS IN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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An experiment consisting six generations (P_1 , P_2 , F_1 , F_2 , BC_1 and BC_2) of four crosses of bread wheat (*Triticum aestivum* L.) viz. 'VL922 X LOK 1'; 'VL 922 X MP 4010'; 'VL922 X Sonalika' and 'VL922 X AKAW 3717' were evaluated in normal and late sown irrigated condition during *Rabi* season at college of agriculture, Gwalior. Result revealed the significant X^2 values of Joint scaling test indicating assumption of absence of epistasis did not hold true and epistasis gene action played significant role in the inheritance of yield and its component characters under both normal and late sown irrigated situation. Under both normal and late sown irrigated condition, both additive (d) and dominance (h) effects were significant in positive direction for grain yield in cross 'VL922 X LOK 1' and for biological yield 'VL922 X Sonalika', thereby indicating contribution of both additive and non additive components in the inheritance of these traits. Fixable additive (d), additive X additive gene effects (i) were significant in positive direction under both normal and late sown irrigated condition for grain yield in cross 'VL922 X LOK 1' but in opposite direction for plant height in 'VL922 X MP 4010' and 'VL922 X Sonalika', peduncle length in 'VL922 X Sonalika' and 'VL922 X AKAW 3717', spike / plant in 'VL922 X LOK 1'; 'VL922 X Sonalika' and 'VL922 X AKAW 3717', days to 50% heading in 'VL922 X LOK 1' and 'biological yield in 'VL922 X Sonalika'. Both dominance (h), dominance X dominance gene effects (l) were significant in positive direction for grain yield in cross 'VL922 X LOK1', peduncle length in 'VL922 X MP 4010', flag leaf area in 'VL922 X Sonalika' and harvest index in 'VL922 X AKAW 3717' under both normal and late sown irrigated condition. The duplicate epistasis for most characters showed their complex nature of inheritance. Inbreeding depression was significant for all traits in all crosses. Crossing in promising segregating families and pure line selection in advance generation will be more effective for fixing allelic as well as epistatic additive X additive interaction for improving grain yield and its components in future breeding programme.

Keywords: Bread wheat, generation mean analysis, gene effects, heterosis,

UTILIZATION OF PLANT GENOME SEQUENCING IN CROP PLANTS

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A genome is an organism's complete set of genetic material, including all of its genes. Genome sequencing is determining the sequence of each and every base in DNA. Breakthrough in genome sequencing was achieved when Frederick Sanger, a British biochemist invented chain



termination method of DNA sequencing. There are basically three generation of sequencing platform but Illumina/ Solexa Genome analyzer platform has mostly been used for sequencing of crop genomes. The first plant whose genome was sequenced is *Arabidopsis thaliana* and first cereal is rice with the genome size of 125 and 420 Mb respectively while latest reported genome sequence is of *Chenopodium quinoa* using both Illumina and SMRT (Single molecule real time) technique. The major utilization from crop genome sequencing projects is in identification of genes of economic importance, molecular marker discovery and its application in genetic mapping, and marker assisted selection, approaching from QTL to gene, studying pattern of evolution, domestication and population structure and in conservation and utilization of plant genetic resources. The availability of high-quality whole-genome sequence assemblies for major crops creates a paradigm shifting change in how one should approach crop improvement. Breeders now have access to all of the many thousands of genes that make up an organism which helps in understanding of complex traits and its easy manipulation for improvement. The soybean genome was used to unravel the maturity locus E1 which has a major impact on flowering time whereas, in rice a major QTL Gm1a was identified which has a profound effect on grain yield. Chickpea genome sequencing identified 76,084 SNPs in 15,526 genes and in Arabidopsis it was 79961 so this illustrates the potential of sequencing in identification of geneic/ functional markers. In almost all the sequenced crop genome it revealed the genomic area which was mostly targeted during domestication by analysis of reduction in diversity coefficient, and the major traits which were affected is plant architecture, flowering and growth pattern. Genome sequencing has led to emergence of new field of pangenomics which shows a large amount of both sequence and gene variation even among individuals of same species. Rice sub1 gene is present in tolerant genotype and absent in the susceptible one while re-sequencing project of 17 wild and 14 cultivated soybean genomes revealed that 10% of reference genome genes had SNPs (Single Nucleotide Polymorphism) likely to have large functional impact. So these regions may be manipulated according to the need of breeder. In a nutshell, genome sequencing reveal the hidden picture of how one can design ideal crop structure according to need of the hour.

ROLE OF BIO-NANOTECHNOLOGY IN SUSTAINABLE AGRICULTURE DEVELOPMENT

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Nanotechnology is considered as one of the possible solution to problems in food and agriculture. Nanotechnology will play a vital role in the development of the agricultural sector, as it is capable of being used in agricultural products that protect plants and monitor plant growth and detect diseases. Bio-nanotechnology and Nano bio-technology are terms that refer to the intersection of nanotechnology and biology. Bio-nanotechnology generally refers to the study of how the goals of nanotechnology can be guided by studying how biological "machines" work and adapting these biological motifs into improving existing nanotechnologies or creating new ones. Simply, nanotechnology is used to create devices to study biological systems. In other words, bio nanotechnology is essentially miniaturized biotechnology. DNA nanotechnology is one important example of bio-nanotechnology. The utilization of the inherent properties of nucleic acids like DNA to create useful materials is a promising area of modern research. The aim of nonmaterial to reduce uses of plant protection products, minimize nutrient losses in fertilization and increases yield through optimized nutrient management. Nano-encapsulated slow release of fertilizers has also become a trend to save fertilizer consumption and to minimize environmental pollution through precision farming. The gold nanoparticle has been used to induce growth and seed yield in *Brassica juncea*. Silver nanoparticles (AgNPs) treated leaves of asparagus showed the increased content of ascorbate and chlorophyll. Similarly, AgNPs-treated common bean and corn has increased shoot and root length, leaf surface area, chlorophyll, carbohydrate and protein contents. Some specific nano-products for the agricultural sector have been put on the market by technology-oriented smaller companies like soil-enhancer product that promote even water distribution, storage and consequently water saving.

Keyword: Bio-Nanotechnology Sustainable Agriculture Development

GENETIC CHARACTER VARIABILITY STUDIES IN DESI CHICKPEA (*CICER ARIETINUM* L.) GENOTYPES

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Keeping the importance of the crop and the aspects to be studied, the present investigation entitled "Genetic Character Variability Studies in Desi Chickpea (*Cicer Arietinum* L.) Genotypes" was conducted in *rabi* 2014-15 at the Research Farm of Agricultural Research Station, Ummedganj, Kota, Agricultural University, Kota to assess the variance revealed sufficient amount of variability present in the genotypes studied. Harvest index recorded maximum phenotypic range of variation followed by 100 seed weight, number of pods per plant, plant height and number of nodules per plant. The high to moderate genotypic coefficient of variation and phenotypic coefficient of variation was observed for harvest index, plant height, 100 seed weight and number of seeds per pods, seed yield per plant, secondary branches per plant and primary branches per plant. The genotypic and phenotypic path coefficient analysis revealed that biological yield per plant and harvest index exhibited high and positive direct effects on seed yield per plant. The results of path coefficient analysis revealed that for improvement of seed yield in chickpea through selection programme, more emphasis should be given to harvest index, days to 50 % flowering number of seeds per pod and number of pods per plant.

DIVERSITY ANALYSIS IN A CORE COLLECTION OF INDIAN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Diversity analysis provides opportunity to assess genetically important distinct traits that will be contributing to improvement of genotypes. Genetic diversity assess in a core collection is key to find out ways to efficient utilization of genetic resource. Indian bread wheat cultivars spanning over a century is procured from the Indian Institute of Wheat & Barely Research (IIWBR), Karnal, used made up of a core collection. A characterization of DUS descriptors and analysis of core collection by traditional and multivariate methods. The present investigation was carried out with a view to know the degree of genetic diversity, association among yield attributing characters in bread wheat (*Triticum aestivum* L.) at the agro-morphological level. The experimental material consisted of ~100 genotypes which were evaluated in an Augmented Randomized Block Design. DUS descriptors were used to discriminate genotypes during germplasm evaluation. Descriptors like waxiness on plant parts, foliage colour, flag leaf attitude and seed size considerable amount of variability. Quantitative characteristics were recorded to record variation in genotypes at agro-morphological level. The data were subjected to appropriate statistical analysis for estimation of mean, range, variance, heritability, genetic advance as percentage of mean and correlation. Quantitative characters like no. of grain per spike, no. of spikelet per spike and test weight have significantly contributing to yield. These characters have huge amount of genetic variation, high GCV and PCV value, highly heritable, GAM and positive significant correlation with yield. PCA and cluster analysis of eight characters and genotypes fall into three principal component and three cluster respectively. Based on analysis, first and third cluster genotypes have associate with yield component and great chances to enhance their characters. Second cluster genotypes have lower than average characters. Avoid use of second cluster genotypes to reduce the time, cost and labour.

Keyword: Diversity Analysis, bread wheat

STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN OAT

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The present investigation was comprised of eight promising diverse parents and their all possible 28 F_1 's, developed through crossing eight parental lines in diallel mating design (excluding reciprocals). All genotypes were evaluated in a complete randomized block design with three replications at Crop Research Center (Chirodi) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during *rabi* season 2015-16 and 2016-2017. Analysis of variance for the experiment and for parents and F_1 's showed highly significant differences among the treatments for all the ten characters viz., days to 50 % flowering, plant height, number of leaves per plant, leaf area, number of tillers per plant, stem girth, number of green pods per spike, length of spike, leaf stem ratio and green fodder yield per plant which indicates that wide genotypic difference among the parental lines and F_1 's cross combinations. Highest percentage of genotypic and phenotypic coefficient of variation (more than 25%) were recorded for number of leaves per plant, number of tillers per plant, leaf stem ratio and green fodder yield per plant. Estimates of phenotypic coefficient of variation were generally higher than their corresponding genotypic coefficient of variation for all the attributes. The high values of genotypic and phenotypic coefficient of variation for these characters, suggested that there was a possibility of improvement of fodder yield through direct selection. High heritability (>60%) was observed for days to 50 % flowering, number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per spike, length of spike, leaf stem ratio and green fodder yield per plant. The high degree of heritability estimates for these characters suggested that the attributes were under genotypic control. High (>20%) genetic advance expressed as per cent of mean estimated for number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per spike, length of spike and green fodder yield per plant, suggesting good response for selection based on *per se* performance. High heritability coupled with high genetic advance as percent of mean was noted for number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per spike, length of spike and green fodder yield per plant, which indicated that these characters are controlled by additive gene action. Direct selection of these attributes will be effective and profitably for yield improvement.

COMBINING ABILITY IN OAT (*AVENA SATIVA* L.)

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The present investigation entitled "Studies on combining ability and heterosis in oat (*Avena sativa* L.)" was undertaken to assess the information on genetic parameters for green fodder yield and its components from a eight diverse parents *i.e.* Kent, OS6, JHO-99-2, JHO851, OS403, OL125, UPO212 and NDO612 using diallel mating design. The experimental material for the present investigation was comprised of eight promising diverse parents and their all possible 28 F_1 's, developed through crossing eight parental lines in diallel mating design (excluding reciprocals). All genotypes were evaluated in a complete randomized block design with three replications at Crop Research Center (Chirodi) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during *rabi* season 2015-16 and 2016-2017. The observations were recorded on ten characters viz., days to 50% flowering, number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per plant, length of spike, leaf stem ratio and green fodder yield per plant. The study revealed that parents JHO851 was found good general combiner for maximum eight characters including green yield per plant, OL125 for eight character and NDO612 for eight characters, may be used in the hybridization programme aimed at development of superior genotypes. Out of 28 F_1 's hybrids twelve best cross combinations, viz., Kent x OS6, Kent x JHO-99-2, Kent x JHO851, OS6 x UPO212, JHO-99-2 x JHO851, JHO-99-2 x OS403, JHO 851 x OS403, JHO851 x OL125, JHO851 x NDO612, OS403 x OL125, OL125 x NDO612 and UPO212 x NDO612 exhibited significant and positive specific combining ability effects along with good *per se* performance for green fodder yield per plant and also showed significant positive specific combining ability effects for some other important yield components characters. These cross combinations may be exploited in suitable breeding device for the some attributes. On the basis of overall results and *per se* performance the four F_1 's hybrids *i.e.* Kent x OS6, Kent x JHO-99-2, OL125 x NDO612 and UPO212 x NDO612 were emerged to be as best specific combiners for maximum attributes including green fodder yield per plant for 8-9 other contributing traits, which may be utilized for obtaining transgressive segment in the next generation.



HETEROSIS FOR YIELD AND YIELD COMPONENTS IN OAT (AVENA SATIVA L.)**Charupriya Chauhan and S. K. Singh**

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Study of heterosis in twenty eight different hybrids of oat resulting from 8x8 diallel, excluding reciprocals indicated pronounced hybrid vigour for yield and most of the yield components. All genotypes were evaluated in a complete randomized block design with three replications at Crop Research Center (Chirodi) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during *rabi* season 2015-16 and 2016-2017. The observations were recorded on ten characters *viz.*, days to 50% flowering, number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per plant, length of spike, leaf stem ratio and green fodder yield per plant. Out of 28 F_1 's, 15 cross combination expressed high heterotic response with significant and positive heterosis and among these four crosses *viz.*, Kent x JHO851, Kent x UPO212, JHO-99-2 x JHO851 and UPO 212 x NDO612 showed heterosis per cent more than 27% over better and mid parents for 8-9 attributes. These crosses which showed very high level of heterosis can be exploited further in future breeding programme to develop high yielding genotypes in forage oat. As above cross combinations may be exploited for heterosis breeding programme. Since these hybrids involve high x high or high x average or average x average or average x low or low x low gca value of parent and significant sca effect for involved of non additive gene action and response of dominance and dominance x dominance type of gene effect. A high heterosis result for yield might be obtained by exploiting these individual cross for developing hybrids through heterosis breeding programme.

ASSESSMENT OF INDUCED MUTAGENESIS BY INDIVIDUAL AND COMBINATION TREATMENTS OF EMS, GAMMA RAYS AND THEIR COMBINATION TREATMENTS**Tariq Ahmad Bhat**

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Seeds of *Vicia faba* L. var. PRT-12 were subjected to different doses/concentrations of EMS, Gamma rays individually as well as in combination. The effect of different mutagenic treatments on meiosis and pollen fertility were studied in M_1 generation. Various types of meiotic aberrations such as univalents, multivalents, stickiness, stray bivalents, cytotoxicity, bridges, laggards, unequal distribution, non-synchronization, disturbed polarity, micronuclei and multinucleate condition were observed. The reduction in pollen fertility were observed in all the treatments. However, the combination treatments proved to be more effective in inducing meiotic aberrations and reduction in pollen fertility as compared to individual ones. There was dose dependent increase in meiotic aberrations and reduction in pollen fertility both in individual and in combination treatments. Moreover, the frequency of meiotic aberrations was at its maximum at metaphase followed by anaphase and telophase stages.

Keywords: Induced Mutagenesis, meiotic aberrations, pollen fertility, EMS, Gamma rays**NANOTECHNOLOGY: A WAY TO ACHIEVE SUSTAINABILITY IN AGRICULTURE SECTOR****Jayashri Barcchiya and Diksha Manware**

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Nanotechnology mainly functions at nano scale (1-100nm) and can play an important role in many areas. Availability of arable land for agriculture would reduce in future due to urbanisation. With the growing limitation in arable land and water resources, the development of agriculture sector is only possible by increasing resources use efficiency with the minimum damage to agro ecology through effective use of modern technologies. Nanotechnology can be used for sensors which based on biological processes and these biosensors can be used for detection of biological molecules. This technology can be applied in agriculture for efficient delivery of fertilizers, pesticides, and growth regulatory hormones. Smart sensors and smart delivery systems will help the agricultural industry combat viruses and other crop pathogens. Nanotechnology for sustainability aims for products and processes that are safe, environmentally sustainable, energy efficient reduce waste and lessen greenhouse gas emissions. With many of the monitoring and control systems, nano technological devices for Controlled environment agriculture technology that provide "scouting" capabilities could tremendously improve the grower's ability to determine the best time of harvest for the crop, the vitality of the crop, and food security issues, such as microbial or chemical contamination. In recent years, agricultural waste products have attracted attention as source of renewable raw materials to be processed in substitution of fossil resources for several different applications. Nanocomposites based on biomaterials have beneficial properties compared to traditional micro and macro composite materials and, additionally, their production is more sustainable. Many production processes are being developed nowadays to obtain useful nano composites from traditionally harvested materials.

COMPARATIVE STUDY ON PHYSIOCHEMICAL QUALITY OF RAW MILK SAMPLES COLLECTED FROM DIFFERENT VILLAGES OF ALLAHABAD DISTRICT, UTTAR PRADESH, INDIA**Sujeet kumar Yadav and Ajit Singh**

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The aim of this study was to determine the Physio-chemical properties of raw milk sample, which included fat, protein, lactose, ash, titratable acidity, specific gravity, SNF (solid-not-fat), pH and MBRT (Methylene Blue Reduction Test). The milk sample were collected from five different villages (Dandupur, Dandi, Bhandra, Badalganj, Iradatganj), of Allahabad district. Twenty five individual samples of the raw milk were randomly collected from milking cow of each village. Samples were collected in 250 ml. capacity sterilized screw cap bottles and transport to the laboratory for conducting the various physico-chemical tests. The organoleptic quality was investigated by a panel of experts with the help of appearance, texture, smell and taste characteristics as per standard score card. The analysis has data obtained on various parameters were tabulated and statistically analyzed using analysis of variance (ANOVA) technique as per **Snedecar and Cochran (1994)** in RBD. The present study recommended that quality assurance programs should be help to start before processing of milk and milk product in dairy industries.

Keywords: Raw milk, Physiochemical analysis, Chemical composition, MBRT.

EXOTIC GENETIC LIBRARY: TOOL FOR PLANT BREEDING IMPROVEMENT

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Every plant now under cultivation was once wild. Plant evolution under domestication has led to increased productivity, but at the same time domestication has narrowed the genetic base of crop species. The challenges that modern plant breeders face are to develop high yielding, nutritious and environmental friendly varieties that improve our quality of life without harnessing additional natural habitats to agricultural production. Since wild germplasm contain many important genes they can be utilized for improvement of crop plants. Utilisation of germplasm poses certain challenges to the plant breeder such as- conservation and evaluation of huge accessions, identification of favourable alleles and incorporate beneficial gene complexes into breeding material considering issues such as mal-adaptation, linkage drag & multi-gene introgression (Wang *et al.* 2017). These challenges can be efficiently tackled by the use of exotic genetic libraries. An exotic genetic library consists of a set of lines, each of which carries a single, defined chromosome segment that originates from a donor species in an otherwise uniform elite genetic background (Zamir *et al.* 2001). Falke *et al.* (2009) reported five different kinds of selection strategies for the development of rye introgression libraries such as two stage selection, three stage selection A, three stage selection B, chromosome selection A, and chromosome selection B. Out of these five strategies three stage selection A was found to be superior over other strategies w.r.t to accuracy whereas chromosome selection A seems to be better if the efforts in the breeding nursery should be minimum. Eshed and Zamir (1994) developed the new kind of genetic resource which is composed of 50 *L. esculentum* lines each containing a single introgression from the green fruited species *L. pennellii* in order to use wild germplasm in tomato breeding and genetic studies. The size and identity of the introgressed segments was determined based on analysis of 350 RFLP markers. A melon IL collection in the Charentais genetic background has been developed using Makuwa as donor parent. Genomic regions that consistently affect flowering and fruit quality traits have been identified, which demonstrates the suitability of this collection for dissecting complex traits in melon (Perpina *et al.* 2016). By the use of these exotic genetic library the improvement in the plant breeding can be dreamt.

GENE ACTION FOR QUALITY AND QUANTITATIVE CHARACTERS IN LINSEED (*LINUM USITATISSIMUM L.*)

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The present investigation had shown that the genetic analysis of different agronomic characters as well as quality traits in linseed of six parents were evaluated in 2009-2010, during *rabi* season at Students' Instructional Farm, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, U.P., revealed the role of both additive and non-additive gene action for all ten characters through diallel cross analysis. Average degree of dominance showed that the presence of partial dominance for all the characters except iodine value that showed over dominance. The proportion of positive and negative effects in the parents were asymmetrical for all the characters. The ratio of dominant and recessive alleles in parents (KD/KR), indicated the dominant alleles were more frequent than recessive alleles for the characters, no. of capsules per plant, days to maturity and iodine value in F_1 and days to flower in F_2 generation. Characters, plant height, no. of primary and secondary branches per plant, 1000-seed weight, seed yield per plant and oil content in both F_1 and F_2 generations showed that recessive alleles were more frequent. The ratio determines the extents of genetic gain that can be made in particular direction. If the alleles present in the population are predominantly of recessive nature, the extent of genetic advance will be limited. The computed ratio of ($\hat{h}^2/\hat{H}_2$) that estimate the no. of gene groups suggested that the preponderance of recessive genes, however they do have dominant genes. ' t^2 ' value for uniformly test for W_r , V_r interpret distribution of dominant and recessive genes among the parents by investigating the relations.

Keyword: Linseed, gene action, additive and non-additive, diallel analysis.

BIODIVERSITY CONSERVATION

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A wide variety of living organisms including plants, animals and micro-organisms with which we share this planet earth makes the world a beautiful place to live in. Living organisms exist almost everywhere from mountain peaks to the ocean depths; from deserts to the rainforests. They vary in their habit and behavior, shapes, sizes and colour. Biological diversity is usually considered at three different levels – a) genetic diversity i.e. at genetic level, b) species diversity i.e. at the level of species, and c) ecosystem diversity i.e. at the level of ecosystem. Genetic diversity refers to the variety of genes contained within species of plants, animals and micro-organisms. Ecosystem diversity encompasses the broad differences between ecosystem, and the diversity of the habitats and ecological processes occurring within each ecosystem type. Importance of biological biodiversity Humans depend for their sustenance, health, wellbeing and cultural growth on nature. Biodiversity



also has enormous social and cultural importance. The value of biological diversity the various benefits of biological diversity can be grouped under three categories: a) ecosystem services, b) biological resources, and c) social benefits. Conservation efforts can be grouped into the following two categories: In-situ (on-site) conservation includes the protection of plants and animals within their natural habitats or in protected areas. The main strategy for conservation of species is the protection of habitats in representative ecosystems. Currently, India has ninety six National Parks, five hundred Wildlife Sanctuaries, Biological Diversity Act, 2002 This Act provides for setting up of a National Biodiversity Authority (NBA), State Biodiversity Boards (SBB) and Biodiversity Management Committees (BMC) in local bodies.

INSECTS BIODIVERSITY IN INDIA

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Biodiversity is variety of organisms at all levels, from genetic variants belong to the same species through arrays of species to arrays of genera, families, and still higher taxonomic levels; includes the variety of ecosystems, which includes communities of organisms within particular habitats and the physical conditions under which they live The Indian region is recognized as one of the major centres of biodiversity in the world. The diversity is equally rich at the natural ecosystem and at the species level has been well documented by field work carried out by naturalists and professional field biologists during the past 200 years. The habitat diversity offered by alpine ecosystem to mangrove ecosystem through a wide range of tropical forest ecosystem, freshwater and marine ecosystem, desert and island ecosystem found expression in richness of faunal elements in all groups. Insect biodiversity in india is restricted to about 52000 species. The constitute about 6 per cent of the world insect fauna. About 155.5 milion insect species are found for every million hectare of land in india. There are about 2.83 milion insect species for every flowering plant species in india. The low insect to plant ratio in india is largely due to comparatively higher plant biodiversity in country. Insects of agricultural importance are found in high endemism in india except for Lepidoptera, even Lepidoptera, where endemism is only 10 per cent, the economic importance of Lepidopterans in their damage to the crops and role in pollination .

Haematological Analysis of Konkan Kanyal Goats Reared under Semi-intensive Management System

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A study was conducted at Cattle Breeding Farm, Nileli, Sindhudurg, Dr B.S. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra to evaluate the Haematological parameter in fifteen Konkan Kanyal Goats reared under semi-intensive system. Haemoglobin (Hb), packed cell volume (PCV), Total Leucocyte Count (TLC), Total Erythrocyte Count (TEC), Neutrophil, Eosinophil, Lymphocyte and Monocyte were recorded as 8.58 ± 1.05 g/dl, 31.12 ± 3.26 per cent, 8584.51 ± 1788.80 mm, 4.6 ± 1.78 $10^6/\mu\text{l}$, 53.00 ± 2.83 $10^3/\mu\text{l}$, 2.00 ± 0.67 per cent, 33.3 ± 1.49 per cent and 1.40 ± 0.52 per cent, respectively. Results showed that Haematological parameters were found normal range under semi-intensive system. It can be concluded that physiological and immunity profile of Konkan Kanyal goats normal under semi intensive management system.

EFFECT OF DIFFERENT LEVELS OF POTASSIUM ON GROWTH, YIELD ATTRIBUTES AND YIELDS OF CHICKPEA VARIETIES

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The present study was conducted with the objective to know the effect of potassium levels and different varieties on growth, yield attributes and yield of chickpea. The present investigation consisted four levels potassium ($K_1=0$, $K_2=30$, $K_3=60$ & $K_4=90$ kg potash ha^{-1}) and three varieties ($V_1=Udai$, $V_2=Awarodhi$ and $V_3=KWR-108$) observation recorded on growth, yield attributes and yield. The present investigation revealed that the maximum number of primary and secondary branches per plant, fresh weight of plant, dry weight, number of pods per plant, number of seeds per plant, weight of pod per plant, biological, grain and straw yield were recorded in K_4 treatment (90 kg potassium ha^{-1}) and variety V_3 (KWR-108). However, maximum number of primary and secondary branches per plant, fresh weight of plant, dry weight, number of pods per plant, number of seeds per plant, weight of pod per plant, biological, grain and straw yield were recorded unfertilized plot K_1 (0 kg potassium ha^{-1}) and variety V_1 (Udai).

Keywords: Chickpea, grain yield, potassium levels and varieties

HUMAN-WILD BOAR CONFLICT IN THE JOSHIMATH FOREST RANGE OF THE NANDA DEVI NATIONAL PARK, UTTARAKHAND, INDIA

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The Joshimath Forest Range is only Range in the Nanda Devi National Park which lies in the Nanda Devi Biosphere Reserve, Garhwal region of Uttarakhand. In 1977, UNESCO initiated its Man and Biosphere Program in an effort to protect ecosystem that are valued for their natural and aesthetic qualities. The Nanda Devi Biosphere Reserve became one of the first Biosphere Reserve in India in 1988, and remains one the best known. This is presently the case in the Joshimath Forest Range where conserving the natural landscape and promoting economic



growth often collide in the form of Human-Wildlife conflict. Surveys based study was conducted in the five villages of the Joshimath Forest Range from August, 2016 to November, 2016 to document the Human-Wild boar conflict. A total of 94 incidences were recorded from the five villages during the questionnaire survey. Results revealed that Wild boar was serious problem for the villagers to damaging their field crops and harming their economy. Wild boar also attracts from the waste food materials people used to throw near to the house or field. Mostly damaged crops were Potato, French bean, Mandva (Finger millet), Cowpea, Cucumber etc.

NANOTECHNOLOGY IN AGRI-FOOD PRODUCTION AND BIODIVERSITY CONSERVATION

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Nanotechnology is growing rapidly in modern agriculture, and agri-food production for biodiversity conservation. Nanotechnology may increases in agricultural production and their many application include: (1) nano devices were used for the genetic manipulation of plants and plant disease diagnostics; (2) nano fertilizers were used for crop improvements; (3) animal breeding and animal health, poultry production. Nanotechnology uses include nanoparticle-mediated gene or DNA transfer in plants for the development of insect-resistant varieties, nano feed additives, food processing and storage, and increased product shelf life. Nanotechnology promises to accelerate the development of biomass-to-fuels production technologies. Nanotechnology promises to accelerate the development of biomass-to-fuels production technologies. Experts feel that the potential benefits of nanotechnology for agriculture, food, fisheries, and aquaculture need to be balanced against concerns for the soil, water, and environment and the occupational health of workers. On the basis of only a handful of toxicological studies, concerns have arisen regarding the safety of nanomaterials, and researchers and companies will need to prove that these nanotechnologies do not have more of a negative impact on the environment. We assess the potentials and limitations for successful conservation of biodiversity in productive agricultural landscapes, the feasibility of making such approaches financially viable, and the organizational, governance and policy frameworks needed to enable eco agriculture planning and implementation at a globally significant scale. We conclude that effectively conserving wild biodiversity in agricultural landscapes will require increased research, policy coordination and strategic support to agricultural communities and conservationists.

Keywords: agriculture, food, nanotechnology, nanoparticle, nanopesticides, nanosensors, smart delivery systems

STABILITY ANALYSIS FOR SEED YIELD AND ITS COMPONENTS OF SOYBEAN IN DIFFERENT CLIMATIC CONDITIONS IN MADHYA PRADESH REGION

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Fifty genotypes of soybean [*Glycine max* (L.) Merrill.] were subjected to stability analysis for seed yield and its components under three environments. The pooled analysis of variance indicated that G X E interaction and E + (G X E) components were found significant for all the traits suggested the linear function of the additive environment effects and allowed for evaluation of genotypes for stability across the environments. Linear and non-linear components of G X E interactions were also present. However, most of the genotypes showed significant deviation mean square (S^2_{di}) implying that these were unstable and thus did not show general adaptability. For seed yield per plant, JS 20-65, JS 20-87, JS 20-102 and JS 20-109 showed above average stability as regression coefficient was less than unity ($b_i < 1$) and minimum deviation from regression ($S^2_{di} \sim 0$). The genotypes JS 20-113, JS 20-41 and JS 20-96 were most stable across the environments for seed yield per plant as regression coefficient (b_i) being near to unity with minimum deviation from regression ($S^2_{di} \sim 0$).

Keywords: G X E interaction, regression coefficient, soybean, stability

COMPARATIVE PERFORMANCE OF F₁ HYBRIDS OF OKRA (*Abelmoschus esculentus* L. Moench) UNDER NATURALLY VENTILATED POLYHOUSE, SHADENET HOUSE AND OPEN FIELD CONDITIONS

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The field experiment entitled, "Comparative performance of F₁ hybrids of okra (*Abelmoschus esculentus* L. Moench) under naturally ventilated polyhouse, shadenet house and open field condition" was carried out at Department of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri (M.S.) in the year 2014 in Split Plot Design with 3 replications. There were two factors studied in experiment viz. a) growing conditions and b) F₁ hybrids. The growing conditions were taken as main plot treatment and F₁ hybrids were taken as sub plot treatment. Three growing conditions studied were GC₁ (Naturally ventilated polyhouse), GC₂ (Shadenet house) and GC₃ (Open field). The four hybrids used were V₁ (OH-152), V₂ (Bhendi NS- 851), V₃ (Bhendi No- 10) and V₄ (NOH- 1258). The variety V₅ (Varsha Uphar) was used as control. While observing the effect of growing conditions, GC₁ showed the highest plant height (2.00 m), internodal length (8.97 cm), number of nodes (22.36), leaf area (221.97 cm²), days to last harvest (109.19). With regard to variation in F₁ hybrids, significantly the highest height of plant (1.66 m) at last harvest and number of nodes (21.79) were observed in V₁. Further, the highest internodal length (9.09) and the highest leaf area (214.16 cm²) was recorded in V₃. While observing the interaction effect of growing conditions and F₁ hybrids, the highest plant height (2.24 m) at the last harvest is in treatment combination GC₁ V₂. Lowest internodal length (6.69 cm) is in treatment combination GC₃ V₄. Fruit yield per plant (0.28 kg), fruit yield per m² (2.08 kg), yield per ha (16.47 t) and leaf area (245.86 cm²) were the highest in the treatment combination GC₃ V₃.

Keywords: Comparative performance, F₁ hybrids, naturally ventilated polyhouse, shadenet house, open field.



AN AVIAN DIVERSITY OF FATEHNAGAR TOWN, UDAIPUR FOREST DIVISION, RAJASTHAN

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A recent avifaunal survey of the Fatehnagar town, Udaipur Forest Division of Rajasthan was carried out in between May, 2014 to April, 2015 to evaluate the variation in avian diversity in three different seasons such as summer, rainy and winter. The town falls under Mavli Tehsil. The Fatehnagar was established by Maharana Fateh Singh of Mewar. Fatehnagar town lies between the Chittaurgarh and Udaipur District boundaries and coordinates of 24°48'49.2" N and 74°05'47.0" E. Line transect method and point count method were followed for the survey for the forest, farmlands, wetlands and urban areas. In the sense of bird diversity of the town, there is no base line data available. This is a first study of avifaunal diversity in the Fatehnagar town and its surrounding areas. A total of 182 bird species were recorded during the study period. In summer season, avian diversity was lowest (155 species) while it was medium (165 species) in rainy season and highest (170 species) in winter season. Highest species richness (73 species) was observed in the Order Passeriformes.

Keywords: Birds, Diversity, Point count, Species richness, Transect

MOLECULAR DIAGNOSTIC TECHNIQUES FOR DETECTION OF PLANT PATHOGENS

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Plant pathogens infect a wide range of plant species and cause great yield and quality loss of agricultural crops. Detection and accurate identification of harmful plant pathogens is very essential to improve the strategies for controlling plant diseases. Traditional methods may take days or week for particular pathogens to produce diagnostic spores. Indexing for many intracellular pathogens is also very complex because they are obligate in nature biotrophs. Recent advance in biotechnology and molecular biology have played a significant role in the development biotrophs of rapid, specific and sensitive diagnostic tests. The use of ELISA by employing other polyclonal or monoclonal antibodies was a significant step in adding sensitivity and precision to virus detection. Molecular method have been used to detect several pathogens and to study the development of fungicide resistance in wheat pathogens technological advances in PCR-based method, such as polymerase chain reaction (PCR), RT-PCR, allow fast, accurate detection and quantification of plant pathogens. The application of polymerase chain reaction (PCR) technology to molecular diagnostic holds great promise for the early identification of agriculturally important plant pathogens. DNA microarray technology is currently a new and emerging diagnostic technology for plant pathogens. When coupled with PCR results in high level of sensitivity, specificity and throughout. Introduction of RT-PCR technique has improved and simplified the method for PCR-based diagnosis of plant pathogens. Information resulting from such work could be used to improve disease control by allowing more rational decisions to be made about the choice and use of fungicides and resistant cultivars. Molecular methods have also been applied to the study of variation in plant pathogens populations, for example detection of different mating types or virulence types. PCR-based method can provide new tools to monitor the exposure of a crop to pathogens inoculum that are more reliable and faster than conventional methods.

KeyWords: Pathogen, Detection, Diagnostic, Spores, Obligate, Biotrophs, Biology, Antibodies, Fungicide and Conventional methods.

NANOTECHNOLOGY AND ITS APPLICATIONS

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Scientific discoveries and research have in fact propelled man to challenge new frontiers and by using his superior brain, man has been able to deliver most of these goodies. Nanotechnology is the study manipulation and manufacture of extremely minute machines or devices which are so small to the point of manipulating the atoms themselves to form materials. Nanotechnology is one such technological wonders that we are experiencing now. By using Nanotechnology we can make computers billions of times more full than today's and new medical capabilities. Today, nanotechnology and nanoscience approaches to particle design and formulation are beginning to expand the market for many drugs and are forming the basis for a highly profitable niche within the industry. The properties of manufactured products depend on how those atoms are arranged. If we know about exactly how many dopant atoms are in a single transistor and exactly where each individual dopant atom is located and placed roughly the right number in roughly the right place, we can make a working transistor. Next improvement in Nanotechnology is self-replication. That is makes an effective route to truly low cost manufacturing. Our intuitions about self-replicating systems learned from biological systems that surround us are likely to seriously mislead us about the properties and characteristics of artificial self-replicating systems designed for manufacturing purposes. Artificial systems able to make a wide range of nonbiological products like diamond under programmatic control. Now Nanotechnology is playing an important role in medicines and industries. Thus the progress of technology around the world has already given us more precise, less expensive manufacturing technologies that can make an unprecedented diversity of new products.

Keywords: Nanoscience, dopant atom and transistor.



RECENT ADVANCES IN GENETICS AND BREEDING OF RAPESEED MUSTARD

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Rapeseed mustard is an important *Brassica* oilseed crop, which accounts for 13.9 per cent of the world's vegetable oil production and supply more than 12.5 per cent of the edible oil in the world. They are being used in medicine, condiments, pickles and in several religious ceremonies etc.. *Brassica* oil, in addition, serve as an important raw material for industrial products like soaps, lubricants, paints, plasticizers etc. Breeding methods employed for the improvement in rapeseed and mustard depends upon mode of reproduction and inheritance of characteristics thus, on the basis of mode of reproduction oilseed *Brassica* can be divided in two groups viz., Self compatible (*amphidiploids*, *B. carinata*, *B. napus* and *B. juncea*) promotes self-pollination and self-incompatible (diploids; *B. nigra*, *B. oleracea* and *B. campestris* promotes self-incompatibility which ultimately leads to cross-pollination. Therefore, the breeding methods such as Pureline selection, mass selection, bulk and pedigree methods have been widely used for improvement in autogamous crops utilizing the advantage of additive gene action. On the other hand, in case of cross-pollinated groups; self-incompatibility offer unique opportunity of exploitation of heterosis. The existence of male sterility also provides chances for hybrid breeding. Now, different biotechnological methods viz., protoplasts fusion, tissue culture and transgenics for various biotic and abiotic stress have been exercised.

GENOMICS RESEARCH AND ITS ROLE IN PLANT BREEDING

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Genomics is a discipline in genetics that applies recombinant DNA, DNA sequencing methods, and bioinformatics to sequence, assemble, and analyze the function and structure of genomes. Advances in genomics have triggered a revolution in discovery-based research to understand even the most complex biological systems such as the brain. The field includes efforts to determine the entire DNA sequence of organisms and fine-scale genetic mapping. The term genomics was coined by Thomas H. Roderick (1987). At that time, this term was taken to mean mapping and sequencing to analyze the structure and organization of genomes, but today genomics includes sequencing of genomes, determination of complete sets of proteins encoded by an organism, the functioning of genes and metabolic pathways in an organism. Several techniques have been developed for genome sequencing such as Maxam and Gilbert technique, Sanger technique, Whole genome shotgun sequencing, Random shotgun sequencing, DNA chips(MICROARRAYS), and Direct sequencing techniques. It can provide comparing a wide variety of genomes, the nature of horizontal gene transfer and microbial evolution can be studied. Plant breeding has been very successful in developing improved varieties using conventional tools and methodologies. Nowadays, the availability of genomic tools and resources is leading to a new revolution of plant breeding, as they facilitate the study of the genotype and its relationship with the phenotype, in particular for complex traits. Next Generation Sequencing and high-resolution maps have led to a significant improvement in the identification of molecular markers linked to specific genes and to QTLs. The most important advantage comes from the dense genome coverage, which allows the identification of markers closely linked to any target genomic region, with the advantages that this tight linkage provides.

STUDIES ON GENETIC DIVERGENCE AND HERITABILITY IN TUBEROSE (*POLIANTHES TUBEROSE* LINN.)

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The tuberose (*Polianthes tuberosa* Linn.), is a night-blooming perennial plant, belongs to the family Asparagaceae and thought to be native to Mexico along with every other species of *Polianthes*. The flowers are used in wedding ceremonies, garlands, decoration and various traditional rituals. Its Hindi name is "Rajnigandha", means "night-fragrant" (rajni=night; gandha=fragrance). It occupies a prime position because of its popularity as a cut flower, loose flower, as well as for its potential in perfume industry. It has a great demand for making floral arrangement and bouquets in major cities of India. In the last two decades or so a few new tuberose cultivars have been identified and recommended for commercial cultivation in different regions of our country. Several cultivars had been assessed and evaluated for their performance under different regions of the country taking single petalled and double petalled cultivars. The market demand has increased manifold for want of diverse forms and intense fragrance found in them. The field experiment entitled "Studies On Genetic Divergence And Heritability In Tuberose (*Polianthes Tuberose* Linn.), was carried out during 2015-16 at Horticultural Research Centre, Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India. The experiment was laid out in RBD with three Replications, total twenty-two genotypes were undertaken to examine the genetic variability, heritability, correlation coefficient and path coefficient analysis. 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 bulbs, 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 per plant, yield of bulblets per plant and yield 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 D^2 statistic revealed considerable genetic diversity among the genotypes.

COMPUTATIONAL ANALYSIS OF CHITINASE GENE IN TRITICUM AESTIVUM

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Chitinases are the hydrolytic enzymes which protect plants against pathogen attack. However, the precise role of chitinases in disease resistance has not been explored in wheat. In the present study, in silico approach, including secondary structure analysis, detailed signature pattern study, cis-acting regulatory elements survey, evolutionary trends and three-dimensional molecular modeling was used for different chitinase classes of wheat (*Triticum aestivum*). Homology modeling of class I, II, IV and 3 chitinase proteins was performed using the template crystal structure. The model structures were further refined by molecular mechanics methods using different tools, such as Procheck, ProSA and Verify3D. Secondary structure studies revealed greater percentage of residues forming α helix conformation with specific signature pattern, similar to casein kinase II phosphorylation site, amidation site, N-myristoylation (N-MYR) site and protein kinase C phosphorylation site. The expression profile suggested that wheat chitinase gene was highly expressed in cell culture and callus. We found that wheat chitinases showed more functional similarity with rice and barley. The results provide insight into the evolution of the chitinase family, constituting a diverse array of pathogenesis-related proteins. The study also provides insight into the possible binding sites of chitinase proteins and may further enhance our knowledge of fungal resistance mechanism in plants.

AGRO-MORPHOLOGICAL CHARACTERIZATION AND SELECTION OF SUPERIOR GENOTYPES OF JACKFRUIT (*ARTOCARPUS HETEROPHYLLUS* LAM.)

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Cultivar identification and estimation of diversity using phenotypic markers/ characterization though generally used since time immemorial, have several limitations, especially in perennial crops. Also there is very less literature pertaining to characterization of jackfruit germplasm. It serves as an important breeding tool which can be used to exploit the diversity and breed for crop improvement. A survey on local genotypes of jackfruit with small sized fruits was conducted during the fruiting season of April, 2014 in 8 villages of Pudukkottai district of Tamil Nadu, India with an objective to characterize and evaluate local seedling genotypes of jackfruit. Various morpho-metric and qualitative traits were observed in 40 genotypes based on IPGRI jackfruit descriptor. Correlation coefficients (r) and path coefficient analysis (P) were carried out to analyze and to identify the superior genotypes. Depending upon the yield and yield contributing attributes, the genotypes namely AH-11, AH-13, AH-24, AH-33 and AH-35 were found promising under the survey of Pudukkottai district of Tamil Nadu. Therefore these alone can be recommended for further clonal propagation.

ASSESSMENT OF GENETIC VARIABILITY INDUCED BY CADMIUM [$Cd(NO_3)_2$] IN *LENS CULINARIS* MEDIK.

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Chemical mutagenesis is significant mechanism to generate genetic variability in a short period of time to improve specific traits. An efficient genetic improvement of a cultivar depends on the knowledge of mode of gene action, genetic variability, and the inter-relationship among important plant characters. In the present experiment, it is aimed to investigate the mutagenic potency of heavy metal [$Cd(NO_3)_2$] on genotypic expression of lentil (*Lens culinaris*), one of important proteinaceous crop, containing high amount of protein and consumed as a food throughout the world. To widespread use of lentil, all over the world ought to enhance genetic variation by using mutagen. The seeds of lentil were treated with different doses of cadmium nitrate and studies were undertaken on M_1 generation. Genetic variability was determined through meiotic behavior of pollen mother cells. Different meiotic anomalies were found during microsporogenesis and it was dose dependent i.e., it increases with increasing concentration of mutagen which shows positive relationship between the doses of mutagen and chromosomal aberration. Germination percentage and pollen fertility was decreased with increasing concentration of cadmium nitrate. Thus on the



basis of above result, it can be concluded that genetic variability in lentil was directly proportional to the increasing concentration of cadmium nitrate.

Keywords: Heavy metal, *Lens culinaris*, Genetic variability, Meiotic anomalies, Pollen fertility,

GENETIC DIVERSITY OF ELITE GERMPLASM LINES OF WHEAT (*TRITICUM AESTIVUM* L.) BASED ON UPGMA CLUSTER ANALYSIS

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Determination of genetic diversity can be done by assessing morphological or molecular data. Since expression of morphological markers are effected by environment, cultivation practices and some of these are visible at a particular developmental stage, they do not provide sufficient and appropriate discriminative details about the genetic diversity of the germplasm. Molecular markers are useful complements to morphological and phenological characters because they are plentiful, independent of tissue or environmental effects, and allow cultivar identification in the early stages of development. The present experiment was carried out at the Agriculture Research Farm, Institute of Agriculture Sciences, Banaras Hindu University, Varanasi during the Rabi season 2010-11. A total of 12 simple sequence repeat (SSR) markers, selected from 30 wheat SSR linkage map were used for genetic diversity analysis among 52 wheat genotypes. The similarity coefficients ranged from 0.09 to 1.00 which showed presence of great diversity in the germplasm studied. The minimum similarity coefficient (0.09) was observed between genotypes CSISA-6702 and CSISA-6704. These two genotypes have very diverse pedigree therefore low similarity coefficient between them is expected. The highest similarity coefficient (1.00) was observed between genotypes CSISA-6718 and CSISA-6747, CSISA-6725 and CSISA-6737, and CSISA-6726 and CSISA-6746. It showed that these genotypes are similar at all the 12 loci studied. The genotypes CSISA-6718 and CSISA-6747 have common pedigree, therefore no difference was observed at molecular level. The genotypes CSISA- and CSISA-6746 have Inqalab91 and kukuna in their pedigree. These two genotypes have one different parent in their pedigree, but could not be separated from each other. The higher number of SSR markers could be used to separate these genotypes from each other. The genotypes CSISA-6725 and CSISA-6737 have different pedigree but could not be separated from each other which may be due to lower number of SSR markers utilised in this study.

INOCULATION EFFECTS OF FUNGICIDE TOLERANT *RHIZOBIUM LEGUMINOSARUM* STRAIN RP1 ON *PISUM SATIVUM* GROWN IN KITAZIN AMENDED SOIL

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Introduction: Frequent application of fungicides in agronomic practices cause deleterious effect on soil microbiota and legume production. Considering these, the present study aimed at identifying fungicide tolerant rhizobia from pea nodules and to assess its growth promotory impact on pea plants. **Methodology:** *Rhizobium leguminosarum* strain RP1 (identified by 16S rRNA gene analysis, Accession no. KY940047) recovered from nodules was assessed for PGP activities such as IAA, siderophores, HCN, ammonia, EPS and P solubilization under kitazin stress. Damaging impact of kitazin on strain RP1 was assessed under SEM and CLSM. Also, the impact of different concentration of kitazin on biological and physiological parameters including antioxidative response of inoculated and uninoculated plants was assayed using standard methods. The alterations in root morphology exposed to kitazin was also observed using SEM. **Results and Discussion:** Strain RP1 tolerated kitazin up to 2600 $\mu\text{g ml}^{-1}$ and secreted PGP bioactive molecules even in the presence of kitazin. Strain RP1 produced IAA (128 $\mu\text{g ml}^{-1}$), solubilized TCP (58.4 $\mu\text{g ml}^{-1}$) and secreted exopolysaccharide (34 $\mu\text{g ml}^{-1}$) and produced siderophores, (SA 42.8 $\mu\text{g ml}^{-1}$, 2,3-DHBA 38.2 $\mu\text{g ml}^{-1}$) which decreased consistently with gradually increasing concentrations of kitazin. Also, the SEM image revealed significant distortion in cellular morphology of strain RP1 grown with increasing concentration of kitazin. Phytotoxicity of kitazin on pea plants grown in fungicide amended soil were significant. The application of strain RP1 in contrast alleviated toxicity and enhanced the length of plant organs, dry biomass, symbiotic attributes, photosynthetic pigments and grain yield. Additionally, *R. leguminosarum* strain RP1 expressively reduced the levels of antioxidant enzymes like, POD, APX, GPX and CAT and malondialdehyde relative to fungicide stressed plants. Content of proline in plant organs increased under kitazin stress which however declined in bio inoculated plants. Furthermore, the kitazin exposure caused distortion of root tip and surface topology that may result in poor growth and development. **Conclusion:** It can be concluded from this study that RP1 strain could be explored as a potent biofertilizer for enhancing legume production in soils polluted even with fungicide.

Keywords: Pea; Fungicide toxicity; *Rhizobium leguminosarum*; Proline; Antioxidant enzymes; Bioremediation

SUSTAINABILITY IN MAXIMUM SUGARCANE AND SUGAR PRODUCTION: OPPORTUNITIES AND LIMITATIONS IN UTTAR PRADESH

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Sugarcane is cultivated under exceptional and wide range of climatic conditions viz., hot weather during summer and very low temperature during winter with different particular opportunities in U.P. state of subtropical region. Hot and dry summer months followed by cool, wet and few days of frost in winter months are mainly concern with growth and quality of sugarcane crop. The Indian sugar industry, second largest in the world, is a key driver of rural development, supporting India's economic growth. The industry is inherently inclusive supporting over 6 million farmers and their families, along with workers and entrepreneurs of over 550 sugarmills, apart from a host of wholesalers and distributors spread across the country. Contribution of sugarcane to the national GDP is 1.1% which is significant considering that the crop is grown only in 2.57% of the gross cropped area. The industry produces 350 – 365 million tonnes cane, 25-27 mt white sugar and 6-8 mt jaggery and



khandsari every year. India occupies better position in the world in area and production after Brazil but the cane yield/ha is generally lower (70 t/ha) than several other countries like Peru (120t/ha), Australia (100t/ha), and Brazil (80t/ha) etc. Uttar Pradesh rank first in the country with regards to cane area (2.3mha) and also in sugar production (8.75 mt). Therefore, the northern states particularly Uttar Pradesh plays important role in improving national sugarcane productivity is obvious. Now days stagnation in crop yield (72.37 t/ha) and sugar recovery (10.61%) in U.P. with decline in the factor productivity have raised a question mark over sustainability of crop yield level reached during green revolution period. In order to maintain crop sustainability, applied researches are being conducted in different disciplines and research finding's as well as exercises such as crop rotation, integrated nutrients management strategy and green cane harvesting have been resulted to increase irrigation and drainage efficiency, improvement in organic matter and its better effect on soil properties and sugarcane nutrition. In this aspect an experimental result at sugarcane Research Institute of U.P. Council of Sugarcane Research Shahjahanpur (U.P.) showed that integration of 10t/ha Farm Yard manure + inorganic fertilizer N, P₂O₅ and K₂O on soil test basis + biofertilizers (*Azotobacter* and phosphorus solubilizing bacteria (PSB)) each @ 10kg/ha gave significantly better cane yield of plant and also in their sub – sequent ratoons with trash mulching at the starting of ratoon management.

Keywords: Sustainability, Sugarcane productivity, Sugar production, Opportunities, Uttar Pradesh, Subtropical region.

IMPORTANCE OF INTEGRATED WEED MANAGEMENT (IWM) FOR SUSTAINABLE AGRICULTURE

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Weeds are the main competitor of crops which can reduce crop yield to a extent of 20-50 per cent or even more by utilizing the nutrients, soil moisture and other growth factors available for crops. According to an estimate every year around 2000 crores rupees' lost due to weeds in India. A good crop husbandry is able to control about 50% of the weed population and weeds germinate in this situation are very weak, can easily controlled by physical or chemical method. But for quick response we continuously use herbicides to control the weeds which causes crop damage and environmental pollution. Indiscriminate application of herbicides for weed control has led to many problems like- resistant development in weeds, weed flora shift and gradual population build-up etc. IWM involve use of cultural (crop, seed rate, time and method of sowing, plant population, irrigation and fertilization), mechanical (use of *khurpi*, hoe and paddy weeder etc.), biological (bioagents- insects, bacteria, fungi, plants etc.) and chemical (herbicides) methods. The main aim of IWM is not total eradication of weeds but maintaining the weed population below economic injury level for maximizing profit and reducing the chance of crops damage on one hand and minimize soil, water and air pollution on the other. So, IWM is economically viable and ecologically sound system where we use all available techniques and methods in as compatible manner for weed control.

DRIP FERTIGATION SYSTEM: A SUSTAINABLE APPROACH TOWARDS IRRIGATION AND FERTILIZER MANAGEMENT IN AGRICULTURE

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The aim of farmer is to produce “more crop per drop” and “ more crop from low input” hence there is need to find the irrigation and fertilizer management practices which consumes less fresh water and fertilizer particularly in areas where water scarcity is the most common problem. The demand for new water saving techniques in irrigation is increasing rapidly right now. In the modern drip fertigation systems, the most significant advantage is that nutrients along with water is supplied near the root zone of the plants drip by drip due to which a large quantity of nutrients and water are saved. If the nutrients are available in the right amount for the growth of crops then the yield of the crops also increases. With keeping in view an experiment was conducted to study the effect of irrigation and fertigation scheduling on tomato crop. Field was split plot designed having fifteen treatments combination. Fertigation with 50% RDF + 2 foliar spray of 1% urea phosphate improves the nutrient use efficiency of tomato significantly to the extent of 61.35 per cent over fertigation with 100% RDF. The highest water use efficiency (21.57 per cent) was recorded with the drip irrigation at 50% PE as compared to 100% PE. Fertigation with 75% RDF through fertigation + 2 foliar spray of 1% urea phosphate improved water use efficiency of tomato significantly to the extent of 8.98 per cent over fertigation with 50% RDF. Thus the productivity can be raised with the proper management of water resources and nutrients.

OILSEEDS AND ITS PROCESSING: NEED OF DIVERSIFIED APPLICATION, CHALLENGES AND CONSUMPTION EXPECTATION

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The oilseeds and oils are one of the important constituents of human food. Oilseeds, as important sources of fat and protein, could improve food structure, and promote development of aquaculture and processing industries, etc. The basic unit of fats and oils consists of one molecule of glycerol combined with three molecules of fatty acid, known as a triglyceride. The kinds of fatty acid present in a triglyceride have marked effects on its physical and chemical behaviour. Natural fats contain a wide range of minor components which, when present, give them their characteristic colour, flavour, odour, enhanced resistance to oxidation and ease of emulsification. Some compounds such as carotene, chlorophyll and the isothiocyanates are non-fatty in origin; others simply arise from the breakdown of the fat itself by oxidation and hydrolysis, leading the fat to become rancid. India occupies a prominent place in global oilseeds scenario with 12-15% of area, 6-7% of vegetable oil production, and 9-10% of the total edible oil consumption and 13.6% of vegetable oil imports. The rich agro-ecological diversity of India makes it suitable for production of all the major oilseeds and even having the largest area under oilseeds in the world (26.77 m ha), it imported about 50% of



total oil requirement at a huge cost of Rs.56,000 crores (2011-12). The per capita consumption of edible oils at 12.7 kg/annum is well below the world average of 23.46 kg/annum. The processing of oilseeds and oils has effect on oil quality. Hence, it is necessary to select suitable processes for oil processing to minimize the quality deterioration. The introduction of new processing techniques in the oil industry will allow increasing the amount of bioactive compounds in the edible oils. However, when developing these new technologies, the presence of minor components other than those desirable bioactive compounds should also be considered. In this context, the presence of proteins is particularly important because of their demonstrated relationship with both the stability and, more important, the potential allergenicity of the obtained oils. Use of organic solvents such as hexane for oil extraction lead to residual effect in human and in very long duration may result in health hazard also. Use of aqueous extraction or supercritical fluids economically for oil extraction has to be explored to solve this problem.

Keywords: oil, oilseed processing, consumption, challenges, isothiocyanates, carotene.

ALLEVIATION OF CHILLING INJURY IN FRUITS USING ECOFRIENDLY APPROACHES

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Storage under lower temperature is an effective and commercial means for extending shelf life of horticultural produce. Although, most of the horticultural produce native of tropical or subtropical regions are highly sensitive to chilling temperatures (below 10-15 °C but above freezing point). Therefore, use of naturally occurring or generally recognized as safe (GRAS) substances and sustainable ecofriendly techniques to minimise our dependence on potentially hazardous chemicals is needed to reduce chilling injury and postharvest losses of fruits.

Objective: To know the role and activity of GRAS compounds against chilling injury

Method and hypothesis: Several GRAS compounds such as methyl jasmonate, salicylic acid, polyamines, nitric oxide, ethrel, hot water dip etc. are used during cold storage to alleviate chilling injury by dipping and fumigation methods.

Result and implication: Methyl jasmonate may induce the plant to produce different types of defense chemicals and protect the plant through signal transduction pathway. Due to cationic nature, polyamines interact with the anionic groups of membrane phospholipids and cell membranes to stabilise and protect produce under stress conditions. They have anti-senescent properties and exert a protective effect against low temperatures. The exogenous application of nitric oxide down-regulates the generation of ROS, consequently reducing oxidative stress in fruits and vegetables stored at chilling temperatures. Salicylic acid induces expression of several gene like ROS avoidance and scavenging genes.

Keywords: chilling injury, biologically safe compound, fruits and vegetables

INTEGRATED WEED MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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One of the most serious and fastest growing problem in agriculture is the spread and establishment of invasive non-native plants. Noxious weed infestations have contributed to the loss of agricultural productivity and ecological functions. Under such circumstances, integrated weed management (IWM) is becoming more relevant to cope-up with these challenges. IWM means integrating multiple methods to manage weeds, using the combination of practices that is most effective for solving the specific weed issue at hand. These weed management techniques form a “toolbox” in which each “tool” can be integrated into a weed management plan catered to the particular farm problem. The toolbox includes chemical, mechanical, cultural, biological practices and prevention of weed introduction and spread. IWM tactics span a wide range of types and complexity. Some examples are equipment cleaning, timely scouting, altering herbicide tank mixes, rotating herbicides, cover cropping, changing tillage practices and hand-pulling weeds. Weed management is most effective when it integrates a combination of strategies, based on what works best for achieving a particular management goal while maintaining economic and environmental stability. IWM has the potential to restrict weed populations to manageable levels, reduce the environmental impact of individual weed management practices, increase cropping system sustainability and reduce selection pressure for weed resistance to herbicides. The long term approach to integrated weed management should reduce the extent of weed seed stock in the soil. The single weed control measure is not feasible due to the number of different weed species and their highly diverse life cycles and survival strategies. Therefore, the suitable combination of different methods of weed control or integrated weed management (System Approach) should be practiced for minimizing the losses caused by weeds in different crops and also for protection of the environment.

CLIMATE CHANGE ON IPM FOR SUSTAINABLE INTENSIFICATION OF AGRICULTURE

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Integrated pest management (IPM) is a leading complement and alternative to synthetic pesticides and a form of sustainable intensification with particular importance for tropical smallholders. Global pesticide use has grown over the past 20 years to 3.5 billion kg/year, amounting to a global market worth \$45 billion. Climatic change refers to any change in climate over time, whether due to natural variability or as a result of human activity. There is much concern about future changes in our climate and its effects on agriculture. The earth's mean surface temperature is projected to warm 1.4 to 5.8° C by the end of the 21st century. It will affect individual organisms, species distributions and ecosystem composition. Insects being ectothermal, temperature is the most important factor determining their distribution, survival, multiplication,



crop-pest synchronization, dispersal and behavior. It has been observed that metabolic rate increases exponentially rather than linearly with temperature in ectotherms. These metabolic increases are expected to alter food web dynamics, leading to elevated rates of herbivory. Our studies have revealed that increase in minimum temperature by 3⁰ C resulted in a jump in food consumption by more than 12 per cent in gram caterpillar larvae even when the maximum temperature remained unchanged. Elevation of temperature also directly induces the shift of distributions range, reduction in winter mortality, earlier occurrence in spring, and increase the number of annual generations. The climatic changes have probably already contributed to an exacerbation of pest problems, viz. *H. armigera*, *S. litura*, *P. brassicae*, *L. trifolii*, several species of sucking pests on various crops.

AGRARIAN CRISIS AND ITS IMPACT ON INDIAN AGRICULTURE ECONOMY

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Indian Agriculture is faced with a serious and intractable crisis. The crisis is most glaringly manifested in the continuous and widespread deceleration in agricultural growth, a drastic fall in per capita food grain availability, transfer of agricultural land for non agricultural use and of course the unceasing and pervasive reports of farmers suicides and starvation deaths. We still have 59% of workforce engaged in agriculture, and the distribution of land among rural households is extremely skewed. According to the 59th round of NSS survey for the year 2003, 90.48 percent of rural households are either landless or belong to the categories of small and marginal farmers. Together, they account for 43% of the total land owned by rural households. The remaining 10% households own 57% of the land. A resolution of agrarian crisis would, therefore, demand a radical restructuring of production structure and production relations in the entire economy. The government is naturally not interested in resolution of the crisis. Unfortunately, the neoliberal policy frame does not even allow containment of the crisis. In particular, opening up to the work market, withdrawal of government from production and marketing activities and deep inroads made by the corporate sector in Indian agriculture has played havoc with the livelihood security of millions of farm households. The investment and modernization drive of the corporate sector may benefit a small section of large and medium farm households with respectable resource base, but the 90 percent households with insufficient resource base get further marginalized in the environment.

Keywords: Agriculture, Land, Growth, Agrarian, Economy, Household, Environment.

IMPACT OF SWARNA JAYANTI GRAM SWAROZGAR YOJANA (SGSY)

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The SGSY, a centrally sponsored scheme of Ministry of the Rural Development, is the largest credit based poverty alleviation programme in the world. Poverty in India is widespread with the nation estimated to have a third of the world's poor. According to 2005 world bank estimate, 42% of India falls below the international poverty line of \$ 1.25 / day (PPP, in nominal term's Rs. 21.6 / day in urban area); having reduced from 90% in 1980. According to the criterion used by the planning commission of India 27.5% of the population was living below the poverty line in 2004-2005, down from 51.3% in 1977-1978, and 36% in 1993-1994. Since its independence, the issue of poverty with in India has remained a prevalent concern. As of 2016, more than 12.4% of India's population of 1.70 billion still lives below the poverty line. The year 2010-11 was the eleventh year of implementation of the scheme. During 2010-11, a total number of 391700 swarozgari achieved under SGSY (in U.P.) in the comparison of 400612 target swarozgaris, which is 97.78% of target swarozgaris. The total 47270 SHGs achievement against 34135 target SHGs, which is 138.48% of achievement against target. In the number of total swarozgari involvement of SC/ST and women is 191545 (48.90%) and 156836 (40.04%) respectively.

IMPORTANCE OF COMMUNICATION AND MANAGEMENT SKILLS IN RURAL DEVELOPMENT

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For each type of development such as social, economic, religious, political and educational, communication has its important place, similarly for the all round development of agriculture the communication process also deserves its significant role. Farming is an ancient occupation. If the farming may be recognized only as a factory of producing the food grains there is no difference between the ancient time and modern time farming. According to the economics, for other productions there are needed factors as land, labor, money and management which are still in the present and were in the past also. Communication is sharing information by observing, listening, speaking, and writing etc. People communicate in many ways, including talking by moving their hands and even by making faces. People also use telephone calls and letters for personal communication. Without communication parents would not know what their children need. Teachers could not help their students learn. People could not share knowledge. Each person would have to learn everything for himself or herself. Friends could not make plans with one another. In fact human beings probably could not survive for long without communicating each other. Agricultural communication (or agricultural communications) is a field of study and work that focuses on communication about agriculture related information among agricultural stakeholders and between agricultural and non agricultural stakeholders. Agriculture is broadly defined in this discipline to include not only farming, but also food, fiber (e.g., cotton), animals, rural issues, and natural resources. Agricultural communication is done formally and informally by agricultural extension and is considered related to science communication. However, it has evolved into its own professional field.



Skill management is very important in communication. Without management communication skill you cannot motivate audience and not satisfy to the farmer. If sender has the good communication skill he makes good relationship to audience.

PRADHAN MANTRI MUDRA YOJANA: MICRO UNITS DEVELOPMENT AND REFINANCE AGENCY

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Prime Minister, Shri Narendra Modi, today said that supporting the small entrepreneurs of India is the biggest way to help the Indian economy grow and prosper. He was speaking at the launch of the Pradhan Mantri MUDRA (Micro Units Development and Refinance Agency) Yojana in New Delhi. Stressing the contribution of small entrepreneurs in the economy, the Prime Minister expressed confidence that within a year's time, the major banks would also adopt the MUDRA model. The Prime Minister said that in our country, one often experiences that things revolve around mere perceptions, while the details often paint a different picture. Giving the example of the perception that large industries create more employment, he said that a look at the details reveals the reality that only 1 crore 25 lakh people find employment in large industries, whereas small enterprises employ 12 crore people in the country. The Prime Minister said that while there are a number of facilities provided for the large industries in India, there is a need to focus on these 5 crore 75 lakh self-employed people who use funds of Rs 11 lakh crore, with an average per unit debt of merely Rs 17,000 to employ 12 crore Indians. He said that these facts, when brought to light, led to the vision for MUDRA Bank. The Prime Minister spoke about his time as the Chief Minister of Gujarat, when he focused on the environment-friendly cottage industry of kite making, which employs lakhs of poor Muslims. The Prime Minister also congratulated SIDBI on the silver jubilee of its inception, and appreciated the work done by it in supporting India's small scale industry in these 25 years. The Prime Minister said that MUDRA scheme is aimed at "funding the unfunded". He said that the small entrepreneurs of India are used to exploitation at the hands of money lenders so far, but MUDRA will instil a new confidence in them that the country is ready to support them in their efforts that are contributing so heavily to the task of nation building. The Prime Minister said that mere launching of new schemes is not progress. Real success lies in real change on the ground, as was seen in the Jan Dhan Yojana and PAHAL, which had delivered concrete results within limited timeframes, he added. He said that the established financial systems will soon move to the MUDRA-model of functioning, i.e. to support entrepreneurs that give employment to a large number of people using least amount of funds.

ROLE PERFORMANCE OF RURAL WOMEN IN AGRICULTURAL ACTIVITIES

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In India society, women have a multi-dimensional role. Rural women play a significant role in agriculture activities such as seeding, transplanting, weeding fertilizer application, plant protection, harvesting, processing, storage etc. The present study was conducted in Morar block of Gwalior district, Madhya Pradesh. Total 120 rural women were selected for the study. Large majority (62.50%) of the respondent had medium level of participation. The finding leads to conclude that participation of rural women in agriculture activities were significant positive relationship with education, farming experience, annual income, extension participation, source of information, attitude toward agriculture and knowledge about agriculture activities. Age and marital status did not exert any association with level of participation in agriculture activities.

Keywords: Role performance, Rural women, Participation and Agriculture activities.

AGRICULTURAL INNOVATIONS FOR SUSTAINABLE CROP PRODUCTION

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Wheat (*Triticum aestivum* L.) is the most important cereal food crop ranking first in India with respect to area and production of the total grain crops. In India major wheat area is under subtropical region. The cool and sunny winters are very conducive for growth of wheat crop. Wheat contributes more towards public distribution system (PDS) and has become backbone of country's food security. Quality seed is a basic requirement to sustain any crop. Target yield of the crop depends on availability of quality seeds of improved varieties as effectiveness of agricultural inputs depends on seed potential. System of wheat intensification is based on the principles of system of rice intensification (SRI), is a new wheat cultivation technique which demands to maintain proper spacing with proper plant density which allows for sufficient aeration, moisture, sunlight and nutrient availability leading to proper root development in early stage of crop growth till harvesting. SWI is the system of modified agronomic practices such as lower seed rate, seed treatment, sowing of seeds at proper spacing, which result in higher ratio of tillers to mother seedlings, increased number of effective tillers, and bolder grains and finally enhanced yield of wheat. In the conventional system, farmers use about 100-140 kg/ha of seed but in the SWI method seed requirement is only 5-7% of conventional method. SWI is one of the promising technologies to increase productivity which ultimately contributes to the household level of food security of marginal farmers.

Keywords: Conventional, PDS spacing, SRI, SWI



EFFECT OF NUTRIENT MANAGEMENT PRACTICES AND FOLIAR NUTRITION ON SUSTAINABLE PRODUCTION OF FIELDPEA (*PISUM SATIVUM*)**Baldev Ram, S. S. Punia, Sarfraz Ahmad, J. P. Tatarwal, H. R. Chaudhary and Pratap Singh**

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A field experiment was conducted at Agricultural Research Station of the Agriculture University, Kota (Rajasthan), during winter (*rabi*) season of 2016-17. The treatments comprised 3 levels of nutrient management practices (75 % RDF, 100 % RDF i.e 20-17-16-20-5 kg NPKSZN/ha and seed inoculation with rhizobium + PSB + PGPR (RB-2) + 1.0 g ammonium molybdate /kg seed and 125 % RDF/ha) and 5 levels of foliar nutrition at pre flowering & pod initiation (water spray, neem coated urea @ 2 %, NPK (19:19:19) @ 0.5 %, NPK (17:44:0) @ 0.5 % & NPK (0:0:50) @ 0.5 %). The experiment was laid out in split plot design and replicated four times. The soil of the experimental field was clay loam, slightly alkaline in reaction (pH 7.6), poor in organic carbon (4.1 g/kg), medium in available N (378.5 kg/ha) & available K (292.8 kg/ha) and low in available P (8.94 kg/ha) & sulphur (16.1 kg/ha). Results revealed that application of 125 % RDF was recorded taller plant (177.9 cm), maximum branches/plant (3.05), pods/plant (63.5), seeds/pod (3.8), grain yield (2402 kg/ha), net return (Rs. 55763/ha) and B: C ratio (3.42) remained on par with application of 100 % RDF over 75 % RDF, respectively except statistically significant over 100 % RDF in grain yield. The per cent increase in grain yield was to the tune of 6.8 and 24.5 per cent over 100 % RDF and 75 % RDF, respectively. Amongst the foliar nutrients, application of NPK (17:44:0) @ 0.5 % at pre-flowering and pod initiation stage was recorded taller plant (183.8 cm), maximum and significantly higher branches/plant (3.10), pods/plant (65.6), seeds/pod (4.0), grain yield (2336 kg/ha), net return (Rs. 54735/ha) and B: C ratio (3.56) being on par with NPK (19:19:19) @ 0.5% at pre-flowering and pod initiation (2294 kg/ha, Rs. 53473/ha & 3.48) over neem coated urea 2 % spray (2170 kg/ha, Rs. 49922/ha & 3.29), NPK (0:0:50) @ 0.5% (2122 kg/ha, Rs. 48323/ha & 3.14) and water spray (2043 kg/ha, Rs. 46200/ha & 3.05), respectively. The per cent increase in grain yield was to the tune of 7.6, 10.1 and 14.3 % over neem coated urea @ 2 % spray, NPK (0:0:50) @ 0.5% spray and water spray, respectively. Hence, results encourages that standing fieldpea crop requires more nutrients especially phosphorus and potash and supplied through water soluble fertilizers either NPK (19:19:19) or NPK (17:44:0) @ 0.5 % to fulfil the nitrogen, phosphorus and potash requirement after pre flowering stage to seed development and higher sustainable yield of fieldpea can be harvested.

MASS MEDIA IN AGRICULTURE**Gaurav Kumar, Satendra Kumar and Sushil Kumar***

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In the coming days global terrorism and global warming are the serious threat to mankind. But, perhaps in recent future global food insecurity is going to be most menacing problem for human being throughout the world. Being the second largest populated country in the world and with the staggering rate of increase of population, India may face this problem little earlier. Hence, the biggest challenge to agriculturists in the country is not only to sustain the growth of agricultural production but also to increase it without damaging the environment and conserving the natural resources. There is very little scope in traditional approach as most of our arable lands are already being exploited. But, fortunately or unfortunately, a large percent of our research findings in the agricultural sciences has not been adopted by our farmers, mostly due to lack of proper extensive and intensive approach of extension activities. In a country like India, having more than one billion population, the potential of mass media for agricultural extension is still not properly exploited. Through mass media, a large number of populations can be reached in very short time in less cost. In 2003-04, Government of India has taken a bold initiative to sponsor a scheme on 'Mass Media Support to Agricultural Extension'. Opinion of the farm people regarding farm information, disseminated by mass media and needs and interest of the farm people are also enlightened.

Keywords: Mass media, Agricultural production**GOVERNMENTAL STRATEGIES FOR SKILLING INDIA: FUTURISTIC PROPOSITIONS****Anuj Pratap Singh, A.S. Maurya and Kshitij Parmar**

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There is an urgent need to focus on the labour force of the unorganized sector. Though the better and superior skills are essential requirements of the competitive market but practically the unorganized sector do not have the affordability to hire expensive labour of high quality. Thus this conflicting objective can be resolved with an integrated approach that gradually enhances labour quality while maintaining a purposeful balance with the demand and affordability of labour markets. A perfect blend of education and vocation needs to be prepared to utilize the vast demographic profile of the YOUNG INDIA. Advancement in the skills over time in association with industrial support leads towards progressive improvement in the overall economic scenario. On one hand availability of workforce with higher skill levels would increase competitiveness of unorganized sector and on the other hand it would benefit the organized sector too as some of the workforce with higher competency may get absorbed there despite having low education levels. Skill India is a campaign launched on 15th July 2015 by Prime Minister Narendra Modi with an aim to train the youth in different skills of varied sectors to provide job and improve entrepreneurship by 2022. Skill India Campaign encompasses other initiatives such as National Skill Development Mission, National Policy for Skill Development and Entrepreneurship, Pradhanmantri Kaushal Vikas Yojana (PMKY).

Keywords: Skill India, Labour force, Young India

HUMAN RESOURCE MANAGEMENT- EMERGING TRENDS IN INDIA

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Human Resource Management is a process of bringing people and organization together so that the goals of each are met. Few years back HRM filed was nowhere in existence but now it is very common in business world due to its needs and importance. The goal of this is to establish the importance of HRM and how it has evolved to provide some proof of its context so as to elaborate over its potential and future development. Many experts have accepted to the fact that Human Resources need more attention and wise management than any other resource of an organisation. The role of HR personnel must and must meet the needs and requirements of the drastically changing organisation. Companies which are more adaptable, resilient, quick to change directions, and are customer oriented definitely prove successful in the long run. An Effective and ideal HR personnel must be capable enough to manage effectively the human resources through various managerial tools like Planning, Organising, Directing, Controlling etc. On the other hand he should be having sound knowledge of emerging trends in training and employee development.

Keywords: Effective Manager, Human Resource, Knowledge, HR Trends People, Personnel, Skills

ENHANCEMENT OF SUGARCANE PRODUCTIVITY IN SUBTROPICAL INDIA

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Sugarcane is an important cash crop in India and its planting needs 60-80 quintal of seed cane/ha. seed of sugarcane has been defined in two categories(i) seed cane which is vegetatively propagated while (ii) cane seed takes many steps for developing a variety. In 2011-12, sugarcane acreage was over 5 million hectare. Ratoon crops occupied nearly 2.5 million ha area was planted to sugarcane. In order to plant such a vast area. there is need 15-20 million tons of seed cane annually. If we have to improve the sugarcane and sugar production in the country. there is an urgent need to ensure availability of quality seed canes. In subtropical zone, number of mill able canes contribute canes contribute 70 percent to cane yield while length of the cane contribute only 27 percent and girth of cane, 3 percent to yield build up. Therefore, any technology aims to maximize number of mill able canes per unit area would be appropriate for enhancing cane yield in subtropical India. To get maximum possible yield of sugarcane about $1.92-2.0 \times 10^5$ mill able canes per hectare each of 2.0 kg weight are required. However, at present only $1.0 \times 10^5 \pm 20.0 \times 10^3$ mill able canes per hectare, each having 0.6 to 1.0 kg weight are obtained under varying conditions of growth and cultivation. Therefore, a great scope exists to improve cane productivity by increasing number of mill able canes per unit area.

POTENTIAL AND PROSPECTS OF FLY ASH IN AGRICULTURE: AN ECO FRIENDLY APPROACH

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Fly ashes (pulverised fuel ash) , is a coal combustion product composed of fine particles that are driven out of the boiler with the flue gases. Production of fly ash in India has been increased from 40 Mn T/yr (1994) to about 235 Mn T/yr (2013) and it is expected to be 500 Mn T/yr (2021-22) and 1000 Mn T/yr (2031-32). As it is the problematic solid waste all over the world, this waste by-product material must be disposed off or recycled. Fly ash has a great potential for use in organic Agriculture. Being a good soil ameliorant and source of secondary plant nutrients as well as micronutrients, can significantly improve the physico-chemical properties (like B.D., W.H.C., pH, CEC, free lime etc.).It improves soil buffering capacity, soil aeration, percolation and water retention in the treated zone. The high concentration of elements (K, Na, Zn, Ca, Mg and Fe) in fly-ash increases the yield of many agricultural crops. Use of fly ash alone or in combination with farmyard manure, sewage sludge, water hyacinth, lime, gypsum and microbial cultures has been found to improve growth, yield and nutrients uptake of various crops including vegetables. The application of lignite fly-ash reduced the growth of several soil borne pathogenic microorganisms, whereas the population of Rhizobium sp. and Phosphorus solubilizing bacteria were increased under the soil amended with either farmyard manure or fly-ash individually or in combination.

AQUAPONICS: AS SUSTAINABLE FISH PRODUCTION TECHNIQUES

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Aquaponics is a combination of fish and plant production by using recirculating aquaculture and hydroponics systems. This technique is moving from the experimental to commercial. A hydroponic system involves growing plants without soil by using nutrient solution or in some type of artificial media. In aquaponics system, waste water (contain solid material, ammonia etc.) from the fish tank pass to the filters (for solids removal and bio-filtration) and then into the plant cultivation platform before returning to the fish tank. Ammonia is converted to nitrite and then to nitrate by microbes living in the system. Plants absorb nitrogenous waste from the water so it can be returned to the fish tank, and that nitrogenous waste can use for their own growth. Plants, fish, and microbes thrive in a balanced symbiotic relationship. A successful aquaponics system



requires the management of the plants, fish, and nutrients to provide a balanced and interdependent relationship. In this fish production techniques commonly used fish species are; Tilapia, Perch, Trout and Striped Bass etc. and plant species are; cucumbers, tomatoes, holy basil, peppers etc. Thumb rule for stocking density of fish in aquaponics is requiring 8-10 gallon water for each pound (453 g) fish. Aquaponics can increase income in following manner compare to other cultivation practices of fish and plant: easily setup, use only approximately 10% of the water normally required to grow the crop, it can grow up to 30% more food in same amount of space, no soil required for growing plant, faster plant growth, organic cultivation of fish and plant, year-round production. For better management adopt suitable practices and strategy: use good nutrient solution or artificial media and water resource for cultivating fish and plant crops, production target and area require (size and capacity), use durable physical resources (tanks, pipes, etc.), require human resources.

Keywords: Aquaponics, Ammonia, Plants, Fishes, Bio-filter

BIOTECHNOLOGY IN SUSTAINABLE DEVELOPMENT

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Agricultural biotechnologies have major potential for facilitating and promoting sustainable agriculture and rural development. They could also generate environmental benefits, especially where renewable genetic inputs can be effectively used to substitute for dependency on externally provided agrochemical inputs. The fact that genes or genotypes (e.g., varieties, breeds) can constitute locally renewable resources is of profound significance to the further development of sustainable agriculture and rural development. However, the power of modern biotechnologies to generate useful genotypes has not yet been harnessed for poorer farmers. Nevertheless, the extent to which modern biotechnology will contribute to the achievement of food security for all is still an open question. Science alone is unlikely to provide a complete solution to the problems of rural development. There are many processes, factors and socio-economic structures underlying poverty in rural areas, such as lack of access to land and other productive resources, low purchasing power, political powerlessness, fragile environments and distance from markets. Agricultural (or indeed plant biotechnology) research is but one factor which could impact on rural poverty; it is not a panacea for sustainable agriculture and rural development. Comparative reviews of the state of agricultural biotechnologies in some developing countries have been carried out by the International Service for National Agricultural Research — Intermediary Biotechnology Service, a Consultative Group on International Agricultural Research (CGIAR) centre, and the Organisation for Economic Cooperation and Development (OECD), which concluded that the majority of developing countries have limited practical access to the tools and germplasm necessary to apply more sophisticated biotechnology research to their national needs. The barriers to such access are many and include lack of financial, scientific and infrastructural resources.

SUSTAINABLE DEVELOPMENT OF LAND RESOURCES AND ITS MANAGEMENT

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India constitutes 18 per cent of the world's population, 15 per cent of the livestock population and only 2 per cent of the geographic area; one per cent of the forest area and 0.5 per cent of pasture lands. The per capita availability of forests in India is only 0.08 per ha. as against the world average of 0.8 per cent, thus leading to the pressure on land and forests. This poses a major and urgent concern. In accordance with the National Remote Sensing Agency's (NRSA) findings there are 75.5 million ha. of wastelands in the country. It has been estimated that out of these around 58 million ha. are treatable and can be brought back to original productive levels through appropriate measures. At the moment, taking into account the efforts being made by all the various players in this field treating facilities are in place only for around 1 million ha. Per year. The objectives to improve the management system of China's land resources are: First, the coordination of farmland protection, ecological protection and the relationship between non-agricultural land; The second is to coordinate between the central government and local government relations; Third, to coordinate the public interest and the personal interests of farmers relations; Fourth, to achieve the sustainable development of land resources. In order to achieve this goal, we must reform and improve the existing land management system, gradually improve the market allocation of land elements of a mechanism, through the market operation and government co-ordination with two reasonable ways to improve the degree of intensive land use to achieve the sustainable use of land resources.

Keywords: Livestock, Forests, Land Management, Sustainable.

ECOLOGICAL LITERACY: EDUCATING EVERY ONE FOR A SUSTAINABLE WORLD

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The ever increasing population and changing lifestyles are making the environmental problems more critical. Ecological literacy is about understanding the principles of organization of ecosystems and their potential application to understanding how to build sustainable human society. It combines the sciences of systems and ecology in drawing together elements required to foster learning processes toward a deep appreciation of nature and our role in it. Higher education can play a crucial role in sustainable development of any nation. Higher educational institutions can be the best solution to solve this situation. As environmental sustainability is becoming an increasingly important issue



for the world, the role of higher educational institutions in relation to environmental sustainability is more prevalent. Universities are the apex bodies in higher education system and can provide environmental education through its curricular design, research and collaborative efforts with NGO's working in those areas. They can provide trained manpower and knowledgeable expertise to solve critical environmental problems. This paper demonstrates how education for sustainable development has been embedded in environmental education programmes. It outlines the key concepts of education for sustainable development that are taught to students undertaking such environmental courses. The paper will be of interest to academics that are looking for ideas of how to embed education for sustainable development

Keywords: Ecological literacy, Role of Higher education, Environmental Protection, Universities, Sustainable Development

ARTIFICIAL NEURAL NETWORK AND MOLECULAR BIOMARKERS FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT IN RICE (*ORYZA SATIVA*) GROWN UNDER SALINE STRESS

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Plants encounter with various environmental factors during their life span including biotic, abiotic and climatic changes. Detecting the severity of stress (biotic or abiotic) is very difficult and time consuming in field condition. Digital image processing method is the use of computer algorithms to process the images by using Artificial Neural Network. It is very efficient for early detection of stress conditions. Salinity is one of the major challenges for the crop production in salt-affected soil. In the present study, we have analyzed the salinity effect at vegetative stage of paddy seedlings by using different image processing algorithms for feature extraction and classification. Image of the paddy leaves were collected and preprocessed. The affected portions were manually selected by choosing the region of interest. Then histogram was plotted for the region of interest. Textural based features were obtained using Run Length Matrix Method (RLM) and classified using Naïve Bayes approach. We also have analyzed the biochemical and molecular changes under saline stress and correlated with image processing data. The Real-Time PCR analysis of biomarkers involved in autophagy was also carried out to analyze the gene expression during salinity. The preprocessing of images, region of interest, feature extraction and classification methods showed efficient and rapid detection techniques to assess the salt stress severity at an early stage. Our finding suggested that artificial neural network for image processing analysis and naïve bayes approach is an efficient, effective and rapid method of detection of salinity stress. This technique will be helpful for early detection of abiotic stress induced by environmental factor and reduced the agronomic loss of crops. This combined neural network and biomarkers approaches will be useful for sustainable agricultural development.

APPLICATIONS OF PRECISION AGRICULTURE IN HORTICULTURAL CROPS

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Precision agriculture is a comprehensive system that relies on information, technology and management to optimize horticultural production. It involves the application of technologies and principles to manage spatial and temporal variability associated with all the aspects of horticultural crop production for improving crop performance and environmental qualities. In short it means adding the right amount of treatment at the right time and the right location within a field. The technical evolution in the horticultural production is accompanied by changes in cultural practices, new varieties or new chemical treatments. The successes of the past have generated new possibilities and new demands, for example, for an even further reduction of production costs under more severe market constraints or environmental pressure. Technological developments in electronics and sensors create the possibilities for a more precise production system that takes into account the natural variability of biological production and its environment. Some examples of possible applications of precision agriculture technology for production and postharvest treatment of crops are given. It makes it possible to monitor and control production quantity and especially quality such that the requirements of the consumers and the markets can be continuously taken into account during the production and post harvest process, from the planting to the eating. This technological development also requires a better understanding of the the biological processes and of the properties of the biological materials. This then can be used in concurrent engineering work in which biology; electronics, software and mechanics are bundled for new procedures in a quality assurance system of horticultural production. It leads to a horticultural production technology that enables to deliver products with a precisely specified quality using accurate and precise cultural practices.

Keywords: Precision agriculture, horticultural crops, postharvest, sensors and quality

THE ROLE OF ICT ON WOMEN EMPOWERMENT

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Information and Communication technology, is used as an extended synonym for information (IT), but is a more. Specific term that stresses the role of unified communication and the integration of telecommunications (telephone lines and wireless signal). 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 social and economic milieu. For rural women, participation in social network, relevance in society, freedom of movement, leadership in rural institutions, control on family formation decisions and assets are key precondition.



Empowering them to participate in economic and social progress, and make 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 30% and Wipro 29%. The major players in 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, e-learning center to support education and training of women and girls.

Keywords: Empowerment, information communication technology, women, internet.

ROLE OF MNREGA ON WOMEN EMPOWERMENT

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MNREGA is a job guarantee scheme for rural Indians. It was enacted by legislation on 25 August 2005, but the act was come in to force on 2 February, 2006. In phase one; it was introduced from the Anantpur District of A.P. National Rural Employment Guarantee Act (NREGA) and was renamed with the prefix “Mahatma Gandhi” on 2 October 2009, Gandhi’s birth anniversary. The scheme is being implemented in 150 most backward districts. This will later be scaled up to 600 districts. The scheme offers a guarantee of 100 days of paid employment at the level of minimum wages of the states. There is 33% reservation for women and there are expectations that 40% of the employment benefits would go to women. Thus one major objective of introducing the MGNREGA scheme is to ensure economic empowerment of women. The higher the income share of women, the more likely they will have a collective social voice and control over their life events. MGNREGA is its approach towards empowering citizen including women citizen to play an active role in the implementation of the scheme through Gram Sabha meetings, social audits, participatory planning and other activities. MGNREGA is considered to be an opportunity for rural poor, particularly the women, to earn a specified level of income with a sense of dignity. NREGA jobs and hence income may not be associated with a corresponding degree of economic empowerment of women members in the household. Uttar Pradesh job card holder in women 2015-16 5.38cr, and 2016-17 4.17cr. Women person days out of Total 56.08% 2016-17.

Keywords: Empowerment, women, MNREGA, Role

MUSHROOM CULTIVATION: A PRACTICE FOR EMPLOYMENT GENERATION OF RURAL YOUTH

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Mushroom cultivation is one of the agricultural activity in which rural youth can play a vital role without sacrificing their household responsibilities. Its cultivation is very simple, low cost, landless based activity, labour intensive and environmental friendly and based upon the utilization of agricultural wastes with protein rich materials. It can provide self-employment and earning extra money for both the semi-urban and rural areas, especially suitable for small, marginal poor farm household, farmwomen, landless labourers, rural unemployed youth and even retired or in-service person in order to raise their social-economic status through skill development. Apart from the socio-economic status of the mushroom growers, it is not only solve the problems related to employment of both literate and illiterate person (specially women) *vis-a-vis* considered as an alternative source of income to uplift the living standards of poor people’s and also to add high quality protein in their daily diets to eradicate malnutrition problems. The global food and nutritional security of growing population is also a great challenge, which looks for new crop as a source of food and nutrition. In this context, mushrooms find a favour which can be grown even by landless people, that too on waste material and could be a source for proteinoous food. Use of mushrooms as food and nutraceutical have been known since time immemorial, as it is evident from the description in old epics Vedas and Bible. Earlier civilization had also valued mushrooms for delicacy and therapeutic value. In the present time, it is well recognized that mushroom is not only rich in protein, but also contains vitamins and minerals, whereas, it lacks cholesterol and has low calories. Furthermore, it also has high medicinal attributes like immunomodulating, antiviral, antitumor, antioxidants and hepatoprotective properties. Constraints to production include lack of quality spawn, problem of pest and disease, complex process of obtaining loan and lack of proper skills in production. Recommendations were made around the aspects of training on mushroom cultivation, financial institutions should make loans flexible to farmers, government should encourage the use of laboratories to produce and distribute spawn and government should consider mushroom productions as an agricultural activities. It concluded that, mushroom farming may flourish like mushroom growth in the coming years; if the problems identified and attended urgently and remedial measures are undertaken at the earliest.

BLUE REVALUATION IS NEXT REVOLUTION FOR NUTRITIONAL SECURITY IN INDIA

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Fisheries is a sunrise sector with varied resources and potential, engaging over 14.50 million people at the primary level and many more along the value chain. The sector registered an overall annual growth rate of about 4% during the 11th Five Year Plan period. It has contributed about 0.91% to the National Gross Domestic Production (GDP) and 5.23% to the agricultural GDP (2014-15). Blue Revolution, the Neel Kranti Mission has the vision to achieve economic prosperity of the country and the fishers and fish farmers as well as contribute towards food



and nutritional security through full potential utilization of water resources for fisheries development in a sustainable manner, keeping in view the bio-security and environmental concerns. The vision of Blue revaluation is creating an enabling environment for integrated development of the full potential of fisheries of the country, along with substantially improvement in the income status of fishers and fish farmers keeping in view the sustainability, bio-security and environmental concerns. Objective of the blue revolution is to enhance the food and nutritional security of the country.

Keywords: Blue, Neel Kranti, GDP, Bio-security, Food.

A STUDY ABOUT SCALE TO MEASURE THE ATTITUDE OF RURAL WOMEN TOWARDS SELF HELP GROUPS

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The study about considering the growing significance of self-help groups for women empowerment, an attitude scale was developed to measure the attitude of rural women towards self-help groups by using equal appearing interval scale method. The present study was conducted in three blocks of Kanpur dehat district with a sample size of 220 women to measure their attitude towards SHGs. For the purpose of this study, attitude was operationalized as the mental disposition of rural women about self-help groups in varying degrees of favourableness or unfavourableness. Since the selected scale values should have equal appearing interval and distributed uniformly along the psychological continuum, it was necessary to form nine compartments so as to select nine statements at one statement from each compartment. Based on high scale and low Q values, nine attitude statements were finally selected and administered for assessing the women's attitude. The nine attitude items finally selected were arranged randomly in order to avoid biased responses. A five-point continuum of 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree' was used as response categories.

TO COMPARE IMPACT OF MNREGA ON SOCIO-ECONOMIC STATUS OF RURAL WOMEN IN UTTAR PRADESH AND BIHAR STATE

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Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) implemented by the Ministry of Rural Development (MoRD), is the flagship programme of the Government that directly touches lives of the poor and promotes inclusive growth. The study conducted in the Uttar Pradesh and Bihar States has investigated the impact of MGNREGA on socio-economic status (SES) of the rural women in two districts (Faizabad and Chhapra) from the selected two states respectively. Besides, demographic characteristic, the paper has investigated the differences in income and landholding size in the two districts by taking 120 farm families (60 beneficiaries and 60 non-beneficiaries) the impact of MGNREGA within the districts has also been studied in term of SES by seeking information from 30 beneficiaries and 30 non-beneficiaries households in MGNREGA works in each district. A significant difference has been found in the SES between both the categories in Chhapra district i.e. MGNREGA had helped the beneficiaries in raising SES in the community of Chhapra district as compared to Faizabad district where it has not been shown any significant difference in SES between these two categories.

ROLE OF MUTATION BREEDING IN SUSTAINABLE AGRICULTURAL PRODUCTION

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Mutation breeding is a fundamental and highly successful tool in the global efforts of agriculture to feed an ever increasing and nutritionally demanding human population. The physical and chemical mutagens, their effects and their utility are discussed. The induction of mutations has been used to enhance the yield, better nutritional quality and wider adaptability of world's most important crops such as cereals, pulses, millets and oilseeds. The total area covered by commercially released mutant cultivars clearly indicates that they have played a significant role in solving food and nutritional security problems in many countries. Mutation breeding employs three types of mutagenesis. These are induced mutagenesis, in which mutations occur as a result of irradiation (gamma rays, X-rays, ion beam, etc.) or treatment with chemical mutagens; site-directed mutagenesis, which is the process of creating a mutation at a defined site in a DNA molecule; and insertion mutagenesis, which is due to DNA insertions, either through genetic transformation and insertion of T-DNA or activation of transposable elements. Mutant confirmation, on the other hand, is the process of re-evaluating the putative mutants under a controlled and replicated environment using large samples. Through this process, many putative mutants are revealed to be false mutants. In general, the mutations that are important in crop improvement usually involve single bases and may or may not affect protein synthesis. These observations show that mutation breeding has had an ever-growing impact in crop production, especially in rice, as it is considered the most important food crop in the world.

Keywords: Mutation breeding, nutrition, physical and chemical mutagen, yield, mutants.



CITRUS IMPROVEMENT THROUGH CONVENTIONAL AND NON-CONVENTIONAL METHODS: CURRENT STATUS AND FUTURE PROSPECT

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Most citrus species are partially apomictic, which means that adventitious embryos initiate directly from maternal nucellar cells, precluding the development of zygotic embryos, and thus the recovery of sexual progeny. The plants also possess relatively long juvenile growth phase and most members grown in subtropical areas require at least 5 years before flowering. These features, together with the large plant size of citrus and high heterozygosity impeded the genetic improvement of citrus through conventional breeding methods. A higher number of varieties/genotypes with potential for commercial growing, either for the industry or fresh market, has been one of the main objectives of citrus breeding programs. Citrus breeding programs have many limitations associated with the species biology and physiology, requiring the incorporation of conventional and new biotechnological tools to provide new breeding possibilities. As immediate objectives of this review, the program aims at selection of genotypes, particularly rootstocks and scion varieties, tolerant to drought conditions and resistant to diseases such as Phytophthora root rot and the complex of Citrus Tristeza Virus - CTV, and adapted to high density tree population. The use of molecular markers for early selection of zygotic seedlings from controlled crosses resulted in the possibility of selection of a high number of new combination and, as a consequence, the establishment of a great number of hybrids in field experiments. The faster new tools are incorporated in the program, the faster is possibility to reach new genotypes that can be tested as a new variety. Good traits should be kept or incorporate, whereas bad traits have to be excluded or minimized in the new genotype. Scion and rootstock can not be considered separately, and graft compatibility, fruit quality and productivity are essential traits to be evaluated in the last stages of the program. The mapping of QTLs has favored breeding programs of several perennial species and in citrus it was possible to map several characteristics with qualitative and quantitative inheritance. The use and benefit of such informations will depend on the genetic basis of the breeding program.

Keywords: Citriculture, Breeding, Transgenic, New approaches, Disease resistance.

ADVANCES IN AGRICULTURAL AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT

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Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. According to IUCN Sustainable development is improving the quality of human life while living within the carrying capacity of supporting ecosystems. Biodiversity conservation and sustainable development are two inter-related branches focusing on social progress, economic growth and environmental protection on one side, and ecosystem conservation on the other. Conservation includes the efforts carried out in protected areas such as national parks and community reserves, and in other areas with rich and important biodiversity where conservation is not the main focus. It is in these latter productive landscapes where sustainability is needed most. Sustainable agriculture, sustainable fisheries and sustainable management of natural resources are the main approaches for preserving these landscapes for long-term social, economic and ecological benefits. Biodiversity provides people with basic ecosystem goods and services. It provides goods such as food, fibre and medicine, and services such as air and water purification, climate regulation, erosion control and nutrient cycling. Biodiversity also plays an important role in economic sectors that drive development, including agriculture, forestry, fisheries and tourism. More than three billion people rely on marine and coastal biodiversity, and 1.6 billion people rely on forests and non-timber forest products (e.g. the fruits from trees) for their livelihoods. Many people depend directly on the availability of usable land, water, plants and animals to support their families. In fact, ecosystems are the base of all economies. Biodiversity conservation in developing countries has its own set of challenges. Not only are there natural issues, such as climate change and climate variability effects, but many local communities rely on the natural resources they harvest and hunt in protected areas. Biodiversity conservation does not happen in a vacuum. It requires the participation of many different groups of people, working with various conservation mechanisms both in situ and ex situ. Biodiversity policy and conservation activities are informed, enhanced and driven by research and technology.

ORGANIC FARMING- A FARMER FRIENDLY VENTURE.

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IFOAM defines organic agriculture as a production system that sustains the health of the soil, ecosystems 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. Organic agriculture is developing rapidly and today at least 162 countries produce organic foods commercially. As per the estimates in the year 2012, organic food is produced in about 37.2 million hectares globally managed by more than 1.8million producers including small holders. The regions with largest organic land are Oceania (12.2 million hectare), Europe (9.3million hectare) and Latin America (8.6 million hectare).The countries with the most organic agriculture land are Australia, Argentina and the United States. India has a strong traditional farming system with innovative farmers, vast dry lands and least use of chemicals. In fact, the rain fed tribal, North- east and hilly regions of the country where negligible chemicals were used in agriculture, have been practicing subsistence agriculture for a long period and such areas are organic by default. Currently, India ranks 10th among the countries in terms of cultivable land under organic certification. The certified area



include 10% cultivable area with 0.5Mha and rest 90% (4.71Mha) is forest and wild area for collection of minor forest produces. The total area under organic certification is 5.21 million hectare (2012-13.) according to APEDA(2014). India produces around 1.34million MT of certified organic products which include all varieties of food products namely sugarcane, cotton, basmati rice ,pulses ,tea, spices, coffee, oilseed, fruits and other value added products. India exported 135 products during 2012-13 with the total volume of 165265MT including 4985MT organic textiles. The organic export realization was around 374 million US \$ including 160US \$ organic textile registering 4.38% growth over the previous year. The governments of mountainous states of Uttarakhand , Sikkim and Mizoram have under taken significant initiatives to turn their states completely organic. In Kashmir valley farmers are producing world class walnuts without any chemical and the produce is organic by default. Moreover, the rain fed areas in the upper reaches are also under mixed cropping with maize and pulses without fertilizers and pesticides. The organic agriculture can be selectively practiced in specific areas to cater to the demands of niche markets.

ORGANIC FORMULATION TO ENHANCE SEED GERMINATION IN CEREALS

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Now a day's Sustainable cultivation practices are the prime concern for the better environmental conditions, there is an ongoing need to reduce the use of chemical fertilizers and pesticides in agriculture and alternative to chemicals are being required to improve crop establishment and health. One choice is the use of organics nutrients or growth regulators to seed or roots, which may promote plant growth or provide diseases control through a variety of mechanisms, including supply of organic nutrients production of plant hormones, antibiotic or enzyme, induced systemic resistance and control soil born and seed born disease. Use of various organic formulations like panchagavya, jeevamrut, beejamrut and sole treatment of cow urine are beneficial for cereals to improve seed germination. In this view organic formulations are the potential source for the seed treatment with minimum input and to provide sustainable way of farming.

PRECISION AGRICULTURE IN CONSERVATION AGRICULTURE SYSTEM (PRECISION AGRICULTURE: A HIGH-TECH AGRICULTURE)

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Precision agriculture (high-tech agriculture, spatial variability management) is a site-specific management approach in modern crop production for applying agrochemicals to the field in an economic and environmentally sound fashion. Precision agriculture entails the collection and management of a wide variety of variable of agronomic information with purpose of identifying and meeting the real needs of variable parts of a field, through supplying what is actually needed rather than the average needs of the whole field, as in the case of conventional agriculture. Key objective of variable rate technology (VRT) strategy is to develop an accurate application map for the field to be used as the blueprint for determining the level and location of agronomic inputs applied to the field. This technology is applicable to a wide variety of agronomic production operations including tillage, fertilizer application, seed rate, pesticide application, irrigation etc. To be effective, each application requires a clearly developed accurate guide. Conventional ways of variable application of agronomic inputs are based on operator intuition, soil survey map, soil data from sparsely spaced grid samples and visual observation of variations in the field by the operator while traversing it. Modern strategies used in site specific applications involve dividing the field into smaller homogeneous management zones. A precision agriculture management zone is a sub region in the field that expresses a functionally homogeneous combination of yield limiting factors for which a single rate of a specific cropping input is appropriate. A good management zone strategy will maximize economic return by optimizing rates of yield limiting inputs and controlling the adverse effect of weeds and other crop pests.

ATTITUDE OF FARMERS TOWARDS E-CHOUPAL

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Recent advancements in Information and Communication Technologies (ICTs) coupled with its gradual and regulated expansion has changed the way information is processed, stored and communicated among different stakeholders. Consequently, a number of ICT initiatives have been launched in agriculture and rural development sector to provide agro-advisory services of varying nature and appropriate to diverse farming situations. The e-Choupal is one of such innovative and imaginative ICT initiatives started in India by ITC Limited, a private sector corporate business major in India. e-Choupal was established at Hoshangabad (M.P.) in June 2000, and till date more than 6500 e-Choupal is functioning in 10 states of India. The e-Choupal system provides farmers with information about latest market price of crop, up-to-date information on weather, a provision to sell crop harvest directly to the buyers, and sharing of good farming practices through its network. In this context it is important to study the attitude of farmers towards e-Choupal. The analytical research design of social science was used in conducting the study in Gonda district of Uttar Pradesh. Four villages purposively selected were Belsar, Chitnapur, Pure Dhirja and Mujheni, from each village 30 respondents were selected; total 120 farmers were selected randomly for the study. The result revealed that more than two-third (80.00 %) of the respondents had moderately favourable attitude followed by 13.33 per cent of respondents having highly favourable attitude and only 5.66 per cent respondent with least favourable attitude towards e-Choupal and it was found that annual income, education, cosmopolitaness, innovativeness, risk orientation, economic motivation, mass media exposure, extension contact and scientific orientation had significant and positive



relationship with farmer's attitude towards e-Choupal. The findings of the study will be useful first to the e-Choupal network for future expansion, and then also to extension administrators, planners, extension personnel and others who are involved directly or indirectly in the planning and policy making to form a proper framework for promotion of ICT in agriculture and rural development sector.

IMPORTANCE AND CONSTRAINTS OF ORGANIC AGRICULTURE IN INDIA

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The intensive system of farming is becoming unsustainable as evidenced by declining crop and factor productivity, the occurrence of multi-nutrient deficiencies and overall decline in the productive capacity of soil due to non-judicious fertilizer and damage to environment and increasing chemical contaminations etc. There is a need of an alternative agriculture method which can help to develop a friendly eco-system while sustaining and increasing the crop productivity. Organic farming is recognized as the best known alternative to the modern intensive agriculture which is a holistic production management system, avoid or minimize the use of synthetic fertilizers, pesticides and antibiotics and promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and biological activities, avoiding leaching losses and runoff and reducing soil erosion by enhancing soil structure. Area under such farming is increasing in India and abroad over the years. But, major weaknesses of organic agriculture in the country are poor linkages between the farmers and markets and absence of financial support from the governments. An appropriate national agriculture policy is required that give a prominent place to organic farming addressing the issues related to its coverage, financial support, creation of linkages among the farmers, marketing agencies and consumers. They instead rely on biological pest control and specific soil management techniques, such as crop rotations including grass/clover leys, winter break and catch crops and green manures, crop residue management and manuring, to control plant diseases and pests, maintain soil fertility and improve physical soil properties.

IMPORTANCE OF GREEN MANURING IN SUSTAINING AGRICULTURE

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Continuous cropping and frequent cultivation of soil result in breaking down of crumbs of aggregates and destruction of organic matter leading to depletion of soil fertility. Intensive use of inorganic fertilizers degrades and emits toxicants of chemicals that enter the food chain endangering the whole life sustaining system through nitrate poisoning. The use of chemical fertilizers is the quickest and the shortest way of boosting crop production. But fossil fuel resources are shrinking with escalating costs. Hence the alternate sources of plant nutrients is essential. Applying organic matters (by green manuring), recycling organic wastes and enhancing biological nitrogen fixation combined with the use of mineral fertilizers are a few measures to maintain an adequate level of soil fertility for sustainable farming.

Green manures can be defined as any crops or plants grown and ploughed into the soil to improve soil fertility by the addition of organic matter and nitrogen. For green manuring, fast growing legumes with more vegetative growth should be used. *Crotalaria juncea* and *Sesbania speciosa* are the common green manures in South India which produce relatively higher biomass and accumulate more nitrogen. Green manuring should be encouraged where irrigation facilities are available. For effective green manuring, legume crops are grown for 40-50 days (before flowering) to attain full vegetative growth and then ploughed in the same field before sowing the next crop. Growing of green manure crops in the off-season, reduces weed proliferation and weed growth. It helps in reclamation of alkaline soils. Root knot nematodes can be controlled by green manuring. Hence, green manures are a useful tool for sustainability in productivity.

INTEGRATED NUTRIENT MANAGEMENT IN KHARIF SORGHUM (*Sorghum bicolor* L.)

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The field experiment was conducted at Sorghum Research Station, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani. Dist. Parbhani during *kharif* season of 2015 to study the "Integrated Nutrient Management in *Kharif* Sorghum (*Sorghum bicolor* L.)". The experiment was laid out in randomized block design with three replications and variety CSH -16 as test crop along with nine (09) treatment combinations. Gross and net plot size was 4.5 x 5.0 m and 3.6 x 4.4 m, respectively. Seeds were treated with insecticide (Emamectin benzoate) and biofertilizer like PSB and *Azospirillum*. Sowing was done on 21st June 2015 by seeds are dibbling and distance between 45cm x 15 cm.

The study revealed that the application of 75% RDN through inorganic fertilizer + 25% RDN through vermicompost + seed treatment with PSB + *Azospirillum* (T₈) gave significantly higher grain yield (2356.89 Kg ha⁻¹), fodder yield (5450.31 Kg ha⁻¹) and biological yield (7807.20 Kg ha⁻¹) over rest of the treatments, however it was at par with application of 75 % RDN through inorganic fertilizer + 25% RDN through FYM + seed treatment with PSB + *Azospirillum* (T₇). Similar trend was observed with gross monetary returns, net monetary returns and B:C ratio.

INTEGRATED NUTRIENT MANAGEMENT IN CABBAGE (*BRASSICA OLERACEA* VAR. *CAPITATA* L.)

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A field experiment entitled “Integrated Nutrient Management in Cabbage (*Brassica oleracea* var. *capitata* L.)” was conducted during Rabi season, 2015-16 to study the effect of different nutrient sources on growth, yield and quality of cabbage. The treatments consist of different combination of inorganic fertilizers and organic manures along with biofertilizer. There are total 17 treatment combinations and experiment was laid out in RBD with three replications. Investigation of results indicated a remarkable significant influence on all the vegetative growth attributes (plant height, plant spread, number of outer leaves per plant, days to head initiation and head formation), yield parameters (weight of head, volume of head, biological yield and head yield) and quality attributes (ascorbic acid, chlorophyll content, protein content, NPK content & uptake and NPK use efficiency) in different sources of nutrients. The treatment 100% RDF + 5 t Vermicompost + *Azotobacter* (T_{17}) exhibited maximum plant height at 45 DAT (24.99 cm) & harvest (30.80 cm), plant spread (42.02 cm²), outer leaves per plant (18.62), weight of head (0.938 kg), volume of head (1.107 cc), biological yield (1.209 kg plant⁻¹), head yield (377.60 q ha⁻¹), ascorbic acid (35.42 mg/ 100 g), chlorophyll content (0.771 mg/ 100g), protein content (19.03 %), nitrogen content (3.04 %), phosphorus content (0.281 %), potassium content (3.75 %), nitrogen uptake (114.97 kg), phosphorus uptake (10.56 kg) and potassium uptake (141.74 kg). Similarly, in respect to earliness i.e., days to head initiation (43.19 days) and head formation (70.21 days) T_{17} (100% RDF + 5 t Vermicompost + *Azotobacter*) treatment was better than all other treatment combination. Maximum nitrogen (44.72 kg kg⁻¹) and phosphorus use efficiency (7.88 kg kg⁻¹) were recorded with 75% RDF + 10t FYM + *Azotobacter* (T_{10}) and it was superior to all other treatments. However, potassium use efficiency (99.73 kg kg⁻¹) was highest in treatment 75 % RDF + *Azotobacter* (T_8). The highest net return (Rs. 2,25,267 ha⁻¹) and B: C ratio (3.50) were recorded in 100 % RDF + 5 t vermicompost + *Azotobacter* (T_{17}) and 75 % RDF + *Azotobacter* (T_8), respectively.

INTEGRATED NUTRIENT MANAGEMENT IN SUSTAINABLE AGRICULTURE BY IMPROVING SOIL FERTILITY, CROP GROWTH AND CROP PRODUCTIVITY

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Current soil management strategies are mainly dependent on inorganic chemical-based fertilizers, which caused a serious threat to human health and environment. Plant nutrients are essential for the production of crops and healthy food for the world's expanding population. Plant nutrients are therefore a vital component of sustainable agriculture. Increased crop production largely relies on the type of fertilizers used to supplement essential nutrients for plants. The nature and the characteristics of nutrient release of chemical, organic and biofertilizers are different, and each type of fertilizer has its advantages and disadvantages with regard to crop growth and soil fertility. The eco-friendly approaches inspire a wide range of application of plant growth promoting rhizobacteria (PGPRs), endo- and ectomycorrhizal fungi, cyanobacteria and many other useful microscopic organisms led to improved nutrient uptake, plant growth and plant tolerance to abiotic and biotic stress. The present review highlighted biofertilizers mediated crops functional traits such as plant growth and productivity, nutrient profile, plant defense and protection with special emphasis to its function to trigger various growth- and defense-related genes in signaling network of cellular pathways to cause cellular response and thereby crop improvement.

EFFECT OF ORGANICS AND INORGANICS APPLICATION ON PRODUCTIVITY AND CHEMICAL COMPOSITION OF SOYBEAN GROWN IN SEMI-ARID VERTISOLS

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A permanent field experiment is continuing since 1972 on a swell-shrink soil at Research Farm, ACRIPDA, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, College of Agriculture, Indore (M.P.) the experiment was conducted during kharif season of the (2014-15) with a view to study the Effect of Organics and Inorganics Application on Productivity and Chemical Composition of Soybean Grown in Semi-arid Vertisols. The treatment comprised different levels of RDF viz., $N_{20}P_{13}$, $N_{30}P_{20}$, $N_{40}P_{26}$, $N_{60}P_{35}$ of recommended NP along with FYM and crop residue. Addition of organic along with chemical fertilizer and alone reduced the bulk density, due to reduced bulk density the porosity of soil has also increased in organic amendments treated plots. The moisture content is higher in organically amended soils when moisture availability is low. The chemical properties of soil the treatments involving FYM and crop residue resulted in a considerable buildup of soil fertility particularly available N, P and organic carbon content in plough layer. The highest available nutrient content was observed in T_6 (307 kg/ha N, 13.53 kg/ha P_{2O_5} , 0.87% O.C.). Superiority of the treatments involving FYM may be due to improvement of various physico-chemical properties of soil and increased availability of plants nutrients.

RESILIENCE THINKING: SUSTAINING INDIAN AGRICULTURE IN A CHANGING CLIMATE

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Indian agriculture faces high degree of sensitivity to climate change, which is compounded in areas of extreme poverty and high dependency on agriculture. The anticipated changes in climate as well as their associated impacts are all likely to affect substantially the potential of future agriculture in India. The agriculture sector in India is susceptible to the frequent and erratic climatic irregularities. Anticipated changes in the climate due to intensive anthropogenic activities may cause worst conditions. The climatic changes led to increase in temperature and water stress, which caused heavy losses in yield of any crop. It may be a big challenge for the agriculture scientists and country leaders to feed the coming future Indian population sufficiently. Development of new climate resilient crop varieties, generation of renewable energy resources and use of green technologies might be helpful for mitigating the impact of climate change and sustained agriculture productivity in near future. To cope with intense changes as projected in climate, new research paradigm of bringing all stake holders is urgently required to establish suitable long-term strategies for addressing the Indian agriculture sustainability.

EFFECT OF ORGANIC MANURE ON GROWTH CHARACTERS OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.) CV. PUSA NARANGI GAINDA

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A field experiment was conducted to evaluate the plant growth characters of African Marigold cv. Pusa Narangi Gainda at Horticulture Research Center (HRC), of Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram Meerut during summer season in year 2017. The experiment was laid out in R.B.D. with three replications and seven treatments separately. Studies showed that the maximum effect on plant height (62.70cm), no. of branches per plant (9.86) and total no. of flowers per plant (38.40) was recorded maximum in treatment with T₇ (vermicompost) @ 20 t ha⁻¹ followed by, (58.80cm) plant height, (8.40) no. of branches per plant, (34.68) total no. of flowers per plant obtained from treatment T₃ (FYM) @ 20 T ha⁻¹ under western agro-climatic conditions of Uttar Pradesh.

PRECISION AGRICULTURE IN CONSERVATION AGRICULTURE SYSTEM

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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. In addition to cutting production costs and saving energy, precision agriculture reduces environmental pollution and improves water quality by reducing nutrient runoff. Other benefits include viz-improved crop yield, reduced compaction by limiting traffic to specified travel lanes, increased opportunity to operate equipment after dark, labor savings through reduced implement overlap and More accurate farming records.

INTELLECTUAL PROPERTY RIGHTS IN INDIA

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Intellectual property rights are like any other property right. They allow creators, or owners, of patents, trademarks or copyrighted works to benefit from their own work or investment in a creation. Intellectual property has increasingly assumed a vital role with the rapid pace of technological, scientific and medical innovation that we are witnessing today. Moreover, changes in the global economic environment have influenced the development of business models where intellectual property is a central element establishing value and potential growth. In India several new legislations for the protection of intellectual property rights (IPRs) have been passed to meet the international obligations under the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). Intellectual property has therefore grown into one of the world's biggest and fastest-growing fields of law thereby necessitating the demand for IP professionals well versed in this area to deal with (IPRs) across the national and international borders. While writing the study material, relevant provisions of the various Acts and Rules made thereunder have been kept in mind. This paper warrants continuous updation in terms of substantive and procedural laws as well as latest judicial pronouncements. Although care has been taken in publishing this study material yet the possibility of errors, omissions and discrepancies cannot be ruled out. This publication is released with an understanding that the Institute shall not be responsible for any errors, omissions and/or discrepancies or any action taken in that behalf. In the event of any doubt.



EFFECT OF ORGANIC MANURES AND MICRONUTRIENT ON GROWTH, YIELD AND QUALITY OF TOMATO (*SOLANUM LYCOPERSICUM* L.)**Bhanu Prakash Singh and Dr. S. Saravanan**

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An investigation was under taken at Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during Rabi season of 2016-17. The experiment was laid out in randomized block design with 12 treatments replicated thrice. The treatments consisted of different combinations of organic manures and micronutrients i.e., FYM, Vermicompost, Boron and Zinc. Among 12 treatments under study, treatment T₁₂ [RDF + FYM (5 t/ha.) + Vermicompost (1.25t/ha.) + Boron (0.62kg/ha) + Zinc Sulphate (1.5kg/ha)] was best in all characters and recorded maximum @ 30, 60 and 90 DAP in plant height (23.33cm, 63.87cm and 130.53cm), No. of branches (1.87, 3.93 and 6.53) and No. of leaves (37.86, 86.53 and 117.07); and also treatment T₁₂ [RDF + FYM (5 t/ha.) + Vermicompost (1.25t/ha.) + Boron (0.62kg/ha) + Zinc Sulphate (1.5kg/ha)] was found highest with total number of fruits per plant (30.23), average fruit weight (81.12g), diameter of fruit (5.61cm), fruit yield per plant (2.75kg), fruit yield per plot (22.03 kg) and fruit yield per hectare (91.79 ton) and also found significantly best in quality traits i.e. TSS (4.40⁰B), Vitamin C (25.00mg) and acidity (1.07%) followed by the treatment T₁₁ [RDF + FYM (10 t/ha.) + Vermicompost (1.25t/ha.) + Boron (0.3kg/ha) + Zinc Sulphate (0.75kg/ha)] and treatment T₉ [RDF + Vermicompost (2.5 t/ha.) + Boron (0.62kg/ha) + Zinc Sulphate (1.5kg/ha)].

INDIGENOUS TECHNICAL KNOWLEDGE OF FARMERS OF KANDI BELT OF JAMMU REGION**Neerja Sharma^{*}, R.K.Arora^{**}, Pawan Sharma^{***}, Vinod Gupta^{*}, Sanjay Khajuria^{*}, Amit Mahajan^{*}, Shalini Khajuria**^{**}Krishi Vigyan Kendra ,Samba, ^{**}Directorate of extension, ^{***} Krishi Vigyan Kendra ,Kathua, Sher-e-Kashmir University of Agricultural Sciences &Technology, Jammu-180009,India

The term indigenous knowledge, traditional knowledge and ethno science have been used interchangeably to describe the knowledge system of an ethnic rural group that has originated locally and naturally. Indigenous knowledge is an essential cultural and technological element of human society and community which provide valuable insights to sustainable farming process. It is holistic in nature, because it treats the farming system as an interdependent part of the whole environment, nature and bio diversity. Indigenous knowledge systems refer to the ways by which members of a given community define and classify phenomena in the physical , natural and social environment .examples are local classification of soils, crops , plants, livestock etc. such knowledge provides the background for local level decision making . Every society has stock of knowledge generated within sociocultural system in order to solve the problem unique to it. Such indigenous knowledge is not only economically viable but also locally feasible. Undesirable consequences of new and exogenous technologies have drawn attention of experts to ITK. However wide variety of ITK is highly localized and restricted for outsiders because of indigenous overtones. It is passed on from one generation to another through word of mouth. Such knowledge is product of trial and error, natural selection and keen observations through centuries. Many of the traditional knowledge in agriculture are always targeted for productivity, sustainability, stability and equality. The rural people of Jammu region make traditional uses of natural growing vegetation. Farmers make use of wild grown bushy shrub *Carissa spinarum* locally grown as Gharna as fodder for goat and sheep and for fencing of crop fields beside using it as fruit. *Zizyphus nummularia* and *Z. xylopyra* locally known as Phoakar and Kathi ber are used for fruit ,fuel ,fodder and fencing purpose. Its wood is used for making agricultural implements like handle of Desi plough, locally known as Dandi. *Acacia nilotica* and *A.modesta* are used for making traditional agricultural implements locally known as Sohaga, Panjali and Sangi. Sohaga is used for planking of fields. Sangi is used fencing and Panjali is put around the neck of bullocks and ox for ploughing. The flowers of tree species like *Moringa oleifera*(Sohanjana),*Bauhinia variegata*(Karal) are used as vegetables and for making pickles. As a traditional practice farmers grow marigold on the bunds of maize crop field s to protect it from attack of Blister beetles. Such lots of indigenous practices are carried out by the farmers. Sharing this knowledge with the farmers will help them in restoring the pride in their innovative potential . Farmer to farmer communication and learning would be feasible if ITK of one region is shared in other region.

RESPONSE OF VERMICOMPOST AND NITROGEN ON GROWTH, YIELD AND QUALITY IN BOTTLE GOURD [*LAGENARIASICERARIA* (MOL.) STANDL.]**Karshan Kumar^{*}, P.K. Yadav^{*} and Desh Raj Choudhary^{**}**^{*}Department of Horticulture, College of Agriculture, SKRAU, Bikaner, ^{**}Department of Vegetable Science, CCS HAU, Hisar-125 004

In the present investigation, the response of bottle gourd to different levels of vermicompost (control, 3, 6 and 9 tones ha⁻¹) and nitrogen (control, 50, 75 and 100 kg ha⁻¹) was studied at SKRAU,Bikaner during summer season of 2016. The vermicompost applied at the rate of 6 tones ha⁻¹ has shown least number of days for appearance of first female flower, while number of primary branches per vine, length of leaf (cm), per cent fruit set, fruit length, weight and total yield per vine etc. were found maximum in plants applied with 9 tones ha⁻¹. The application of increasing levels of nitrogen 100 kg ha⁻¹ has significantly increased the length of leaf, per cent fruit set, number of fruits per vine, fruit length, weight and total yield per vine etc., chlorophyll content in plant (mg/100), P uptake by plant and available N content in soil after harvesting compared to the control. The treatment combination of vermicompost (9 t ha⁻¹) + nitrogen (100 kg ha⁻¹) has showed maximum number of primary branches per vine, leaf length (cm), per cent fruit set, number of fruits per vine etc. compared to the control plants. The maximum yield (q ha⁻¹) was found under the treatment combination of vermicompost (9 t ha⁻¹) + nitrogen (100 kg ha⁻¹) while remaining treatment combinations was at par with each other. The higher nitrogen content as well as B: C ratio (1.70) in plant was observed in the treatment combination of vermicompost (6 t ha⁻¹) + nitrogen (100 kg ha⁻¹).



SRI METHOD OF PADDY CULTIVATION: AN ALTERNATIVE ECONOMIC APPROACH

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Agriculture is the backbone of Indian economy. It provides employment to 52 per cent of the total labourforce and contributed approximately 14 per cent of the Indian GDP. Indian population continues to increase. It increases 36 crore in 1951 to 121 crore in 2011 same times food grain production increased from 50.82 million tones to 241.5 million tones. During same time paddy production also increased from 20.58 MT to 95.33 MT. A major issue with the traditional system of paddy cultivation is high water demand. Water demand of rice farmers are a continue increasing under such circumstances, any strategy that could produce higher rice yields with less water and less expenditure is the need of the day. Under such circumstances the system of rice intensification (SRI) method was suitable and followed by the farmers. SRI method of rice cultivation was developed by Fr. Henri de Laulanie in Madagascar in 1980. System of rice intensification is a method for increasing the productivity of rice cultivation while at the same time reducing inputs, including seeds and fertilizers, and water requirements. Under SRI paddy fields are not flooded, but kept moist during vegetative, phase. Later only one inch water is maintained. SRI requires only about half as much water as normally applied in irrigated rice. If we follow the SRI method of paddy cultivation it will reduce the cost of paddy cultivation and same time will save the water, which can be used in other crops and other purposes. The present study was conducted in *Hindebli, Kuchu, Tapa, Khulsi* and *Bundu* villages of *Ormanjhi*, block of *Ranchi* district Jharkhand.

SUGGESTIONS OF STUDENTS TO IMPROVE RURAL AGRICULTURE WORK EXPERIENCE PROGRAMME IN RAJASTHAN STATE

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The present study was conducted in the State Agriculture Universities of Rajasthan. There are 3 Agriculture colleges Viz. S.K.N. College of Agriculture, Jobner (SKNAU, Jobner), Rajasthan college of Agriculture, Udaipur (MPUAT, Udaipur) and college of Agriculture, Bikaner (SKRAU, Bikaner) where the PG degree in agriculture is offered and RAWE programme is being conducted for last 10 years. Hence only these three colleges have been selected for the study. Total 90 students were selected for the study randomly. The study shows that "Duration of village attachment programme in RAWE to be increased" (85.55 MPS), was perceived as the biggest suggestion with high intensity given by students followed by "Students to be placed in ideally functioning institutions only" and "Students should be allowed to take up individual projects in their areas of interest in RAWE" both (81.11 MPS) in village attachment. "More orientation to be given to students in areas of post harvest operations and marketing aspects" was most important suggestion with 81.11 MPS given by respondents in skill training. In educational tour "Tour should be on the basis of all India" (86.93 MPS) was perceived as major suggestion, followed by "All the major agricultural institutes of India should be visited" (86.03 MPS) suggested by the students.

ORGANIC FARMING- A FARMER FRIENDLY VENTURE

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IFOAM defines organic agriculture as a production system that sustains the health of the soil, ecosystems 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. Organic agriculture is developing rapidly and today at least 162 countries produce organic foods commercially. As per the estimates in the year 2012, organic food is produced in about 37.2 million hectares globally managed by more than 1.8million producers including small holders. The regions with largest organic land are Oceania (12.2 million hectare), Europe (9.3million hectare) and Latin America (8.6 million hectare). The countries with the most organic agriculture land are Australia, Argentina and the United States. India has a strong traditional farming system with innovative farmers, vast dry lands and least use of chemicals. In fact, the rain fed tribal, North- east and hilly regions of the country where negligible chemicals were used in agriculture, have been practicing subsistence agriculture for a long period and such areas are organic by default. Currently, India ranks 10th among the countries in terms of cultivable land under organic certification. The certified area include 10% cultivable area with 0.5Mha and rest 90% (4.71Mha) is forest and wild area for collection of minor forest produces. The total area under organic certification is 5.21 million hectare (2012-13.) according to APEDA(2014). India produces around 1.34million MT of certified organic products which include all varieties of food products namely sugarcane, cotton, basmati rice ,pulses ,tea, spices, coffee, oilseed, fruits and other value added products. India exported 135 products during 2012-13 with the total volume of 165265MT including 4985MT organic textiles. The organic export realization was around 374 million US \$ including 160US \$ organic textile registering 4.38% growth over the previous year. The governments of mountainous states of Uttarakhand, Sikkim and Mizoram have under taken significant initiatives to turn their states completely organic. In Kashmir valley farmers are producing world class walnuts without any chemical and the produce is organic by default. Moreover, the rain fed areas in the upper reaches are also under mixed cropping with maize and pulses without fertilizers and pesticides. The organic agriculture can be selectively practiced in specific areas to cater to the demands of niche markets.



SUSTAINABLE DEVELOPMENT OF LAND AND WATER RESOURCES USING REMOTE SENSING & GIS TECHNOLOGY, CHITRAKOOT DISTRICT (U.P.)

Nipun Kumar Pandey, Beena Singh

M.G.C.G.V.Chitrakoot,Satna M.P.

Due to rapid urbanization in the study area, demand for water Consumption has increased at an unprecedented rate. Statistics on water availability in the study area has already revealed that water table has gone down remarkably in last 2-3decades. Nevertheless, the area has sufficient potential to feed on the ever increasing demand of water if harvest and conserve properly. Site selection for RWH is carried out by overlying the slope, soil, land use/land cover & buffered stream order maps. The study area is having full scope for storage tanks, percolation tanks, stop dam and check dams. Produced map will help in the selection of the suitable location of harvesting structures and hence, help in water conservation in water depleted area. Thus, integrated remote sensing and GIS can provide the appropriate platform for analysis of multi disciplinary data and sustainable development of land and water resources. Remote sensing data can especially play significant role in generation of parameters from remote areas of watershed and enable us to arrive at natural resource management solutions by adopting a holistic approach. The soil conservation service model was applied by using average annual rainfall for the period 2000 to 2011 in Pisangan area to estimate the runoff depth. The analysis of rainfall indicates that a significant amount of annual runoff depth can be harvested. Using GIS techniques, these databases can be converted to information about land use/land cover mapping and change detection, runoff estimation, soil erosion study, site suitability analysis for rain water harvesting, watershed prioritization etc. can be effectively carried out using GIS techniques. The remote sensing technology could be used for monitoring the progress of implementation work and also assess the impact of the implementation.

ROLE OF GREEN MANURING IN SUSTAINABLE CROP PRODUCTION

Bsta Ram Chaudhary

Green manuring is most impactive component of organic farming for sustaining crop production and soil health.Incorporation of cover crops into the soil allows the nutrients held within the green manure to be released and made available to the succeeding crops. This results immediately from an increase in abundance of soil microorganisms from the degradation of plant material that aid in the decomposition of this fresh material. This additional decomposition also allows for the re-incorporation of nutrients that are found in the soil in a particular form such as nitrogen (N), potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg), and sulfur (S).Average biomass yields of several legumes by cropegSweet clover, Berseem clover, Crimson clover, Hairy vetch (1.75,1.10,1.40 and 1.75 respectively) and nitrogen yields (120,70,100 and 110 lbs acre⁻¹) respectively. Green manure is broken down into plant nutrient components by heterotrophic bacteria that consumes organic matter. Warmth and moisture contribute to this process, similar to creating compost fertilizer. The plant matter releases large amounts of carbon dioxide and weak acids that react with insoluble soil minerals to release beneficial nutrients. Soils that are high in calcium minerals, for example, can be given green manure to generate a higher phosphate content in the soil, which in turn acts as a fertilizer.The ratio of carbon to nitrogen in a plant is crucial factor to consider a, since it will impact the nutrient content of the soil and may starve a crop of nitrogen, if the incorrect plants are used to make green manure. The ratio of carbon to nitrogen will differ from species to species, and depending upon the age of the plant. The ratio is referred to as C:N. The value of N is always one, whereas the value of carbon or carbohydrates is expressed in a value of about 10 up to 90; the ratio must be less than 30:1 to prevent the manure bacteria from depleting existing nitrogen in the soil. Rhizobium are soil organisms that interact with green manure to retain atmospheric nitrogen in the soil.Legumes, such as beans, alfalfa, clover and lupines, have root systems rich in rhizobium, often making them the preferred source of green manure material.

ENHANCE THE ORGANIC MATTER IN SOIL THROUGH MODERN AGRICULTURAL PRACTICES

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Soil organic matter (SOM) is the organic matter component of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organisms. Plants produce organic compounds by using sunlight energy and combining carbon dioxide from the atmosphere with the help of water from the soil. Soil organic matter is created by the cycling of these organic compounds in plants, animals, and microorganisms into the soil. Well-decomposed organic matter forms humus, a dark brown, porous, spongy material that provides a carbon and energy source for soil microbes and plants. When soils are tilled, organic matter previously protected from microbial action is decomposed rapidly because of changes in water, air, and temperature conditions, and the breakdown of soil aggregates accelerates erosion. A soil with high organic matter is more productive than the same soil where much of the organic matter has been "burned" through tillage and poor management practices and transported by surface runoff and erosion. However, organic matter can be restored to about 60 to 70% of natural levels with best farming practices.

ORGANIC WEED MANAGEMENT IN FIELD CROPS

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One technology which has a potential to yield substantial increase in the production of food grains is proper weed management as weeds alone are known to account for about 15 to 85 per cent losses in the productivity. A recent estimate says that weed accounts for 45 % of total



annual of loss of crop production in India. The annual loss due to weeds could be equivalent to nearly Rs. 2700 crores in India. In our country we use excessive amount of herbicide that leads to poor soil health and human/animal health hazard. So we need another economical and sustainable way of weed control. So in that situation organic weed management is a better option for controlling weed. The losses due to weed is more in *Kharif* season crops compared to *rabi* season crops (Wall and Smith, 2000). Rice yield was greater when rotated with hyacinth bean or velvet bean than in continuous crop with or without N application. It was concluded that legume in rice rotation reduces weed competition and improves the yield of rice (Marengo and Santosh, 1998). Wheat cultivar PBW 621 had a competitive advantage over weeds as it recorded minimum weed dry weight and highest grain yield (Kaure et al., 2014). The plant population of 50 plants/m² was found to be significantly superior and it recorded significantly less weed dry matter and highest grain yield compared to other population levels (Walia et al., 2005). Weeding of rice three times, especially at 20, 35 and 50 days after emergence gave relatively better yield and found cost effective and recommendable under conditions (Jemberie et al., 2013). The essential oil of *Eucalyptus tereticornis* shows toxicity towards *Echinochloa crus-galli* and has potential to be used as bioherbicide (Vishwakarma and Mittal, 2014). It can be concluded that organic weed management can play an important role for controlling the weed and increasing the crop production. Integration of methods like cultural, mechanical and biological methods can improve the productivity without any adverse impact on soil and human health. Organic weed management emphasises balancing the detrimental effects of weeds (e.g. loss of crop quality or yield) with the beneficial aspects (e.g. biodiversity or pest control).

ORGANIC AGRICULTURE: WAY TO SUSTAIN LIFE

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An experiment was conducted at Medicinal Plants Research and Development Centre (MRDC) of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, District Udham Singh Nagar, India, during *Kharif* season of 2016, to study the effect of biozyme (liquid fermented product contain cow urine, cow dung, pulse flour, jiggery and microbial rich forest soil) on soil microbial population, nutrient availability and to optimize its rate of application for brahmi crop (*Bacopa monnieri* L. var. CIM- Jagriti). The experiment was laid out in randomized block design (RBD) having thirty plots with ten treatments and three replications. The experimental soil was sandy clay loam in texture, neutral in reaction, having pH 6.9, medium in organic carbon (0.64%), low in available nitrogen (180.78 kg ha⁻¹) and medium in both available phosphorus (20.14 kg ha⁻¹) and potassium (200.64 kg ha⁻¹). The results revealed that microbial population was significantly increased on application of biozyme @ 5000 ltr ha⁻¹ which was at par with biozyme 4000 ltr ha⁻¹. NPK availability was highest in treatment consisting of biozyme 5000 ltr ha⁻¹ thus from the above study it was observed that biozyme @ 4000 ltr ha⁻¹ gave equal yield as compare to chemical fertilizer, farmyard manure and vermicompost.

Keywords: Biozyme, Farmyard manure, vermicompost, brahmi

SMART FERTILIZER FOR SUSTAINABLE CROP PRODUCTION

Joginder Pabnawa

Work should begin now on the next generation of fertilizer products using advanced techniques such as nanotechnology and molecular biology, especially in conjunction with plant genetics research. 'Smart' fertilizer products that will release nutrients only at the time and in the amount needed should be developed." (Dr. Norman Borlaug, 1970 Nobel Laureate). With the global uprising in population and rapid urbanization, agronomists are left with the critical duty of feeding more people from agricultural fields which are decreasing correspondingly. Investigations show that, the world population is expected to be 9.1 billion people by 2050. If food consumption in developed countries is coordinated by the other parts of the world and these people are to be fed adequately, total food consumption will have to rise by 50–70%. The plant use efficiency of the current bulk fertilizers is marred by high leaching of nutrients away from the rhizosphere, their fixation in the soil to forms that are not readily bio available to the plant, as well as other forms of losses such as volatilization. Nanotechnology offers a great opportunity to enhance the use efficiency of fertilizers. Slow release of fertilizers implies that both leaching and fixation of nutrients could be reduced, with such release permitting a better timing of nutrient availability and plant nutrient need. In the case of nutrient-deficient soils, because nanoparticles inherently release soluble ions faster than bulk particles, enhanced and sustained release of nutrients from nano materials will be important in supplying nutrients in a quick and timely manner, in contrast to slow release. Slow release of nutrient element negates the possibility of attainment of biotoxic levels of mineral nutrients and reduces loss due to leaching or fixation. At relevant concentrations, iron oxide (magnetite/hematite [Fe₃O₄/Fe₂O₃]) and Mn nano particles have shown beneficial effects on plants through the stimulation of chlorophyll production or the enhancement of the rate of photosynthesis. In addition to boosting chlorophyll formation, iron oxide nano particles also could reduce the severity of chlorosis in plants. Other nano particles synthesized from non-mineral nutrients have also demonstrated positive effects on plants.

SOIL HEALTH MANAGEMENT THROUGH CARBON SEQUESTRATION FOR SUSTAINABLE AGRICULTURE

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Agricultural soils generally have lower organic matter content than natural lands because of reduced C input (due to annual harvest and removal of crop residue, etc.), high organic C decomposition (due to frequent tillage), increased soil erosion (Lal, 2004) and other factors. Many studies have demonstrated that improved management practices can increase the C content of arable soils towards the levels found in natural lands (Smith et al., 2000; West and Post, 2002). Increasing agricultural soil stocks has been suggested as an important measure to sequester



CO₂ from the atmosphere to help stabilize atmospheric CO₂ concentrations and has been estimated that 0.4–0.9 Pg C year⁻¹ can be sequestered within global agricultural soils (Paustian *et al.*, 1998). Addition of organic manures (FYM, poultry manure, pressmud) alone or in combination with N or NP fertilizers for 16 years brought variations in soil pH, EC and organic C over the initial value. The decrease in pH was more with the addition of FYM compared to poultry manure and pressmud. Highest soil pH (7.87) was observed in plots where only NP fertilizers were applied. It might be due to the leaching of soluble salts from surface soil. A significant increase in EC of the soil was observed with the combined application of organic manures plus NP fertilizers over application of NP fertilizers alone (Kumara *et al.*, 2014). Increased biochar application resulted to gradual increase in most of the chemical properties in the soil except H+Al. 10t/ha of biochar produced the highest levels of (pH, = 6.91; %TN, = 0.38; K (mg/Kg), =1.59; %OC, = 0.56; Mg (mg/Kg) = 2.50, and CEC (Cmol/Kg) = 11.35 compare to the other rate and control. However, application of 5t/ha of biochar did not show any significant effect compared with the control (Ndoret *et al.*, 2015). Carbon sequestration was quantified both in biomass and soil in two pasture systems (*Cenchrus ciliaris* and *Cenchrus setigerus*), two tree systems (*Acacia tortilis* and *Azadirachta indica*) and four silvipastoral system (combination of one tree and on grass) in arid northwestern India. The silvipastoral system sequestered 36.3% to 60.0% more total soil organic carbon stock compared to the tree system and 27.1–70.8% more in comparison to the pasture system (Shamsudheen *et al.*, 2014).

Therefore, it may be concluded that carbon sequestration must be viewed as a long-term process in order to see meaningful impact of conservation tillage, residue management, manure and fertilizer use, crop rotation etc on soil health and sustainable agriculture.

Keywords: Carbon sequestration, biochar, soil health, residue management

COW URINE BOON FOR SUSTAINABLE AGRICULTURE

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The Indiscriminate use of agrochemicals led to problems like pest outbreak, resistance to insecticides, elimination of natural enemies, risk to human health and adverse effect on the soil fertility, crop productivity, quality of produce and more specifically on the environmental system. The current scenario under such situations firmly emphasizes the need to adopt eco-friendly agricultural practices for food production by considering the sustainability of soil and environment. The use of cow urine can be considered as a low cost agricultural practice for farmers and had been extensively used in traditional agriculture in India for medicinal and agricultural purposes since Vedic period. Among different organic sources cow urine is good source of nitrogen besides it contains sulphur, phosphate, potassium, sodium, manganese, carbolic acid, iron, silicon, chlorine, salt, enzyme and hormones. It strengthens the fact that cow's urine is not a toxic effluent as 95% of its content being water, 2.5% urea and the remaining 2.5% a mixture of minerals, salts, hormones and enzymes. It is also considered as a natural disinfectant and pest repellent and forms the main component of Panchagavya (urine, dung, milk, curd, and ghee), an organic crop booster prepared and sprayed by Indian farmers. As products of ecological sanitation, urine is therefore in many ways suited for use as fertilizer as they contain essential nutrients needed for plant growth. Favourable effect of cow urine application has been reported in enhancing the productivity of different crops viz. maize, mustard and rice etc. Protein content and chlorophyll content of methi and bhindi were increased with increased concentration of urine as compared to control (Jandaik *et al.*, 2015). Urine increased the N concentration of grass and increased the potassium concentration of grass and clover (Ledgard *et al.*, 1982). Tewari *et al.*, 2016 reported that cow urine reduce the poisonous effects of pesticides to pollinators and natural enemies. Cow urine spray for honey bee disease management has adopted by several beekeepers of Uttarakhand. Cow urine are very effective against mustard aphid, *Lipaphis erysimi* and wheat aphids, *Microsiphum miscanthi* and *Rhopalosiphum padi* and showed higher attractancy of natural enemies and pollinators (in mustard crop) with increase in grain yield. It is the best remedy to cure fungal and bacterial diseases. It has an excellent germicidal power, antibiotics and antimicrobial activity. Therefore, cow urine can kill varieties of germs and it also boosts immunity. It has been considered that cow urine is very useful in agricultural operations as a biofertilizer and biopesticide as it can kill number of pesticide and herbicide resistant bacteria, viruses, and fungi. Cow urine in combination with plant extracts is used to prepare disinfectant which is biodegradable and ecofriendly with good antibacterial action. Majority of people in India use cow urine to get rid of various diseases due to its therapeutic values. Cow urine has several biological activities such as antioxidant, antidiabetic, antitumor, antiprotozoal, and molluscicidal. Therefore cow urine is an best alternative as compare to agrochemicals. It is good for sustainable agriculture.

ITEM-WISE AND SPACE-WISE CONTENT ANALYSIS OF SWACHH BHARAT MISSION IN HINDI NEWSPAPERS

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The press in India has vast potentiality of bringing change in the society. Media is watchdog of government policies and implementation of its programmes. The study aims to evaluate the newspapers' salient features in covering Swachh Bharat Mission and total number of items and space devoted to Swachh Bharat Mission by selected four Hindi newspapers i.e. *Dainik Bhaskar*, *Dainik Jagran*, *Dainik Tribune* and *Punjab Kesri*, in Hisar city of Haryana state. The newspapers were selected based on maximum circulation of these newspapers. Content analysis of the selected newspapers was conducted in three phases i.e. 15 days before and 15 days after in launching year, first anniversary and second anniversary. According to space covered by items related to Swachh Bharat Mission, *Dainik Jagran* had maximum number of 205 items occupying 2802 col. cm. space followed by *Dainik Bhaskar* having 129 items occupying 1596 col. cm. space. The number of items and space covered in 1st column was highest for *Dainik Bhaskar* (67 items and 488 col. cm) and *Dainik Jagran* (86 items and 744 col. cm). The number of items and space covered by *Dainik Tribune* was highest in column 3rd (14 items and 249 col. cm) and it was highest in column 2nd (23 items and



282 col. cm) for *Punjab Kesri*. Out of four selected newspapers, maximum items related to *Swachh Bharat* Mission were covered in 15 days after launching the mission by three newspapers i.e. *Dainik Bhaskar*, *Dainik Jagran* and *Dainik Tribune*.

Keywords: Content analysis, Items, Media, Newspapers, Space, *Swachh Bharat* Mission

NEWSPAPERS READING FREQUENCY AND READERSHIP PATTERN TOWARDS SWACHH BHARAT MISSION

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Print media is the oldest communicating tool still being used in all the life stages. The importance of print media especially newspaper can be accounted from the fact that millions of people across the country depend on the information that appears in the newspapers. Newspapers are a source of information from last many years. However, with the dissemination of television news channels, readers' choice of getting news and information has now changed. This creation of new media has expended the horizons for news and information gatherers; therefore, the focus of this study is on newspapers reading frequency and readership pattern of respondents towards *Swachh Bharat* Mission among Hisar city of Haryana state. The study also identifies language preferences and time spent on reading newspapers. A sample of 100 urban respondents was interviewed randomly from two wards (50 from each ward) of the Hisar city. The results of readership behaviour signifies that majority of the respondents were having the print as well as electronic media possession, listen/watched programmes related to *Swachh Bharat* Mission, got new information from friends, aware about national newspapers in both Hindi and English languages, read newspapers regularly and spent 15-30 minutes per day in reading newspapers. Most of the respondents read newspapers for improving their knowledge and preferred *Dainik Bhaskar* newspaper. About one fourth of the respondents preferred political section in the newspapers. Majority of the respondents read news related to *Swachh Bharat* Mission followed by campaigns.

Keywords: Media, Newspapers, Reading frequency, Readership pattern, *Swachh Bharat* Mission

READING RESPONSES REGARDING SWACHH BHARAT MISSION IN HINDI NEWSPAPERS

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Sanitation is not only associated with internal beauty but also with the health of the people. For every human being; edible drinking water, sanitation and healthy hygiene practices are important to assist healthy life. The well known international organizations and other sanitation related schemes or programmes like *Swachh Bharat* Mission cannot be ignored whenever sanitation and issues related with it become headlines. *Swachh Bharat* Mission came into reality to assure that each citizen of India should get the access to basic requirements. The present study focuses on reading responses by the respondents regarding *Swachh Bharat* Mission in Hindi newspapers. Hisar city of Haryana state was selected purposively to study the reading responses towards *Swachh Bharat* Mission. Total 100 respondents from the 2 wards (50 from each) of the Hisar city were interviewed randomly. The results indicated that all the respondents agreed with the timeliness addition of information related to agriculture in the newspapers and majority of the respondents (95%) told that information related to entertainment, education and agriculture was highly relevant in the newspapers. Most of the respondents opinioned about effectiveness information published in sports section followed by agriculture and political sections. All respondents heard about the mission and 96 percent of them read news related to mission. Half of the respondents found the coverage regarding *Swachh Bharat* Mission somewhat adequate in the selected newspapers and felt that *Dainik Bhaskar* published content related to *Swachh Bharat* Mission could create awareness.

Keywords: Media, Newspapers, Reading response, Sanitation, *Swachh Bharat* Mission

CONSTRAINTS PERCEIVED BY SELF-HELP GROUPS AND ASSESSING THEIR IMPACT IN PROMOTION OF ENTREPRENEURIAL SKILLS IN MEWAT DISTRICT OF HARYANA

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Self-help groups play an important role in empowering and economic development, especially for the powerless and poor rural community. Empowerment of rural community by developing entrepreneurial skills is the only solution to lower down these inequalities. Involvement of the poor section of the society in income generating activities helps to empower them economically, but it is difficult for them to start up a new enterprise alone because of lack of finance, self-confidence, etc. The district Mewat was selected purposively for the study as it have highest number of working women SHGs. Total sample size of 100 respondents was selected for collecting the data. Majority of the respondents had medium level of economic motivation, decision making ability and risk orientation. SHGs gave high impact on economic development and of the respondent's, followed by the socio-cultural, legal/ political, infrastructure/educational, family/interpersonal and psychological. The members of SHGs should be given training on various income generating activities which have demand in the local market. Exposure visits may also be arranged for them to generate a greater impact on the quality of product produced by beneficiaries. This will help in increasing their knowledge and skills. The major constraints faced by the respondents in effective functioning of SHG were the price problem, delay in getting loan, improper demand supply chain commodities, marketing and transportation.

Keywords: Constraints, Empowerment, Entrepreneurship, Impact, Self- help group



SOCIO-ECONOMIC PROFILE OF SELF-HELP GROUP'S IN MEWAT DISTRICT OF HARYANA STATE

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The self- help group is a small voluntarily formed group of people who have same poor economic conditions and low status of living preferably from the same socio-economic background. They come together for the purpose of solving their common problems through self-help. The present study was carried out to study the socio-economic profile of SHGs. The district Mewat was selected purposively for the study, as it has the history of SHGs work and has highest number of working women SHGs. Total sample size of 100 respondents was selected for collecting the data. The majority of the SHG members were middle aged and few of them were old aged members, it means that the involvement of the middle aged members in the group activities was more than the young and old aged members. It was found that above half of the respondents had middle level of education. Most of them were married and few were unmarried. So, the unmarried members should also be motivated and trained to acquire skills so that they can earn their own income. From the data of the self-help groups promoting entrepreneurship of the respondents, 75 per cent were the members of the self-help groups and 25 per cent as leaders of self help groups. Among the respondents, 81 per cent were formed through the self- effort of the members, while 19 per cent were formed through NGO motivation.

Keywords: Entrepreneurship, Self- help group, Socio-economic profile

CONSTRAINTS PERCEIVED BY SELF-HELP GROUPS AND ASSESSING THEIR IMPACT IN PROMOTION OF ENTREPRENEURIAL SKILLS IN MEWAT DISTRICT OF HARYANA

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Keywords: Constraints, Empowerment, Entrepreneurship, Impact, Self- help group

IDENTIFICATION OF SECRETS OF HEALTH WHICH EVERY RURAL WOMAN SHOULD KNOW IN WESTERN UTTAR PRADESH

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Woman is a pillar of any home. She makes everyone ready to get on work or to school. Her presence gives the liveliness to home. Poor health has repercussions not only for women but also their families. Woman passes through different phases in life in respect of physical, mental and social terms. Now we more often talk about women empowerment. Research on women's status has shown that the contributions that Indian woman make to families is overlooked. Women having poor health are likely to give birth to low weight infants. Only few women receive prenatal care. This vicious cycle goes on till the end of women's life. But now it is a call of time for all to emphasise in capacitating women health. Every woman should know some adhering facts related to health, she should captivate herself whether living in rural areas or urban areas. Western Uttar Pradesh, though agriculturally rich but awareness regarding health is poor. The present paper urged to identify some of the health conditions of rural women so that she should not contrite in the future. The important point which needs to be considered is that excess of any nutrient also lays bad impact on the body, which is also a kind of malnutrition. During the process of menopause several hormonal changes takes place in body, due to which she suffers from many symptomatic disorders. Insomnia (sleeplessness), anxiety and stress, indigestion or nausea, shortness of breath, flu-like symptoms (sweaty skin, feeling light headed and weak) or jaw, ear, neck or shoulder pain are some important symptoms which should not be avoided. Rural women face many bodily conditions but, due to ignorance and prejudice, she barely discusses with family members. Awareness should be generated and identification of the primary symptoms should be taught to make the difference in living conditions.



SUCCESS STORY OF ORGANIC TURMERIC PRODUCTION AND PROCESSING: WAY TO ENHANCE SOCIO-ECONOMIC STATUS AND ITS HORIZONTAL EXPANSION IN WESTERN UTTAR PRADESH

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India's economy security is based on agricultural sector. It is not likely to be changed in approaching future. Agriculture endorses 58% of the population as against about 75% at the time of independence. Around 51% of the Indian geographical area is already under cultivation as compared to 11% of the world's average. Uttar Pradesh is the third largest economy in India. Its state domestic product for 2004 is \$339.5 billion by PPP and \$80.9 billion by nominal and in 2013-14 it was 130 billion by nominal which is the second highest in India. Western Uttar Pradesh(WUP) is more advanced in terms of agricultural productivity and aids high numbers in food and nutritional security of India. Changing the format of traditional agriculture is pronounced need of the hour. Diversification is on a call to compel for now. Taking above points in consideration Krishi Vigyan Kendra (KVK), district Bulandshahr of WUP is inculcating the diversification through organic turmeric production and its processing to raise the socio economic statuses of the farmers. One such success story is discussed in the paper to manifest the increase in income and horizontal expansion of the technology. In the year 2010 the area of turmeric in the district was 2.5 hectare and it expanded to 57.5 hectare in 2015. A small farming unit is changed into reasonably big agri-based entrepreneurship. The turmeric production which was about 430.0 qt with area 2.0 ha in 2012 is almost doubled in 2015 i.e. 984.0 qt with area 3.8 ha for single unit. The turmeric powder processed in 2015 was 160 qt making the net profit of Rs. 8.28 lacs per hectare. Now this unit is providing turmeric production and processing (TPP) techniques through trainings and demonstration with the supervision of KVK.

Keywords: Turmeric Production, Processing, Organic, Socio-economic status, Success Story.

AGRIHOTRA FARMING: A VEDIC FARMING TECHNIQUE TO BUILT INNATE IMMUNITY IN PLANT FOR BETTER CROP PRODUCTION

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Agnihotra is ancient Vedic farming technique promises an increase in crop yields with minimal input costs. The practice is used to treat the atmosphere, the soil, plants, pests and disease problems. It is a process of purifying the atmosphere through a specially prepared fire. The process involves preparing a small fire with dried cow-dung cakes in a copper pyramid of fixed size and putting some grains of rice and ghee (clarified unsalted butter) into the fire exactly at sunrise and sunset to the accompaniment of two simple mantras. The ash produced by the fire is also accredited with having healing properties. Dissolved in water and sprayed onto plants, it is said to have fertilizing as well as plant protecting quality.. It is showed that plants under this atmosphere develop cylindrical veins (vascular tissue or bundles) with an above average diameter, permitting water and nutrients to move faster, and thus supporting plant growth and reproduction. Furthermore, a stimulation of photosynthesis and plant respiration, which improves the entire oxygen cycle, is attributed to this atmosphere and potentially used to enhance better crop yield with immunization of environment.

Keywords: Agrihotra, Vedic Farming, Cow dung, Immunization, Mantras

IMPORTANCE OF COMMUNICATION IN AGRICULTURAL DEVELOPMENT

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The term communication originates from the Latin word 'communis' meaning common. According to Rogers and Shoemaker (1971) defined as the *Communication is the process by which messages are transferred from a source to receiver*. Communication has six basic elements as sender, message, channel, treatment of message, audience and response (Leagans 1961). Nature of communication is the two way process and continuous process etc. different types of Communication model, concepts and its purposes. Basically communication involves three methods viz.- Individual, Group, Mass methods. Some type of communication likes verbal, non-verbal, written and oral .For each type of development such as social, economic, religious, educational, communication has its important place similarly for the all round development of agriculture , communication play a significant role. Communication plays a vital role in changing pattern of agriculture from traditional to modern use of new technologies. Communication helps farmers in their decision making process, to get new ideas and to improve their living standards. Various communication tools like extension workers, T.V, newspapers, magazines, radio, input dealers etc play an important role in educating farmers about new agricultural technologies, farming practices etc. These tools are adopted by farmers according to their effectiveness and easily availability of source. Lack of training facility for extension worker, lack of response from audience, effect of local problem on communicator, lack of efficient training of rural leaders etc. Some improvements in government schemes, extension workers, in newspapers for agricultural and rural development etc should be made to strengthen agricultural communication.



ICTs IN AGRICULTURAL MARKETING DEVELOPEMENT

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At a fundamental level, markets are about distributing information. They do so through prices, which serve as a unifying signal to participants to allow for the coordination of dispersed producers and consumers. Underlying this powerful mechanism, though, is the assumption that everyone knows the market prices for commodities, which is not the case in much of the developing world. Farmers have little information about market prices in urban areas of their own countries, let alone internationally. The result of this information asymmetry is price dispersion—the same goods sell for widely different prices in markets merely a few kilometers apart.

Mobile phones, in addition to other ICTs, can overcome this problem by informing both producers and consumers of the prices offered for agricultural products in various locations. A number of studies have shown that when mobiles are introduced to farming communities that previously lacked any form of connectivity, prices unify as farmers learn where they can sell for a better price.

ICTs: A PERSPECTIVE OF RURAL DEVELOPMENT

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Fixed-mobile convergence” is the increasingly seamless connectivity among wired and wireless networks, devices, and applications, which permits users to send and receive data regardless of device and location. Convergence is the result of converting content formats (text, images, audio, and video), devices for creating and communicating this content, and telecommunications infrastructure to digital standards telecommunications companies, and operators of mobile telephony networks. With this context in mind, the discussion that follows examines how technology trends in infrastructure, appliances, and services can influence the delivery of affordable ICTs in developing countries. Wired telecommunications infrastructure tends to reach rural areas in the wake of complementary rural access infrastructure such as roads and electricity and the expansion of public services such as education.

INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE CROP PRODUCTION

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One of the most important challenges facing peoples today is to conserve natural resources, including soil and water, for increasing food production at the same time as protecting the environment. Long-term food security for the increasing population requires a balance supply between increasing production and environmental sustainability. Integrated nutrient management (INM) for sustainable crop production examine the challenges of managing both organic and inorganic nutrient sources in agricultural systems where nutrients are deficient or in excess supply. Balanced application of appropriate fertilizers is a major component of INM. Fertilizers need to be applied at the level required for optimal crop growth based on crop requirements and agroclimatic considerations. Growing legumes and short-duration pulse crops in crop rotations, the effects of integrated use of organics (farmyard manure, piggery manure, poultry manure, green manures and crop residues) with chemical fertilizers and impact the long term use of INM on enhancing crop productivity. Sustainable agricultural production incorporates the idea that natural resources should be used to generate increased output and incomes, especially for low-income groups, without depleting the natural resource base. An integrated approach recognizes that soils are the storehouse of most of the plant nutrients essential for plant growth and that the way in which nutrients are managed will have a major impact on plant growth, soil fertility, and agricultural sustainability. Success will ultimately depend on the complex actions and socioeconomic factors increase crop yields in a sustainable manner and improve the food security of millions of smallholder farmers currently struggling with declining soil fertility and poor management of plant nutrients.

Keywords: INM, Sustainable production, food security.

PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY)

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Pradhan Mantri Krishi Sinchai Yojana (PMKSY) is a national mission to improve farm productivity and ensure better utilization of the resources in the country. The budget of Rs. 500 billion in a time span of five years has been allocated to this scheme. The Cabinet Committee on Economic Affairs chaired by Hon'ble Prime Minister has accorded approval of Pradhan Mantri Krishi Sinchai Yojana (PMKSY) in its meeting held on 1st July, 2015. The primary objectives of PMKSY are to attract investments in irrigation system at field level, develop and expand cultivable land in the country, enhance ranch water use in order to minimize wastage of water, enhance crop per drop by implementing water-saving technologies and precision irrigation. The plan additionally calls for bringing ministries, offices, organizations, research and financial institutions occupied with creation and recycling of water under one platform so that an exhaustive and holistic outlook of the whole water cycle is considered. The goal is to open the doors for optimal water budgeting in all sectors. Tagline for PMKSY is "more crop per drop". Government of India is committed to accord high priority to water conservation and its management. To this effect Pradhan Mantri Krishi Sinchai Yojana



(PMKSY) has been formulated with the vision of extending the coverage of irrigation 'Har Khet ko pani' and improving water use efficiency 'More crop per drop' in a focused manner with end to end solution on source creation, distribution, management, field application and extension activities. PMKSY has been formulated amalgamating ongoing schemes viz. Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation Integrated Watershed Management Programme (IWMP) of Department of Land Resources and the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC). PMKSY has been approved for implementation across the country with an outlay of Rs. 50,000 crore in five years. For 2015-16, an outlay of Rs.5300 crore has been made which includes Rs. 1800 crore for DAC; Rs. 1500 crore for Department of Land Resources; Rs. 2000 crore for Ministry of Water Resources (Rs. 1000 crore for AIBP; Rs. 1000 crores for PMKSY).

ADVANTAGES OF TRADITIONAL AND MODERN TECHNOLOGY IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT

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The only instance in which traditional farming is better than modern agricultural technology is that it produces high quality product in smaller quantities. Whereas, the produce obtained from modern agriculture technology produces big quantity but compromises in quality. In terms of fertilizers and pesticides, traditional technologies use fertilisers and pesticides that do not pollute the soil. Modern agricultural technologies have developed these chemicals in a way that they wipe out pests and herbs but also prove to be harmful to the environment, polluting land and water. Traditional methods use biological pesticides and insecticides and the produce is healthier. Harvested products are grouped under the category of organic produce. Which is sold at high prices resulting in better profits than the produce of modern technologies. On the other hand, the main advantages of modern agricultural technology lie in its predictability. The technology make sure that the farmers have crops to harvest and sell. There is very less chance of the crop being lost to environmental factors like drought, floods, plant diseases or low yield. The modern agricultural technology make sure that the agricultural sector gains profit every harvest season with very less crop losses.

Keywords: Modern agriculture technology, High quality product.

VARIOUS DIMENSIONS OF WOMEN'S EMPOWERMENT THROUGH SELF HELP GROUPS

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Women empowerment has been recognized as a central issue in determining the status of women. Empowerment is a process of delegating power to an individual so that the person can take her own decision without the influence of others. It is the psychological feeling and provides a sense of power to a human to live freely, think freely and act freely for her own benefit without disturbing others. The study was conducted to establish relationship between women empowerment and socio economic characteristics of the respondents and groups in Deoria district of Uttar Pradesh. Out of sixteen blocks of Deoria district four blocks i.e. Salempur, Bhatni, Bankata and Bhatpar Rani were selected by random sampling for this study. Four SHGs from each block thus total 16 SHGs selected for this study. From each SHG ten members were selected thus total 160 members of SHGs were included as respondents. The study showed that the SHGs had followed normal pattern of group behavior and higher percentage of women were realizing noticeable impact of being member of SHGs. Women participation in SHGs made them discover inner strength, gain self-confidence, social and economic empowerment and capacity building.

Keywords: Women Empowerment, Self Help Group, Dimensions, Self Confidence, Capacity building.

A REVIEW ON INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. This concept of nutrient management assumed greater significance in recent years because of two reasons. First, the need for continued increase in agricultural 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. 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. Rather than focusing nutrition management practices on one crop, INM aims at optimal use of nutrient sources on a cropping-system or crop-rotation basis. This encourages farmers to focus on long-term planning and make greater consideration for environmental impacts. INM relies on a number of factors, including appropriate nutrient application and conservation and the transfer of knowledge about INM practices to farmers and researchers. Boosting plant nutrients can be achieved by a range of practices covered in this guide such as terracing, alley cropping, conservation tillage, intercropping, and crop rotation. Given that these technologies are covered elsewhere in this guidebook, this section will focus on INM as it relates to appropriate fertiliser use. In addition to the standard selection and application of fertilisers, INM practices include new techniques such as deep placement of fertilisers and the use of inhibitors or urea coatings. Use of area coating agent helps to restart the activity and growth of the bacteria responsible for denitrification that have been developed to improve nutrient uptake.



Key Word:-Fertilizer, Nutrient, Conservation, Productivity

ROLE OF PMGSY IN RURAL TRANSFORMATION AND SUSTAINABLE DEVELOPMENT: A CASE STUDY OF DISTRICT GONDA (U.P.)

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As we know that Infrastructure is a key factor for all type of socio-economic development and roads are very important component of infrastructure. According to census 2011 about 70% of total population of our country are living in rural areas. Since long most of the rural areas of our country were facing all-weather good roadconnectivity problems. Poor road conditions or low accessibility and low carrying capacity are the big factors for social and economic loss that create a barrier to development at various levels from local to the national. If these facilities and services are not available in the particular area, development will be very difficult and in fact it can be likened to a very scarce commodity that can only be secured at a very high price and cost. Thus Good connectivity of road network is vital for rural transformation and sustainable development. To face these challenges and provide an upliftment for development the Government of India has launched a programme in the whole country named as PradhanMantri Gram SadakYojana (PMGSY). The Prime Minister's Rural Road Project known as "PradhanMantri Gram SadakYojana". PradhanMantri Gram SadakYojana (PMGSY) was launched by the government of India on 25th December 2000 to provide good and all-weather road connectivity to eligible unconnected habitations in rural areas of the country. Gonda district is situated in north-eastern part of Uttar Pradesh, India which is recognised as most undeveloped part of the state. About 93.45 % of the population (as per census 2011) of this district lived in rural areas and they are based mainly on agriculture for their livelihood. The district is categorised as one of the most backward area in view of social, economic, educational as well as public health parameters, etc. Since long the rural areas of the district were facing the problems of poor road conditions and low accessibility. Under PMGSY there are a lot of rural road works (new connectivity and upgradation) have been implemented (between 2001 to 2015) in the poorly backward areas of the country India including Gonda district of Uttar Pradesh. The Present research work is an impact assessment of PradhanMantri Gram SadakYojana (PMGSY) on the local level of district Gonda.

KeyWords: Road-network, PMGSY, Connectivity, Accessibility, Rural Areas, Rural Transformation, Socio-Economic Development, Sustainable Development.

ROLE OF AGRICULTURE AND RURAL DEVELOPMENT

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Agriculture plays a main role in rural development, mainly due to land use, in countries where the sector is of less economic significance. In rural areas all over the world, agriculture represents the major land use and a major component of the viability of rural areas. Farming and related activities make up the basic fabric of rural life, contributing significantly to the overall state of rural regions in terms of employment and business opportunities, infrastructure and quality of the environment. In some countries, farming may be the primary economic activity of a region and support the vast majority of the population in employment. There are some works to the progress. The first section of the development is transferring knowledge to the rural sector. This section will serve to build up the knowledge of farm operators, commercial and semi-commercial agro-processing enterprises and municipal advisors to effectively plan investments and utilize financial support available under component two of the development, other donor-supported grant schemes as well as future grants schemes supported under the EU's Instrument for Pre-Accession Assistance for Rural Development (IPARD). The second section of the project is enhancing investments to promote sustainable rural development, this component will provide rural development grants to encourage growth and competitiveness in the rural sector through the promotion of improved agricultural technologies and support capacity building of the Managing Authority (MA) and Paying Unit (PU) within the Ministry of Agriculture Forestry and Rural Development (MAFRD) to manage grant programs supported by the government, the proposed project, other donors and eventually future schemes under IPARD. The third section of the project is development management, coordination, monitoring and evaluation. A Project Implementation Unit (PIU) will be established within the MAFRD for the daily management, administration, coordination and public awareness of project activities. The focus will be on the semi-subsistence and subsistence farmers, who provide a major share of total production and marketed surplus in most developing countries. The importance of the development of the small-holder sector should be seen not only in terms of increasing rural incomes but also as creating a domestic market for the goods and services supplies by the urban sector.

ADULTERATION IN HORTICULTURAL PRODUCE

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Every food on our plate can be suspected. One out of five food samples fails quality test in India. Data collected by FSSAI across the country shows a steep rise in food adulteration. According to FSSAI, the technical definition of adulteration is "the addition and subtraction of any substance to or from food so that the natural composition and quality is affected". Historically, the use of adulterants has been common even sometimes dangerous substances have been used. Use of adulterants was first time investigated by the German chemist Fredrick Accum in 1820 who had identified many toxic metal colourings in food and drink (Lakshmi *et al.*, 2012). Complete or partial replacement of a food ingredient with a less expensive substitute, addition of small of a non-authentic substance to mask inferior quality ingredient and removal or intentional omission of an authentic and valuable constituent in a food product are the main categories of food adulteration. These definitions broadly reference three categories of adulteration in food (Moore *et al.*, 2012). Various central acts like PFA and FPO were launched by the government to check this kind of anti-social evils. Several agencies such as FSSAI, AGMARK and BIS have been setup by the



government of India to enact the laws to remove adulterants from food stuff. A broad-based food safety law and a body called the Food Safety and Standards Authority of India has occupied the place of The Prevention of Food Adulteration Act. But the change has made no difference at the ground level.

Keywords: Adulteration, ingredients, horticultural produces, food quality

DRUDGERY REDUCTION TECHNOLOGIES FOR FARM WOMEN AND FARM WORKERS - NEED OF THE HOUR

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Right from ancient times, women of Indian society are fully occupied and overburdened with three fold responsibilities of farm, home and livestock management. Agriculture is an important unorganized sector where majority of the women labour force is engaged. Women form the backbone of Agriculture, several farm activities traditionally carried out by men are also being undertaken by women as men are pulled away into higher paying employment. Thus, rural India is witnessing a process which could be described as feminization of agriculture. Women works as agricultural laborers, participate in several activities such as cleaning the fields, weeding/transplanting, fertilizer application, plant protection, thinning, harvesting, threshing, winnowing, drying, storing, looking after animals, kitchen gardening etc. Since all these operations are done manually, they cause considerable physical and mental strain and leads to drudgery. Drudgery is generally conceived as physical and mental strain and monotony experienced by human being in performing any operation. Despite rapid urbanization and improvements in social life, large numbers of poor women live in rural areas where modern technology is unavailable or unaffordable. Although technical innovation and adaptation are important, many factors affect women's ability to benefit from technological change and these are often very location specific. Krishi Vigyan Kendra, Muzaffarnagar also engages in such activity of women empowerment in agriculture and reduction of drudgery through agricultural inventions. Women are given training on value addition through agricultural products like *Ragi*, sorghum, fruits and vegetables. Training program and Demonstrations on Drudgery Reducing tools beneficial for farm women, were conducted. It was observed that use of Improved implements especially for farm women are less in practice. Awareness was created among rural people especially farm women, for use of improved implements and their benefit in Agriculture.

PRECISION FARMING IN SOLANACEOUS CROPS

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'Precision Farming' or 'Precision Agriculture' aims at increasing productivity, resource efficiency, decreasing production costs and minimizing the environmental impact of farming. Brinjal, tomato and potato are the important vegetable crops in India. India ranks 2nd, 3rd and 2nd in area, 2nd, 2nd and 3rd in production and 8th, 10th and 4th in productivity for brinjal, tomato and potato, respectively. Vegetables being short duration and high value cash crops have high scope for implementation of precision agriculture (PA) technologies. Vegetables grown with simple PA technologies like drip irrigation, site specific input management, soil map based fertilizer application, LCC, SPAD have been found to be superior than those grown under conventional techniques- both in yield and quality, with much higher Benefit-Cost ratio. Adoption of precision farming leads to about 80 per cent increase in yield in tomato, 34 per cent in brinjal and 52 percent in potato. Increase in gross margin has been found 165 per cent, 67 per cent and 152 per cent in tomato, brinjal and potato production, respectively. Lack of finance and credit facilities have been identified as the major constraints for non adoption of precision farming. Thus, it has been suggested that development of PA societies, strengthening of marketing channels and providing subsidies on water soluble fertilizers and pump sets of drip irrigation will increase adoption of precision farming in India.

PYRETHRUM A POTENTIAL BIOPESTICIDE

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Botanical insecticides have long been touted as attractive alternatives to synthetic chemical for pest management because botanicals reputedly little threat to the environment or to human health. In this context pyrethrum plays a major role. It refers to the oleoresin extracted from the dried flowers of the pyrethrum daisy, *Chrysanthemum cinerariaefolium* (Asteraceae). Most of the world's supply of *C. cinerariaefolium* comes from Kenya, which produces the most potent flowers. The chemical components are three esters of chrysanthemic acid and three esters of pyrethric acid. Among the six esters, those incorporating the alcohol pyrethrolone, namely pyrethrins I and II, are the most abundant and account for most of the insecticidal activity. Pyrethrum is the predominant botanical in use, perhaps accounting for 80% of the global botanical insecticide market. Technical grade contains 20% to 25% of pyrethrins. Resistance to pyrethrum has been bypassed by pairing the insecticide with synthetic synergists such as piperonyl butoxide (PBO). It is fast acting and toxic to insects at very low doses and characterized by a rapid knockdown effect, particularly in flying insects. The symptoms of pyrethrum poisoning are characterized by hyperexcitation, convulsions, seizures and finally followed by death. These symptoms are a result of the neurotoxic action, which block voltage-gated sodium channels in nerve axons. Although pyrethrum is a potent insecticide, it also functions as an insect repellent at lower concentrations. Hence, in this context of agricultural



pest management, pyrethrum insecticide is best suited for use in organic food production and can play a much greater role in postharvest protection of agricultural commodities in developing countries.

Keywords: Pyrethrum, insecticide, pest management

THE ROLE OF ICT IN INDIA'S AGRICULTURE AND RURAL DEVELOPMENT

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Amongst the emerging Asian Economies, India is a nation with 70 % of population living in rural areas and agriculture is the main source of livelihood for 58 per cent of the population. ICT acts as a provider of major opportunities to rural livelihoods and contributes towards poverty reduction. Productivity of rural areas can be enhanced by usage of ICT. Application of new and contemporary information and communication technologies (ICTs) for rural and agricultural development in the India has been advancing quite rapidly over the last decade. ICT is changing all the spheres of human lives. Hence it is popular. The application of Information and Communication Technology (ICT) in agriculture sector is increasingly important. Agriculture is an important sector with the majority of the rural population in developing countries depending on it. The agriculture sector faces major challenges of enhancing production in a situation of declining natural resources necessary for production. The growing demand for agricultural products, however, also offers opportunities for producers to sustain and improve their livelihoods. Information and Communication Technologies (ICT) act as a key agent in agriculture sector in addressing these challenges and enriching the livelihoods of the poor rural population which depends on agricultural produce. The research institutions and universities being donor of research technologies/practices need to have close linkage with rural industries requiring manpower and farmers requiring technology of 'know-how' and 'do-how' in order to boost agricultural production and thereby increase their income and level of living. In the present scientific era what is needed is the technology, which is profitable, demonstrable, compatible and its dissemination should be quick. Secondly, the present extension system does not have inherent marketing element, which in fact, is closely associated with the development of agriculture. Information and Communication Technology provides information about any event taking place anywhere in the world, at any time, available to any person. The Internet and other forms of computer networking can be of much use for exchange of production, market and other kinds of information with the farmers. ICT can be used effectively in extension education for transfer of technologies by using; Internet access, Mailing systems, Servers, Tele-Conferencing Interactive video, Videoconferencing, Wireless, Computer systems; Local Area and Wide Area network (LAN and WAN), Dial Access, Television, C.D.ROM and Digital equipments etc. and various ICT initiatives like Gyandoot, Warana Wired Village project, Bhoomi project, iKisan project of the Nagarjuna group of companies, Krishniworld.net, FRIENDS, mKrishi Tata Consultancy, Info Village Pondicherry etc., Government of India has ambitious objective of transforming the interaction of citizens with government in an electronic form. Through this, Government can ensure more transparency and better administration. Through this paper an attempt has been led to agriculture and rural development through various ICT initiatives.

Keyword: ICT, Agricultural Extension, Rural Development TOT.

VEGETABLE INTERCROPS: A PATHWAY FOR SUSTAINABLE AGRICULTURE

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The demand of vegetables is increasing day by day among people due to high income and awareness about benefits of vegetables being rich source of nutrients, vitamins, minerals, antioxidants, fibers, carbohydrates, etc. and medicinal value. Presently, availability of vegetables per day per capita is about 200 g, below the required quantity of vegetables (300 g per head per day). Land holding is decreasing day by day due to urbanization, high population growth and industrialization across the country. Hence, the challenges are to produce more vegetables per unit area to fetch up the demand. Therefore, strategies should be to produce higher quantity of vegetables from less land with optimum use of water, fertilizers and by adopting agronomical management practices. Cropping systems like intercropping can be followed for higher production in per unit area. Intercropping refers to growing two or more dissimilar crops simultaneously on the same piece of land. Crop intensification is in both time and space dimensions. It also helps the farmers for getting stable production and maintaining the soil fertility level. Intercropping system results in yield advantage because the component crops differ in their use of growth resources which results in higher farm income. When they are grown in combination, they are able to complement each other and *per se* make better overall use of resources than when grown separately. Many studies have indicated that intercropping with different vegetable was more productive and profitable than sole cropping because of complementary effects of intercrop. The strategy should be to produce more vegetables from less use of land so that our natural resources can be used in an efficient manner which will lead toward the sustainability of agriculture.

ANTHROPOMETRIC MEASUREMENT OF RURAL SCHOOL CHILDREN AGED 6-12 YEARS

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The present study was done to assess the nutritional status of rural school children of 6 to 12 years of Kumarganj town Faizabad district of eastern U.P. All students enrolled in two purposively selected primary schools of Kumarganj area constituted the sample. Out of the total (125) students 84.8 per cent were Hindu whereas, 15.2 percent were Muslim. Total 54.4 per cent subjects were from Nuclear and 45.6 per cent were from Joint family. Total 16.8 per cent children were from general, 30.4 per cent from SC and 52.8 per cent were from OBC category. The result of the study showed that the mean Height, Weight, Mid-Upper Arm Circumference and Body-Mass- Index of children increased with



increasing age. The average height and weight of the children was less than the NCHS standard. Data showed that girls were better than boys in case of height, weight, BMI and MUAC.

EVALUATION OF FAST FOODS PREFERENCES AMONG COLLEGE STUDENTS OF RURAL AND URBAN AREAS

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The present study was conducted to collect information regarding fast foods choice among college students. Faizabad district was purposively selected for the study. Two colleges namely Chandrabali Singh Urmila Mahavidyalay, Shivnagar, Kumarganj – Faizabad from rural area and Saket P.G. College, from urban area Faizabad were selected for the study. A sample of 260 college students 130 each, were selected from two colleges. Information regarding age, sex, caste, family composition, education and economic status of the family and specific information regarding fast food choice, type of fast food liked, reason for consuming fast food, opinion of respondents about fast food etc. were gathered through self structured questionnaire. In this study the majority of respondents were belong to general category (33.84%). Study also reveals that majority (71.92%) was enjoying fast foods and most of the respondents were belong to vegetarian category. Delicious taste, attractive presentation and low price attract the respondents to consuming fast foods. In case of their preference of fast foods majority of respondents in rural area like chaat (30.76%), samosa (29.23%), chole-bhature (18.46%), burger (30.0%) etc. On the other hand, in urban area the majority of respondents like kachorie (23.84%), samosa (22.30%) followed by chole-bhature (13.84), burger (28.46%).

SUSTAINABLE AGRICULTURE: NEED OF THE HOUR

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The Indian agriculture is changing its dimension from conventional subsistence to commercial science based agriculture. It is due to changing demand like shrinking natural resources, increasing population, food availability issues, and globalization and consumers preferences. India became witness to transform the scenario of agriculture since green revolution. Now, we arrive at certain queries that how green the green revolution. Besides the positive sides we have witnessed the negative consequences of post green revolution which is alarming the situation to take actions for saving current and future generations by ecofriendly approaches. There is a need of transforming from blind approach to systematic approach with holistic development in community. The Sustainable farming is the natural and innovative approach to minimize the external inputs like chemicals and optimize the production through maximizing local natural resource use. There is natural farming, permaculture, LEISA (Low External Input Sustainable Agriculture), bio-dynamic farming, organic farming, Integrated Farming System (IFS) etc. under sustainable agriculture. There is a need of sustainable development of individual farmer and whole in participatory mode. These can be possible through the three main goals of sustainable agriculture i.e. environmental health, economic, profitability, social and economic equity. The farmers have to take farming in natural way with innovative methods to optimize the production at lower risk. Certain strategies like conservation agriculture, diversification, IFS, Community based farming etc. where several methods to be implemented like water conservation, soil conservation, natural resource use, local resource mobilization, resource recycling, optimization rather than maximization of produce, management of pest rather than control, physical-mechanical-cultural-biological practices to reduce chemical use, eco-friendly tools etc. It starts from selection of right varieties at right place at right time to diversification of crops (including livestock), soil health management, efficient and humane use of inputs, consideration of farmers' goal and lifestyle choices in to consideration. These can increase the income of small and marginal farmers as low input cost with low risk making stable farm enterprise. The policy makers should make strategies to promote sustainable agriculture with innovative techniques which can be most effective in addressing majority of small and marginal farmers in even rainfed agriculture.

ICTs IN DISTRIBUTION AGRICULTURAL MARKETING INFORMATION

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At a fundamental level, markets are about distributing information. They do so through prices, which serve as a unifying signal to participants to allow for the coordination of dispersed producers and consumers. Underlying this powerful mechanism, though, is the assumption that everyone knows the market prices for commodities, which is not the case in much of the developing world. Farmers have little information about market prices in urban areas of their own countries, let alone internationally. The result of this information asymmetry is price dispersion—the same goods sell for widely different prices in markets merely a few kilometers apart. Mobile phones, in addition to other ICTs, can overcome this problem by informing both producers and consumers of the prices offered for agricultural products in various locations. A number of studies have shown that when mobiles are introduced to farming communities that previously lacked any form of connectivity, prices unify as farmers learn where they can sell for a better price.



RELEASE BEHAVIOUR OF BORON IN LOW AND HIGH BORON STATUS SOILS VIS-A-VIS ZINC AND PHOSPHORUS APPLICATION**Nidhi Kamboj and R. S. Malik**

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A laboratory experiment was conducted to determine the effect of zinc and phosphorus application on release behaviour of boron under high and low B status soils. The incubation was done at an interval of 0, 4, 7, 15, 30, 45 and 60th day after the application of zinc and phosphorus. The levels of P 0, 25, 50, 75 and 100 mg P₂O₅ kg⁻¹ soil and Zn 0, 5, 10 and 20 mg Zn kg⁻¹ soil were applied in triplicate and the soils were kept at field capacity under room temperature in the laboratory for incubation up to 60 days. The results revealed that the release of hot water soluble boron (HWS-B) of high B and low B soils showed a different trend among themselves i.e High B soil released more B continuously up to 60 days compared to low B soil being higher content of native B content. The maximum HWS-B released at 4th days of incubation in high B and low B soil and thereafter a continuous decrease in release of HWS-B was noticed up to 60th days of their incubation. Whereas, combined application of graded doses of P and Zn had no significant effect on desorption/release of HWS-B. However, individual application of P showed an improvement in the release of available B.

Keywords: Boron, phosphorus, zinc, release behaviour, incubation**EFFICACY OF *TRICHODERMA HARZIANUM* AGAINST STEM ROT OF FENNEL CAUSED BY *SCLEROTINIA SCLEROTIORUM* (LIB.) DE BARY****Richhpal Kumawat, Jitendra Sharma, Shailesh Godika, V.K. Bairwa and K.K. Jat**

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Fennel crop suffers from various diseases caused by fungi and other microorganisms. Amongst the major fungal diseases of fennel, the stem rot disease caused by *Sclerotinia sclerotiorum* (Lib.) de Bary, is becoming a measure threat to the fennel cultivation and its management with chemicals is not economically viable, and environmentally safe. Therefore, the present investigations were aimed to carry out the test of *Trichoderma harzianum* as seed, soil and seed + soil applications against *S. Sclerotiorum* under micro plot conditions. Results revealed that minimum disease incidence (23.00 %) was recorded with seed + soil application of *T. harzianum* followed by soil application of *T. harzianum* (36.26 %) as compared to control (71.56 %).

EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON NUTRIENT REMOVAL UNDER RICE WHEAT ROTATION**Robin kumar, Vivak kumar and Ashish dwivedi**

A 2 year field trial was conducted during *kharif* 2012 and 2013 to investigate fertigation and residue management on performance of direct seeded rice and soil biological health. To this effect ten treatments consisting irrigation techniques as a main plot (5) and residue management sub plot (2) were tested in a split plot design with three replication. The soil of experimental field was alkaline in reaction, with 0.33 percent organic carbon, 180 kg ha⁻¹ available nitrogen and 47 kg ha⁻¹ available phosphorous and 346 kg ha⁻¹ potassium. Hybrid rice variety Arize 6129 was sown as a test crop. Remarkable effect was noted where N, P and K uptake by grain and straw was significantly higher with drip fertigation as compared to other combination. Furthermore, nutrient uptake increased significantly with residue incorporation. Thus, the study reveal that drip irrigation coupled with fertilizer application could be option of precise nutrient and water management of direct seeded rice since it removed more nutrient by plant.

ROLE OF WEATHER PARAMETERS ON BOLLWORMS INFESTATION IN SHEDDING MATERIAL IN BT AND NON-BT COTTON GENOTYPES**Roomi Rawal and K.K. Dahiya**

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Cotton bollworms *Helicoverpa armigera* (Hubner), spotted bollworm *Earias insulana* (Boisduval) and *Pectinophora gossypiella* (Saunders) are the most important pests of cotton crop. Cotton yield is highly reduced due to attack of these pests. Bollworms infestation is affected by environmental factors. Their damage differs in *Bt* and non-*Bt* cotton genotypes. Therefore present research was carried out under unsprayed condition on seven varieties of cotton (five were *Bt* with different gene construct; BIOSEED-6588, NECH-6, JK-1947, SP-7007 and RCH-134; one non *Bt* hybrid HHH-223 and one non *Bt* variety H-1236). Experiment was done at research farm of cotton section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during *kharif* 2014. Bollworms infestation was recorded at weekly intervals. Observations on bollworms damage were recorded from the shedding material of crop from each genotype per plot. Observations started from 30th Standard Meteorological Week (SMW) and continued till harvesting of crop (41st SMW). The shedding material were collected from each plot per replication per treatment and damage of bollworms was recorded. Throughout the period of observation highest infestation was recorded on 40th SMW (15.56%). It varied significantly among *Bt* and non-*Bt* genotypes throughout the period of observation, being significantly higher in non-*Bt* genotypes and lower in *Bt* genotypes. On the basis of genotypes mean value it has been observed that minimum infestation was recorded in BIOSEED-6588 (4.05%) and maximum infestation was observed in H-1236 (20.97%). Correlation with weather parameters was also calculated. It was found that bollworms infestation showed negative significant correlation with minimum temperature. Non significant negative with maximum temperature, evening relative humidity and with rainfall. They had positive correlation with morning relative humidity.



PRODUCTION AND CHARACTERIZATION OF BIOCHAR PRODUCED FROM DIFFERENT FEEDSTOCKS**Shiv Vendra Singh and Sumit Chaturvedi**

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In India, million tons of agri-residues are produced every year and these residues are either partially utilized or un-utilized due to various constraints. Hence, conversion of organic waste to produce biochar using the pyrolysis process is one viable option that will enhance natural rates of carbon sequestration in the soil, reduce farm waste and improve the soil quality. Present study was conducted in Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand to characterize the Biochars derived from different feed stocks viz., Rice Husk, rice Straw, Maize straw, Pine needles, and Sugarcane Trash. Physicochemical, Proximate and element analyses along with the morphological and textural properties were investigated using scanning electron microscopy (SEM), Fourier-transform infrared (FTIR) spectroscopy. The results indicated that various Biochars shows the variation in fixed carbon (C), content of volatile matter, O, N and H. Comparison between the biochar obtained from different feed stocks shows, highest pH of RSBC. Biochar samples subjected to Scanning Electron Microscopy (SEM) shows variation porosity. Hence, the Biochars produced from different materials have strong effect on biochar properties.

Keywords: Biochar, Pyrolysis, Proximate and ultimate analysis, FTIR and SEM**ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTRIA FROM SUGARCANE****Kolluri Ramu¹, Amit Kumar² and Shashank Gupta³**

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Use of plant growth promoting rhizobacteria (PGPR) gaining more importance in future aspects of agriculture. PGPR acceptance by world gives us future trend. It is the important tool to increase the yield potential of different crops. Sugarcane is the important commercial crop in Indian agriculture. Sugarcane is majorly cultivated for producing products like sugar, jaggery, ethanol, molasses, baggase, press mud etc. There is wide need of increasing the yield of sugarcane. This can be achieved by identifying the potential PGPR for particular sugarcane varieties and specific PGPR stains. PGPR identification and isolation can be reported by using parameters like indole acetic acid (IAA) production, phosphorus solubilisation, siderophore production and antagonistic against the pathogen especially *Colletotrichum fulcatum*, which cause red rot disease in sugarcane *in vitro*, pyrroloquinoline quinone activity (PQQ), Extracellular polymeric substances (EPS). The identified potential PGPR can be conserved by sub culturing using suitable media (nutrient agar media) or sent to microorganism banks. Conservation of important microbial diversity in field level is very much emphasised to increase the yield of crops.

Keywords: PGPR, IAA, phosphorous solubilisation, siderophore production, antagonistic, PQQ, EPS.**IMPORTANCE OF WILD RELATIVES IN CROP IMPROVEMENT****Deva Ram Meghawal and Ashok Kumar Malav**

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Crop Wild Relatives are likely to play a significant role in securing 21st century food security. This is due to their potential use in plant breeding to produce crops which withstand adverse impacts of climate change, increasing scarcity of nutrients, water and other inputs and new pests and diseases. Increased claims are being made for the role of wild crop-related species as genetic resources for plant improvement. Recently the International Board of Plant Genetic Resources, in looking forward from its first decade has called for greater emphasis on wild relatives. However, breeders of field crops are not the primary users of wild species - they prefer to use 'prebred' lines containing desirable wild traits in domesticated genetic backgrounds. The major factors hindering the use of wild genetic resources are the number, extent, and evenness of sampling of the species range, the availability of and knowledge about samples contained in collections, the weak viability or sterility of hybrids, the restriction on, or tedious process of getting recombinants, the discerning of useful traits in wild germplasm and the expression of such alien traits in the cultivated genetic background. To improve the use of wild germplasm in plant improvement it will be necessary to encourage access to samples, to define marker systems for manipulation, and to make more informed decisions when specifying desirable traits. This erosion of crop genetic diversity on a global scale coupled with a need for novel crop varieties to meet emerging environmental and other challenges, has resulted in much greater interest in the role of Crop Wild Relatives in future plant breeding. This requires a more strategic approach to their conservation.

IMPORTANCE OF WILD RELATIVES IN CROP IMPROVEMENT**Deva Ram Meghawal and Ashok Kumar Malav**

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Crop Wild Relatives are likely to play a significant role in securing 21st century food security. This is due to their potential use in plant breeding to produce crops which withstand adverse impacts of climate change, increasing scarcity of nutrients, water and other inputs and new pests and diseases. Increased claims are being made for the role of wild crop-related species as genetic resources for plant improvement. Recently the International Board of Plant Genetic Resources, in looking forward from its first decade has called for greater emphasis on wild relatives. However, breeders of field crops are not the primary users of wild species - they prefer to use 'prebred' lines containing desirable wild traits in domesticated genetic backgrounds. The major factors hindering the use of wild genetic resources are the number, extent, and evenness of sampling of the species range, the availability of and knowledge about samples contained in collections, the weak viability or sterility of hybrids, the restriction on, or tedious process of getting recombinants, the discerning of useful traits in wild germplasm and the expression of



such alien traits in the cultivated genetic background. To improve the use of wild germplasm in plant improvement it will be necessary to encourage access to samples, to define marker systems for manipulation, and to make more informed decisions when specifying desirable traits. This erosion of crop genetic diversity on a global scale coupled with a need for novel crop varieties to meet emerging environmental and other challenges, has resulted in much greater interest in the role of Crop Wild Relatives in future plant breeding. This requires a more strategic approach to their conservation.

HERBICIDAL POTENTIAL OF ETHOXYLSULFURON AND TRIASULFURON ON SEDGES IN TRANSPLANTED RICE

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A field experiment was conducted during *kharif* season of 2014 in G. B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) to evaluate the effect of different rates of triasulfuron on the performance of transplanted rice (*Oryza sativa* L.) and associated weeds. Treatments consisted of triasulfuron in three different rates i.e. 8, 10 and 12 g ha⁻¹, ethoxysulfuron at 15 g ha⁻¹, metsulfuron methyl at 4 g ha⁻¹, 2,4-D at 500 g ha⁻¹, weed free and untreated check. Experiment was laid out in Randomised Block Design with 8 treatments and 3 replications. Rice cultivar HKR- 47 was transplanted with spacing 20 X 10 cm. Major weed species identified in the experiment were *Ammania baccifera*, *Echinochloa colona*, *Commelina benghalensis*, *Caesulia axillaris*, *E. crus-galli* and *Cyperus iria*. In general, in all the treatments, the density of *Cyperus iria* was maximum at 30 days stage of crop growth and thereafter declined at stages of crop growth. Application of ethoxysulfuron at 15 g ha⁻¹ and triasulfuron at 12 g ha⁻¹ at all the crop growth stages and triasulfuron at its lower doses i.e., 8 and 10 g a.i. ha⁻¹, 2,4-D at 500g ha⁻¹ at harvest stage reduced the population of this weed significantly over weedy check. Ethoxysulfuron at 15 g ha⁻¹ caused complete control of *Cyperus iria* at all the stages of crop growth which showed significant effect over this weed as compared to all other treatments.

RESPONSE OF URDBEAN [VIGNA MUNGO (L.) HEPPEL] TO PHOSPHORUS FERTILIZATION AND THIOUREA ON YIELD, QUALITY, NUTRIENT CONTENT AND UPTAKE

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A field experiment was conducted during *Kharif* season of 2015 on loamy sand soil to study the effect of phosphorus levels and bio-fertilizers on productivity, nutrient content and uptake of urdbean. Experiment consisted of four treatments of phosphorus levels (0, 20, 40 and 60 kg/ha) and five thiourea treatments of bio-fertilizers (control, thiourea 500 ppm at branching, thiourea 500 ppm at branching and flowering, thiourea 1000 ppm at branching and thiourea 1000 ppm at branching and flowering) there by making twenty treatment combinations tested in randomized block design with three replications. Result indicated that application of phosphorus up to 40 kg/ha significantly increased seed and straw yield, net returns, protein content in seed, nitrogen, phosphorus and potassium concentration in seed and straw and total uptake of nitrogen, phosphorus and potassium over preceding levels and remained at par with 60 kg/ha. Whereas, raising the level of phosphorus from 0 to 20 kg/ha registered the highest agronomic efficiency, apparent recovery and physiological efficiency of phosphorus after that, it showed significant decline upto 60 kg/ha. Application of thiourea 500 ppm at branching and flowering registered significantly higher concentration of N and P in seed and straw and total uptake of N, P and K as well as protein content in seed and available P₂O₅ in soil after crop harvest over thiourea (500 ppm) at branching and control. Whereas the highest agronomic efficiency and apparent recovery of P recorded under thiourea 500 ppm at branching and flowering and physiological efficiency under control.

EFFECT OF SEED BIO-PRIMING WITH CONSORTIA OF BIOAGENTS *TRICHODERMA HARZIANUM* AND *PSEUDOMONAS FLUORESCENS* AGAINST *FUSARIUM OXYSPORUM* F. SP. *LYCOPERSICI*

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Trichoderma and *Pseudomonas* are well known bioagents to protect plants from different soil born diseases and also promote growth and development of plants. Therefore the present studies were undertaken to investigate the *in-vivo* effect of seed bio-priming with *Trichoderma harzianum* and *Pseudomonas fluorescens* against wilt of tomato caused by *Fusarium oxysporum* f. sp. *lycopersici*. The field experiment was conducted 2.0 x 1.0m plots at the Experimental farm of C.S. Azad University of Agri. & Tech., Kanpur. Seedlings of tomato variety Azad T-9 treated with spore suspension of each bioagent alone and in combination as *T. harzianum* @ 1 X 10⁸ cfu/ml and *P. fluorescens* @ 1 X 10⁸ cfu/ml with untreated control were sown in three replications. It was observed that combination of *T. harzianum* and *Pseudomonas fluorescens* recorded maximum germination as 87.54% with highest vigour index as 2489.63. The consortia of these bioagents also reduced wilt incidence as 68.9 and 69.6% in pre and post emergence conditions. The highest yield (18.85 Mt/hac) was recorded in plants treated with same consortia of bioagents as compared to control (12.23 Mt/hac). These findings clearly indicated that combination of fungal and bacterial bioagent increased the yield and provided better protection against *Fusarium oxysporum* f. sp. *lycopersici*.

DAILY SUSPENDED SEDIMENT ESTIMATION USING FL, MLR AND SRC MODELS IN VAMSADHARA RIVER BASIN, INDIA

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One of the nature's greatest gifts to man is land, covered by a layer of top soil extending from few centimetres to few meters. It takes hundreds to thousands of years to develop a 5 cm layer of fertile soil where as it can be washed away in a single rainstorm event, thus soil erosion by rainfall and runoff is a major threat to the productivity of agriculture. Soil erosion is the most serious form of land degradation in Vamsadhara River Basin. Reliable estimation of the quantity, rate of runoff and sediment yield from the land surface into streams and rivers is of significant concern these days. Present study was undertaken to develop Fuzzy Logic (FL), Multiple Linear Regression (MLR) and Sediment Rating Curve (SRC) models to estimate sediment yield from Vamsadhara river catchment comprising of 7820 km² area, falls on the south eastern part of India. The perfect input of FL, MLR and SRC models was found by the use of Gamma Test (GT). The suitability of FL, MLR and SRC models was assessed based on three different performance evaluation criteria viz. root mean square error (RMSE), correlation coefficient (r) and coefficient of efficiency (CE). The results revealed that fuzzy logic model (RMSE-104.85 kg/sec, r-0.963 and CE value 87.93%) utilising Gamma Test for input choosing has superior performance for suspended sediment yield estimation in comparison to the traditional models like MLR and SRC. The results of this study may be useful in picking up the suitable modelling approach for similar studies in the other basins.

SCREENING OF PROMISING SUGARCANE GENOTYPES FOR RESISTANCE TO RED ROT DISEASE (*COLLETOTRICHUM FALCATUM*) IN EASTERN UTTAR PRADESH

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Red rot resistance is a pre-requisite in a promising variety for its release to a particular region in the high yielding and tolerant to major diseases resistance of sugarcane especially to red rot resistance. Screening for red rot resistance is being taken up in most of the sugarcane research programme. The experiment was conducted at Genda Singh Sugarcane Breeding Research Institute, Seorahi, spring planting session during 2015-16 and 2016-17. A total of 44 promising initial and advance varietal trails early and midlate with pathological checks were planted and evaluated by plug and nodal cotton swab methods for inoculation. The results revealed that 44 varieties which were evaluated against red rot, 35 varieties were rated as MR, 2 varieties were rated as MS, 01 variety was rated as susceptible, 02 varieties were rated as MS to Cf07 and MR to Cf08, 02 varieties were rated susceptible to Cf07 and MS to Cf08, while 02 varieties were rated as MR to Cf07 and MS and S to Cf08 by plug method. Same genotypes were evaluated against red rot disease, 40 varieties were rated as resistant, 01 variety was rated as MS and 01 variety was rated as resistant to Cf07 and MS to Cf08, while 02 genotype were rated as susceptible reaction of both pathotypes with checks were found similar and dissimilar reaction. Consequently, these resistant and moderately resistant varieties could be utilized in further breeding programme.

Keyword: Sugarcane, Red rot, *Colletotrichum falcatum*, national pathotypes.

EFFECT OF DIFFERENT HERBICIDES ON WEED DYNAMICS OF SEMIDRY RICE

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The experiment was conducted to study the effect of different herbicides on weed dynamics of semidry rice. The treatments consisted of ten different weed management practices viz., Weedy check, weed free check, Pendimethalin as pre-emergence, Orthosulfamuron as pre-emergence, Orthosulfamuron as post-emergence, Ethoxysulfuron as post-emergence, Metsulfuron methyl + Chlorimuron ethyl as post-emergence application, pendimethalin *fb* orthosulfomuron, pendimethalin *fb* ethoxysulfuron, pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl. The lowest total weed density among the herbicide treatments was registered with Orthosulfamuron as pre-emergence, pendimethalin *fb* orthosulfomuron and pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl which were on par with each other and weed free check. Significantly lower total dry weight of weeds and weed index was noticed with weed free check which was however, comparable with pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl at harvest. Pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl registered the highest weed control efficiency which was comparable with weed free check. This might be due to the fact that the successive application of two herbicides at an interval of 20 days created an adverse environment for a fairly long period for the weeds to emerge and grow, which was comparable with weed free check.

Keywords: Herbicides, semidry rice, weed density, weed control efficiency, weed index.

SEASONAL INCIDENCE PATTERN OF MUSTARD APHID, *LIPAPHIS ERYSIMI* (KALT.) IN TARAI REGION OF UTTAR PRADESH AND UTTARAKHAND

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Rapeseed-mustard is the main oilseed crop sown during the *Rabi* season in India. Among the different oilseeds crops, rapeseed-mustard is the second largest oilseed crop providing 13% of the world supply. Even after availability of good production technology mustard crop is unable to give potential yield in the country. This is because *Brassica* crops suffer heavy loss in yield due to various biotic and abiotic factors. Among the biotic constraints, insect-pests are one of the most important biotic factors in reducing the crop yield. About 50 insect species have been found infesting rapeseed-mustard in India. Out of many insect pests, mustard aphid (*Lipaphis erysimi*) has gained the status of key pest. It was found causing damage at flowering stage of the crop and measurable yield losses to the range of 9 to 99%. The pattern of its incidence was observed very erratic. It appeared in 3(1), 4(2), 51(0.6), 52(5.7), 4(1.6), 2(19.5), 6(4.53), 1(0.20), 4(27.33), 1(0.79), 4(19.3), 3(126.33), 4(25.40), 4(20), 52(3.3), 51(181.6), 52(79.3) and reached to its peak in 5(13), 5(7), 5(39.4), 2(21), 7(18.4), 4(121.5), 8(27.73), 6(12.93), 6(73.67),



5(108.87), 7(125.67), 6(500), 7(103.67), 6(53), 3(143), 52(334), 323(5) standard week(SW) during 1998-99, 1999-2000, 2000-01, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2009-10, 2010-11, 2011-12, 2013-14, 2014-15, 2015-16 and 2016-17, respectively. The migratory recorded was also not regular and has been found very erratic.

MANAGEMENT OF ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA* AND *FUSARIUM OXYSPORUM* F. SP. *CUCUMERINUM* ON CUCUMBER USING SEED TREATMENT WITH THE BIOAGENTS IN POLYHOUSE

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A pot experiment was conducted in polyhouse to test the efficacy of the various bio-agents as seed treatment against root-knot nematode, *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *cucumerinum* disease complex on cucumber. Three main treatments, viz., nematode alone, fungus alone and both inoculated simultaneously were taken. Chemical checks with carbosulfan 25 EC @ 3% a.i v/w as well as untreated check were also maintained. All the treatments significantly improved the plant growth parameter, viz., shoot length (SL), root length (RL), fresh shoot weight (FSW), fresh root weight (FRW), dry shoot weight (DSW) and dry root weight (DRW) as compared to untreated check. However, maximum improvement in plant growth parameter was recorded in case of carbosulfan 25 EC @ 3% a.i v/w followed by seed treatment with liquid formulation of bio-agents (*T. viride* + *P. fluorescence* + *P. lilacinus*) @ 15 ml per kg seed. Among the various treatments, minimum number of galls per plant was observed in liquid formulation of bio-agents (*T. viride* + *P. fluorescence* + *P. lilacinus*) @ 15 ml per kg seed (46) followed by *P. lilacinus* @ 20 g per kg seed (48). At 15 days after sowing, disease incidence was minimum (5 %) in case of liquid formulation of bio-agents @ 15 ml per kg seed followed by 10 % in case of *T. viride* @ 20 g per kg seed as compared to untreated inoculated check (60 %).

Keywords: *Meloidogyne incognita*, *Fusarium oxysporum* f. sp. *cucumerinum*, shoot length, and fresh root weight.

EVALUATION OF PLANT GROWTH PROMOTING (PGP) TRAITS OF RHIZOBIA NODULATING *SESBANIA SESBAN* FOR BIOFERTILIZER PRODUCTION RETRIEVED FROM INDIAN SOILS

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In present investigation fourteen different isolates of *rhizobium* were isolated from *Sesbania sesban* root nodules by using trap plant method in cups from different agricultural soil of India. Nodules bearing a smooth surface of varying sizes were well established on top as well as lateral portions of roots. Some of the nodules were found to be have rough surface and the colour of the nodules ranged from pink to brown. Good growth of all the isolates was observed on congo red yeast extract mannitol agar (YEMA) medium. All the isolated isolates of *Rhizobium* failed to show growth on Hofer's alkaline broth. All test isolates gave a negative test on ketolactose medium. The isolates were found to be Gram negative in nature. Indole-3-acetic acid (IAA) production of these isolates varied from 1.45 $\mu\text{g ml}^{-1}$ (SSSn) to 28.35 $\mu\text{g ml}^{-1}$ (SSHs) and P-solubilization index (P-SI) of these varied from 1.98 (SSKei) to 3.7 (SSKrii). Three rhizobial isolates were found to produce bacteriocin against already existing bacteriocin sensitive isolate PPM-37D, while ammonia excretion of these isolates were varied from 1.03 (SSTn) to 4.85 (SSKrii) $\mu\text{g ml}^{-1}$. 43% of the isolates were having ACC deaminase activity while 29% were siderophore producer. Conclusion: On the basis of result obtained in the present observation it can be concluded that isolate SSKr(ii) and SSKe(ii) were found to be the unsurpassed isolate of *Rhizobium* and can be exploited as biofertilizers for better yield of *Sesbania sesban*.

Keywords: *Sesbania sesban*, *Rhizobium*, Nodules, Biofertilizer

SECOND GENERATION BIO-FUEL PRODUCTION FROM INSTITUTIONAL WASTE OR BY PRODUCT.

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The environmental crisis and the storage of fossil fuels have turned public attention to the utilization of other forms of energy, which are environmental friendly and renewable such as bio-ethanol. This is to minimize the competition between fuels and food production. Handling of food wastes which are produced in quantities in industries, restaurants etc can be challenge and their disposal can also cause severe environmental issues. On the other hand, they contained significant amount of sugars (soluble or insoluble) which can be used as raw material for bioethanol production. It can further be utilized to run vehicles or as an electricity source in the institutes and restaurants. For Bio- ethanol production the most conventional raw material used in lignocellulosic biomass, since it is produced in high amount every year, in agricultural based systems. The main challenge utilizing lignocellulosic biomass is efficient sugar release mainly from cellulose. In order to achieve this, efficient pre treatment steps followed by enzymatic hydrolysis have to be applied. Generally, the pretreatment process contributes to increased costs of the whole process.

The common practice of food waste is landfill disposal which cause severe environmental issues and shortage of disposal sites. Another utilization of food waste is as an animal feed which raise hygiene issues and as fertilizers causing pollution to surface & underground water. Until now most of the research is dedicated to utilization of food waste for biogas production. So, a different & alternative utilization of institutional food waste would be for biofuel production. Utilization of institutional food waste as raw material represents a great challenge, as collection from different places and pre-treatment are difficult. Another challenge is heterogeneity that the waste present, nutritional habits and season of collection can also affect the food waste. To overcome these challenges, awareness should be increased in order to achieve low presence of contaminants. Example- Plastic, metal etc. Different dustbin should be used for disposal of food waste & plastics. As it is for bio-safety



level. The food waste collected from institutions is rich in carbohydrates and is first pretreated with hydrolyzing enzymes such as carbohydrase, glucoamylase, and protease. Acid, alkali is used to increase cellulose digestibility with the formation of various inhibitors which degrade the soluble sugars. Due to this, the food source becomes viscous so now no enzymatic saccharification is required. A lab-scale fermentor is setup in which by the help of microbes such as yeast (*Saccharomyces cerevisiae*) bio-ethanol is produced. Now, this bio-ethanol produced has number of benefits associated with such as- It can be used to run vehicles. It can be used for the production of electricity within the institute using as bio-fuel for running generators. This is the feed stock collection & fuel conversion tends to be highly localized & therefore provide local employment opportunities. Cheaper source is used for production so it is economically benefited.

RESPONSE OF GA₃ AS FOLIAR SPRAY ON THE PERFORMANCE OF GLADIOLUS VARIETIES (*GLADIOLUS GRANDIFLORUS* L.)

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A field experiment was conducted during 2014-2015 at R.B.S. College, Bichpuri, Agra, U.P. to assess the effect of gibberellic acid on growth and flower production in different varieties of Gladiolus. The investigation was laid out in Randomized Block Design (RBD) consisting 12 treatment combinations (0, 100, 150 and 200 ppm) GA₃ along with 3 Varieties Viz. Pusa Vidushi (V₁) Chandni (V₂) And Popidear (V₃) Among all the treatment combination under the trial was found significant. On the basis of results obtained on various aspects of the study envisaged that foliar spray of 150 ppm GA₃ on variety Chandni produced better growth and flowering as well as corms production of gladiolus under the experiment.

Keywords: Gibberellic acid, Concentration, Pusa Vidushi, Chandni, Popidear Gladiolus Varieties.

EVALUATION OF *ABELMOSCHUS ESCULENTUS* UNDER DIFFERENT ORGANICALLY MANAGED SOIL OF PUNJAB

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Okra is a multipurpose crop belonging to the mallow family and prized for its edible green seed pods. It is a Kharif crop which is highly demanded in the market for its cholesterol control ability. It generally requires temperature from 20-30 degree Celsius. Major constraints faced by the farmers of Punjab in growing this crop is the infestation of pest like mosaic viruses, Jassids and bollworm due to continuous applied of chemical fertiliser in soil. Therefore, in present studies we selected two varieties of okra (Punjab Padmini and Punjab 7) and inoculated with Mycorrhizal fungi, Azotobacter, and Phosphate solubilising Bacteria (PSB). Our result showed that there was significantly more vigorous growth, yield and less pest infestation in both cultivar (Punjab Padmini and Punjab 7) when treated with the PSB and Mycorrhizal fungi. However, significantly less yield were recorded when treated with PSB. So, we concluded that using optimum dose of PSB and Azotobacter may ensure good yield and growth, less pest occurrence in the field and increases organic content in the soil.

Keywords: Bio fertilisers, Sustainability, Phosphate Solubilizing Bacteria, Mycorrhizal fungi (VAM), Azotobacter

STUDIES ON PHYSIOLOGICAL CHARACTERIZATION OF FIBRE DEVELOPMENT IN COTTON UNDER DROUGHT STRESS CONDITION (*Gossypium hirsutum* L.)

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Studies on physiological characterization of fibre development in cotton under drought stress condition were carried out with three cotton varieties (Pratima, Anjali, Bunny Bt) grown in pot culture at normal field capacity (100 per cent Field Capacity). The soil moisture levels were differentially maintained at the onset of square initiation using gravimetric method. The effect on morphological characters were investigated by using parameters like Plant height, Root length, Angle of branching, Number of leaves, Leaf rolling, No of boll per plant and No of seed per boll. The effect of water stress on growth was investigated by using growth parameters like Total leaf area, Specific leaf area, Specific leaf weight and Total dry matter production. The prominent effect was found in gas exchange parameters which in turn found to influence photosynthetic rate and carbon assimilation which further influenced various morphological and biochemical characters. Gas exchange parameters viz., photosynthetic rate, transpiration rate and stomatal conductance were recorded using an advanced portable CO₂ gas analyzer (LI-6400 XT, Licor Inc, Nebraska, USA). The boll characteristics and fibre development were also influenced by reduced soil moisture levels. The effect of different moisture level on biochemistry of leaf was studied by Reducing sugar, Non-reducing sugar and Total sugar, Proline content, Soluble Protein and Nitrate Reductase. The Proline content was increased at different soil moisture levels. The Nitrate Reductase activity and Soluble Protein were decreased at moisture different levels. Water stress was the most important factor limiting crop productivity and adversely affects fruit production, square, lint yield per boll, lint yield per plant and fiber quality. The Scanning Electron Microscope (SEM) is a type of electron microscope that images the sample surface by scanning it with a high-energy beam of electrons in a raster scan pattern. The effects on the morphology of fibres were studied by Scanning Electron Microscopy at 0 DPA and 3 DPA. The effect of Water stress on boll enzyme activity assays was studied by Peroxidase activity at 10 DPA bolls. It has been concluded that drought affects the process of fibre development as the plant tends to modify its morphology, physiology and biochemistry to survive under stress.

STUDIES ON SEED STORAGE BEHAVIOUR OF *MUSA BALBISIANA*, A WILD PROGENITOR OF BANANAS AND PLANTAINS

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India is the one of the center of origin and diversity of *Musa* spp., comprising cultivated bananas and plantains, besides many wild relatives. Majority of the cultivated bananas are believed to have been derived from inter- and intra-specific crosses between two diploid ($2n = 2x = 22$) wild species, *Musa acuminata* (AA genome) and *Musa balbisiana* (BB genome). Most wild species of *Musa* are diploid and seeded, whereas most cultivated hybrids and species are non-seeded triploids ($2n = 3x = 33$), with a few being diploid or tetraploid. Studies on dormancy, germination and storage behavior of wild banana seeds are very sparse. No genebank in the world has any significant collection of wild *Musa* seeds, primarily due to lack of basic information on its storage behaviour. The present study has been undertaken to elucidate morphology, seed physiology and germination of *M. balbisiana* seeds (accession # EC653579), to standardize the optimal storage regime from a genebank perspective. A total of 6,730 seeds were harvested from a single mature bunch (weighing 5.46 kg), with an average of 95.2 ± 17.2 seeds per fruit and 100-test weight of 5.1 ± 0.3 . The mean mc content of seeds from freshly harvested fruits was 23.2 ± 4.5 % (n=105). Morphological analysis of the seed revealed that about 15 ± 5 % seeds showed absence of embryo or partially developed embryo (absence of haustorium). Viability assessment of excised embryos based on TTC test in fresh seeds was 100% and in seeds desiccated up to 10% mc ranged from 75-100% (n=210). Germination of excised embryos from freshly harvested seeds on MS + 0.1 μ M BAP medium was 100% (n=50). However, germination of whole seeds (after removal of operculum), was only 20% (n=20). Seeds were dried under a laminar air flow for 8-16 h under 2000 lux light at 23-28°C, and RH of about 60-70% or using silica gel beads. Embryo germination varied unevenly (62.5 to 100%) at different mc of seeds (from 23% to 6%), without any correlation between the two parameters. Seeds at 10% mc were stored at 25°C, 4°C, -10°C, -20°C for three months and germination was recorded by embryo culture (n=100 per treatment). Mean embryo germination obtained was 62.8 %, 36.4 %, 66.7 %, 75.0 % embryo germination respectively (N=100 seeds/treatment). The seeds, therefore appear to be desiccation and low temperature tolerant. However, morphologically and in terms of germination, there appears to be some heterogeneity in the seeds, which may possibly contribute to lack of correlation between seed desiccation and germination. The study indicates that *Musa balbisiana* seeds may be orthodox in nature, although more detailed studies are required for confirmation and genetic structure of the seeds also need more investigation.

SCREENING AND EVALUATION OF RESISTANCE VARIETIES OF *CICER AIRETINUM* AGAINST *FUSARIUM WILT* DISEASE

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Chickpea (*Cicer arietinum* L.) is the third most important pulse crop. It is documented that in the last two years, area as well as the production of chickpea has been reduced due to number of biotic diseases and one such is *Fusarium oxysporum* f.sp.*ciceri*. Fusarium wilt is a vascular epidemic or destructive fungal disease that can cause up to 100% yield loss, or can cause disturbance in xylem and phloem mechanism that leads to their wilting. Management practices which are followed to control *F.oxysporum* infection are inadequate and mainly depend on use of fungicides that is able to suppress their growth and development. But, the more use of fungicides can lead to unsustainable agriculture practices. Therefore other alternative approaches are required and in this context enormous efforts has been made to develop alternate and safe methods of control, known as biological and non-biological factors, but they may increase resistance among pathogens, and also able to express locally or systemically in plants. To overcome this major constraint, development of resistant varieties is one of the sustainable alternative approaches for the management of this disease. To develop Fusarium resistant germplasm, conservation and screening of genotypes is the most important factor and after this only we can proceed for different breeding techniques. Earlier, conventional breeding was widely used but it is a time consuming pathway, therefore, in the current scenario molecular tools with conventional aspects are employed which provide a great potential for improving chickpea cultivar. In an attempt for the same, we gathered 25 genotypes that were collected from ICRISAT and used, to study fusarium stress. In morphological screening different strains *fusarium oxysporum* f. sp. *ciceri* were collected from MTCC Chandigarh which will be used to inoculate in the cultivars periphery and it will be screened in pots as well as in field, and in the molecular aspect different fragile SSR markers i.e. TA59, TA96 and TA19 will be used. This screening will further help to identify the elite cultivars that can be utilized for crop improvement.

Keywords: *Cicer arietinum* L, *Fusarium oxysporum* f.sp.*ciceri*, Control measures, SSR marker

BREEDING FOR BROWN PLANTHOPPER (*NILAPARVATA LUGENS* STÄL.) RESISTANCE: AN INNOVATIVE APPROACH FOR SUSTAINABLE RICE IMPROVEMENT

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Brown planthopper (BPH) is one of the serious insect pests causing severe damage to rice crop, either directly through sucking of sap from the phloem or transmitting important viral diseases (ragged and grassy stunt viruses). In order to develop a sustainable insect pest management system, there is a need to find correct balance among breeding and management strategies to keep the pest population under economic threshold levels. Conventional procedures to reduce BPH damage including the use of chemical insecticides are costly, ineffective under some weather conditions and the chemicals can kill BPH predators. Host plant resistance is the most valuable, environment friendly and sustainable approach to prevent the losses caused by BPH. Therefore, it is imperative to recognize BPH resistance genes from diverse sources and integrate them into rice cultivars. The authors investigated 44 advanced breeding lines and eight stable lines of rice to identify the resistance sources against Pantnagar biotype of BPH. The findings revealed that MRST 3 and PHS 29 were resistant, whereas, TN 1 and Pusa Basmati 1 were found to be susceptible. Different F_1 s produced by crossing BPH susceptible and resistant genotypes were advanced to F_2 , F_3 and backcross generations. Upon phenotypic evaluation of F_2 and backcross generations of these crosses, the genetic segregation of resistant and susceptible plants was subjected to goodness of fit and it was found that BPH resistance in PHS 29 and MRST 3 was governed by one and two recessive genes, respectively. The generation mean analysis using Hayman's five and six parameter models indicated that BPH resistance in PHS 29 and MRST 3 donors is governed by additive and dominance gene action, respectively. These results indicate that selection for BPH resistance may be effective in case of segregating generations derived from crosses using PHS 29 as one of the parents.



POTENTIAL OF ABUSCHULAR MYCORRHIZA AGAINST STRESS CONDITION

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Plants encounter many biotic and abiotic stresses under the natural environment in which they are grown. Sometimes these stress condition may leads to huge reduction in quality as well as in yield. Therefore alternative control approaches are required for sustainable production. In that prospect, enormous efforts have been made from many years and in that AbuschularMycorrhiza was found as a piece of good fortune due to their activity of alleviating the influence of biotic and abiotic stresses. In the studies it was suggested that symbiotic association of AM fungi is responsible to boost up the production of secondary metabolites like terpenoids, alkaloids and phenol which have medicinal application that creates a defence mechanism against these stress conditions in the plants. AM fungi also known as a vital component of soil to promote nutrients uptake and protect the plants from various type of stresses. Therefore conservation of mycorrhizal fungi under *In-vitro* condition may provide high-quality; contaminant free AMF inoculums having enormous Industrial application for Bio fertilizers. Also the accumulation of these secondary metabolites having huge value in pharmaceutical industry.

Keywords: AbuschularMycorrhiza, biotic and abiotic, secondary metabolites, defence mechanism.

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.

ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM SUGARCANE

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Use of plant growth promoting rhizobacteria (PGPR) gaining more importance in future aspects of agriculture. PGPR acceptance by world gives us future trend. It is the important tool to increase the yield potential of different crops. Sugarcane is the important commercial crop in Indian agriculture. Sugarcane is majorly cultivated for producing products like sugar, jaggery, ethanol, molasses, baggase, press mud etc. There is wide need of increasing the yield of sugarcane. This can be achieved by identifying the potential PGPR for particular sugarcane varieties and specific PGPR strains. PGPR identification and isolation can be reported by using parameters like indole acetic acid (IAA) production, phosphorus solubilisation, siderophore production and antagonistic against the pathogen especially *Colletotrichum fulcatum*, which cause red rot disease in sugarcane *in vitro*, pyrroloquinoline quinone activity (PQQ), Extracellular polymeric substances (EPS). The identified potential PGPR can be conserved by sub culturing using suitable media (nutrient agar media) or sent to microorganism banks. Conservation of important microbial diversity in field level is very much emphasised to increase the yield of crops.

Keywords: PGPR, IAA, phosphorous solubilisation, siderophore production, antagonistic, PQQ, EPS.

EVALUATION OF BIOCONTROL AGENTS AGAINST PHYTOPHTHORA BLIGHT IN PIGEONPEA

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Pigeon pea is an important pulse crop of the world which is an important source of protein and other nutrients. *Phytophthora* leaf blight is a major disease of pigeon pea which is caused by *Phytophthora drechsleri* f.sp. *cajani*. In vitro evaluation of different isolates of *Trichoderma* and a strain of *Pseudomonas fluorescens* against *Phytophthora drechsleri* f.sp. *cajani* was carried out to test the efficiency of these antagonists as biocontrol agents against the test pathogen. Ten isolates of *Trichoderma* species were tested against the blight pathogen under dual culture experiments. Volatile and non-volatile metabolites released from the antagonists were also tested against the pathogen. Percent inhibition in the mycelial growth of the pathogen was determined. All *Trichoderma* isolates showed significant inhibitory effect on the pathogen in all the



experiments. Under dual culture tests maximum and minimum percentage of inhibition was showed by AN-33 (81.7%) and AN-37 (63.4%) respectively. Under volatile experiments AN-48 (62.6%) and AN-6 (46.9%) showed maximum and minimum percent inhibition respectively. Under non-volatile experiments, the highest inhibition of pathogen was observed at 15% concentration of the culture filtrates of the bio agents. At this concentration AN-33 exhibited the maximum (72%) and AN-6 showed the minimum (43.5%) inhibition to the pathogen growth. *Pseudomonas fluorescens* showed significant inhibition in the mycelial growth of the pathogen under dual culture test with percentage inhibition of 43%. The study suggests that the *Trichoderma* spp. has a potential to be used as biocontrol agents against *Phytophthora* Blight of pigeon pea. *Trichoderma* isolate AN-33 was identified as the most effective isolate out of the ten isolates studied.

Keywords: *Phytophthora*, *Trichoderma*, *Pseudomonas*, antagonist, volatile, non-volatile compounds

STABILITY FOR SEED COTTON YIELD AND ITS COMPONENT TRAITS IN ASIATIC COTTON (*GOSSYPIMUM ARBOREUM* L.)

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Stability analysis helps in understanding the adaptability of genotypes over different environmental conditions and the identification of adaptable genotypes. To study the magnitude and nature of genotype $\times$ environment interaction and to determine stability of yield potentiality in Asiatic cotton was carried out in three different date of sowings (Early, normal and late) during *Kharif* seasons of 2015 and 2016. Significant differences were observed among the genotypes and environments for seed cotton yield per plant, lint yield per plant, seed index, lint index, ginning out turn, number of seeds per boll, boll weight, number of bolls per plant, number of monopods per plant, plant height, days to boll bursting and days to first flower indicating presence of variability among genotypes and environment. Mean square due to genotypes $\times$ environment (linear) were significant for all the characters indicating the preponderance of linear component of G $\times$ E interaction than non linear component hence prediction is possible. The cotton varieties HD 123 and HD 432 were recorded high mean with regression coefficient (b_i) near unity and non significant deviation from regression (S^2d_i) for seed cotton yield per plant, lint yield per plant and number of monopods per plant indicated that these genotypes had average response and high stability over the environments. The estimation of environmental additive effect (I_j) estimates revealed that environment 4 was best for seed cotton yield (g/plant) and lint yield (g/plant). Hence experimental finding suggests the suitability of genotypes and environmental conditions for the exploitation of different traits of cotton to varying conditions.

Keywords: Cotton genotypes, stability parameters, genotype $\times$ environment interactions, potentiality.

STUDIES ON PHOSPHORUS AND SULPHUR FERTILIZATION IN PIGEONPEA AND ITS RESIDUAL EFFECTS ON SUCCEEDING OATS CROP

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The investigation entitled “Studies on phosphorus and sulphur fertilization in pigeonpea and its residual effects on succeeding oats crop” was carried out for the two consecutive kharif and rabiseasons of 2005-06 and 2006-07 at the agricultural research farm of Janta Vedic College, Baraut (Baghpata), U.P. The variables involved in the study were five levels of phosphorus (0, PSB, 40 P₂O₅, 40 P₂O₅+ PSB and 80 kg P₂O₅ ha⁻¹) and three levels of sulphur (0, 30 and 60 kg S ha⁻¹). The experiment was laid out in Split Plot Design. Keeping levels of phosphorus in main plots and levels of sulphur as sub plot treatment and were replicated thrice. The soil of the experimental field was sandy loam, deficient in nitrogen and organic matter, medium in sulphur and phosphorus and fairly rich in potash content during both the seasons. The reaction of the soil was slightly alkaline. The salient features of relevant results pertaining to these observations have been summarized in the following points:

STUDY ON THE EFFECTS OF PSB AND RHIZOBIUM WITH THEIR COMBINATIONS ON NUTRIENT CONCENTRATION AND UPTAKE OF CHICKPEA (*CICER ARIETINUM* L.)

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This study was carried out to determine the effects of PSB and rhizobium inoculation for a Chickpea (*Cicer arietinum* L.) variety, Awarodhi, under Central Uttar Pradesh conditions in 2015 and 2016. The trial was laid out in factorial randomized block design with three replications. The experiment on the chickpea (*Cicer arietinum* L.) crop was conducted at Nawabganj Research Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during Rabi season for year 2015-16, to assess the response of Rhizobium and PSB as affected by their application. The result showed that some plant attributes of the crop like the number of nodules varied from 8 to 25 at 30 days and 12 to 43 at 60 days. The yield of the crop was also varied from 12 to 26 qtl. ha⁻¹ of seeds of chickpea (*Cicer arietinum* L.) and 13.7 to 35.0 qtl. ha⁻¹ Stover of the crop. Maximum N and P uptake in grain and straw as well as protein content in grain were noted maximum with dual inoculation of (Rhizobium + PSB). The treatment combination Rhizobium + PSB has been found best in respect of number nodules, seed and stover yield, nitrogen, phosphorus content and its uptake and also in protein content of seed.



STUDY THE PATH ANALYSIS OF DIIFERENT ORIGIN FABA BEAN (*Vicia faba* L.) GENOTYPES**Praveen Kumar¹, Pryanka Swami, Bhartendu Jain and [Rikshita roy](#)**

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This study carried out in sixty five genotypes was grown in 2014/015 cropping season in a randomized block design with three replications. Analysis of variance indicated that genotypes differed significantly for all of the studied traits. Correlation coefficient analysis indicated that all the traits had positive significant correlation coefficients with seed yield except plant height, having non significant correlation. Path coefficient analysis revealed that five characters viz., 100-seed weight, number of pods per plant, pod length, number of seeds per pod, number of branches per plant days to maturity had positive and direct effects on seed yield, while the characters, days to flowering, plant height, cluster per plant direct negative effects. So lays stress on these characters for the improvement of yield of faba bean during breeding program. The results of correlation and path coefficient analysis indicated that the traits like, 100-seed weight, number of cluster per plant, number of pods per plant , number of branches per plant and days to flowering should be given due consideration while performing selection for seed yield in segregating generations of faba bean

Keywords: Fababean, Correlation coefficient, Path coefficient analysis**EFFECT OF SALT STRESS ON GERMINATION, EARLY SEEDLING GROWTH AND PHYSIOLOGICAL PARAMETER OF RICE (*ORYZA SATIVA* L.)****Subhash kumar¹, A.H. Khan¹, Shashank srivastav²**Department of Crop Physiology, Narendra Deva University of Agriculture and Technology Kumarganj Faizabad¹, Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology Kanpur²

The experiment were conducted in the laboratory of crop physiology department during july-august 2015. Seed of two salinity tolerant and two susceptible varieties of rice namely CSR-43, Narendra Usar Dhan-3, IR-28 and IR-29 were used, respectively. Salt (NaCl) concentrations used in the experiment were 50,100,150,200 and 250 mM. 20 seeds of rice were germinated in 9cm petri dishes containing double layered blotting paper. 15 ml volume of different concentrations of NaCl was added in each petri dish for giving salt stress treatment and untreated control was used where only same volume of distilled water was added. 6 petri dishes constituted each replication and experiment was replicated the rice in Complete Randomized Block Design. Equal volume of NaCl solution of different concentration and distilled water was applied in the dishes as per treatment when moisture content of the blotting paper was declined. Seed were considered as germinated when the radicle had protruded through the seed coat. Germination percentage, length of plumule and radicle as well as their dry weight were recorded for every replication on 4th, 6th, 8th and 10th. On 10th day germinated seedling were used alpha amylase activity, proline content, reducing and non-reducing sugar and catalase and peroxidase activity. Besides this, seed vigour index, percent reduction over control, speed of germination and response index were determined. It was conceived from the results the salinity stress significantly affected germination percentage and all the germination parameters (speed of germination, vigour index, salt tolerance index and response index) in reverse order (Control<50mM<100mM<150mM<200mM<250mM). Varietals differences among under salinity were also recorded significant. Narendra Usar Dhan-3 and CSR-43 have performed better even under 250mM NaCl.

Regarding biochemical studies all the salinity levels influenced alpha amylase activity, proline content, reducing and non-reducing sugar, starch content, catalase and peroxidase activity in both tolerant and susceptible varieties and significant reduction and these parameters were recorded as compared with control there was less reduction in all the biochemical studies in tolerant varieties in comparison to susceptible varieties.

INTEGRATED NUTRIENT MANAGEMENT TECHNIQUES FOR COMPARISON OF MORPHOLOGICAL TRAITS IN RADISH (*RAPHANUS SATIVUS*.L)**Sumant Bindal¹, Shivani Yadav², Bijendra Kumar³, Akashdeep Kamboj⁴**

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Radish is an important commercial crop grown all over the country as a vegetable crop, cash crop and in kitchen garden. In general, the inorganic fertilizers (NPK) are used by the farmers which give the satisfactory yields, but use of such fertilizers cannot be categorized under a good sustainable technique. So, a trial was conducted in which different nutrient management practices were integrated and compared with that of traditional practice of inorganic fertilizers application in regard to three attributes i.e. average length, average circumference and yield of Radish. Four types of treatments were applied in a RBD design, which were recommended dose of inorganic fertilizers NPK (first treatment), Organic treatment with FYM+Bio-energy (second treatment), seed treatment with NAA along with recommended dose of inorganic fertilizers (third treatment) and foliar spray of NPK (fourth treatment) instead of traditional soil application. In all of the four different treatments, the overall requirement of radish plant for nutrients was fulfilled by the applied nutrient practice while other agronomic practices were kept equivalent for all. After harvesting, the data for the three attributes was recorded. The results which were obtained were as follows, in terms of average length of radish, first treatment succeeded all the other three treatments and the same was observed for average circumference and yield also. First treatment showed 11 per cent, 2 per cent and 16 per cent increase in average length over the second, third and fourth treatment, while in case of average circumference first treatment succeeds the second and third treatment by 20 per cent and fourth treatment by 25 per cent. Similarly, in the case of yield, first treatment out yielded the second, third and fourth treatment by 44, 13 and 50 per cent. Therefore, it can be concluded that although the first treatment performed better over all the other treatments in case of three observed attributes but it is not a significant sustainable way of providing nutrients to the Radish plants.

Keywords: inorganic, NPK, RBD, organic, FYM, Bio-energy, NAA.

STUDIES ON THE EFFECT OF SULPHUR, ZINC, BORON AND IRON ON ROOT AND SHOOT DYNAMICS AND PRODUCTIVITY OF WHEAT [*TRITICUM AESTIVUM* L.]**Sunil Kumar and V.K. Verma**

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The experiment conducted during Rabi season of 2015-16 at student instructional farm of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur. The experiment consisted 10 treatments of different nutritional doses of micro nutrient, organic manure, micro organisms, along with NPK doses with the objective to assess root and shoot growth, yield attribute and Increase in yield and economics due to balance nutrition in wheat variety Mahi (K-402). The experiment organized under Randomized Block design with 3 Replications. The soil of field analyzed medium fertility status in respect of available NPK and status of micro nutrient. The treatment NPK + FYM + S + Zn + BO + Fe treatment found superior in terms of maximum root and shoot growth, yield attributes and yield. The maximum grain yield (53.05 q/ha.), straw yield (80.08 q/ha), Gross income (Rs. 103734/ha.) and Net Income (Rs. 58088/ha.) recorded under NPK + FYM + S + Zn + BO + Fe treatment. The increment in Grain yield, Gross income and net income evaluated 34.13%, 28.15% and 40.73%, respectively under NPK + FYM + S + Zn + BO + Fe treatment compared to control treatment.

ASSOCIATIONS AMONG VARIOUS SEED QUALITY PARAMETERS IN FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM*)**Sunil Kumar, Axay Bhuker, Pradeep Singh and V.P.S. Sangwan**

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In the present investigation, two seed lots of Variety HM-57 of fenugreek (L_1 was having standard germination above 70% and L_2 was having standard germination below 70%). Correlation coefficient analysis was employed to find out the association among various seed viability and vigour parameters viz., Test weight, seed density, standard germination, root length, shoot length, seedling dry weight, vigour index-I, vigour index-II, tetrazolium test, electrical conductivity, dehydrogenase enzyme activity, speed of emergence, mean emergence time and seedling establishment. Seedling establishment was found positively and significantly correlated with mean emergence time (0.977**), seed density (0.974**), test weight (0.973**), tetrazolium test (0.968**), root length (0.964**), seedling dry weight (0.926**), standard germination (0.924**), dehydrogenase enzyme activity (0.912*), speed of emergence (0.883*), vigour index-I (0.926**), shoot length (0.844**), vigour index-II (0.941**) while negatively and significantly correlation with electrical conductivity (-0.927**). Seedling establishment of the seeds of second lot (L_2) was found positively and significantly correlated with tetrazolium test (0.981**), speed of emergence (0.969**), seedling dry weight (0.962**), shoot length (0.859**), test weight (0.952**), root length, vigour index-I and standard germination. Among all the seed quality parameters mean emergence time, seed density, test weight, tetrazolium test and standard germination were found highly correlated with seedling establishment for all the seed lots hence they can be used as reliable predictor of seedling establishment (%).

BIOLOGY AND FEEDING POTENTIAL OF *COCCINELLA SEPTEMPUNCTATA* (LINNAEUS) ON NATURAL AND ARTIFICIAL DIETS UNDER LABORATORY CONDITION**Suraj Kumar*, Rajendra Singh and Sudhir Kumar**

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The present investigation entitled "Biology and feeding potential of *Coccinella septempunctata* (Linnaeus) on natural and artificial diets under laboratory condition" was carried out during Nov. 2016 to March 2017 at Bio-control laboratory, Sardar Vallabhbhai Patel Uni. of Agri. and Tech., Meerut. The data on biology of *C. septempunctata* showed that when it was reared on *L. erysimi* the egg incubation, total larval, pupal and adult male and female periods was 3.33 ± 0.33 , 13.0 ± 0.57 , 5.67 ± 0.33 , 30.67 ± 0.67 and 36.67 ± 0.33 days, respectively. To evaluate feeding potential of *Coccinella septempunctata* during total larval to adult period consumed significantly maximum aphids of *A. Craccivora* (1906.67), as compared to other aphid species followed by *L. erysimi*, (1708.00), *Myzus persicae* (1687.67), *Macosiphum rosae* (1611.70), *B. brassicae* (1511.33), *H. coriandari* (1295.33), *A. gossypii* (1179.33) respectively. The result of feeding potential artificial diets show preference of *Coccinella septempunctata* was in the order of Sugar syrup > Honey syrup > Gurhal flower + Distilled water > Caster flower + Distilled water > Honey + Proteinex + Distilled water > Mustard flower + Distilled water > and Distilled water. *Coccinella septempunctata* larval stage was not survive on distilled water. The fecundity of *Coccinella septempunctata* female was recorded significantly maximum aphid of *Myzus persicae* 580 ± 2.88 eggs whereas, it fecundity minimum on *Brevicoryne brassicae* 255 ± 2.88 eggs as compared to other aphid species.

EFFICACY OF PLANT EXTRACTS AGAINST ALTERNARIA ALTERNATA CAUSING ALTERNARIA BLIGHT OF FENNEL**Suresh Meena*, R.P. Ghasolia and Jitendra Sharma**

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Among the fungal disease, Alternaria blight causes huge losses. Disease management with chemicals is economically not viable and also not safe for the environment. Therefore, the present investigations aimed to carry out the test of plant extracts (neem, garlic, datura, tulsi and lantana) against *Alternaria alternata* under *in vitro* and *in vivo* conditions. Among plant extracts, garlic clove extract was found most effective in inhibiting mycelia growth (82.26, 86.43 and 88.61%) of *Alternaria alternata* at 5, 10 and 15 per cent, respectively followed by datura leaf extract (74.51, 81.84 and 84.20 %) over control. The plant extracts were tested *in vivo* as foliar application (5 %) at Agronomy Farm, S.K.N. College of Agriculture, Jobner with susceptible local cultivar of fennel for two consecutive years (2013-14 and 2014-15) during *rabi* season. Among these,



garlic clove extract was found most effective in reducing the disease intensity (38.62%) and increased seed yield (49.54 %) followed by datura 33.05 % and 40.00%, respectively.

EFFECT OF FOLIAR SUPPLEMENTATION ON PRODUCTIVITY OF PEARL MILLET [*Pennisetum glaucum* (L.)]

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Pearl millet [*Pennisetum glaucum* (L.) Br Emend stuntz.] popularly known as Bajra is an important cereal crop of India after rice, wheat, maize and sorghum. The foliar applied nutrients are more effective as compared to soil applied nutrients. Because of higher uptake efficiency, foliar supply of nutrients can increase photosynthetic efficiency by delaying the onset of leaf senescence. Recent interest in foliar nutrition is due to applying nutrients on the leaves in the immediate vicinity of the metabolizing surface has been, though, proved promising but the fact that supplied amount of plant nutrients is also reduced considerably when compared to soil applied quantity. Therefore, a field experiment was conducted during kharif, 2016 at Instructional Farm (Agronomy), College of Agriculture, SKRAU, Bikaner. The experiment comprising total number of fourteen treatments, viz. control, recommended dose, 0.5% spray of NPK (18:18:18) at 25 & 35 DAS 1.0% spray of NPK (18:18:18) at 25 & 35 DAS, 1.5% spray of NPK (18:18:18) at 25 & 35 DAS, 50% as basal (NPK) + 0.5% spray of NPK (18:18:18) at 35 DAS, 50% as basal (NPK) + 1.0% spray of NPK (18:18:18) at 35 DAS, 50% as basal (NPK) + 1.5% spray of NPK (18:18:18) at 35 DAS, 75% N (50% basal + 25% Top dressing at 25 DAS): P : K + 0.5% spray of NPK (18:18:18) at 35 DAS, 75% N (50% basal + 25% Top dressing at 25 DAS): P : K + 1.0% spray of NPK (18:18:18) at 35 DAS, 75% N (50% basal + 25% Top dressing at 25 DAS): P : K + 1.5% spray of NPK (18:18:18) at 35 DAS, 50% N + 100 % (P & K) as basal + 0.5% urea at 35 DAS, 50% N + 100 % (P & K) as basal + 1.0% urea at 35 DAS and 50% N + 100 % (P & K) as basal + 1.5% urea at 35 DAS were laid out Randomized Block Design (RBD) with three replications. Results showed that higher grain yield, stover and biological yield were recorded in 75% N (50% basal + 25% Top dressing at 25 DAS): P: K + 1.5% spray of NPK (18:18:18) at 35 DAS.

EFFECT OF PHOSPHORUS AND POTASSIUM LEVELS ON HERBAGE AND SEED YIELD OF OAT (*AVENA SATIVA* L.)

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Oat (*Avena sativa* L.) is an important source of feed all over the world, both as the nutritious grain and as forage and is considered as second highest protein cereal grain crop after soybeans. The proportion of oat being used for horses and human consumption has increased over the past 25 year. In the present study, effect of different phosphorus (0, 20, 40 and 60 kg P₂O₅/ha) and potassium (0, 20, 40 and 60 kg K₂O/ha) levels were studied on the quality of oat variety HJ-8. The highest green fodder yield (147.69 q/ha) was recorded with the application of 60 kg P₂O₅/ha which is significantly superior from other levels. There is no drastically change was observed in crude protein (%) by either of phosphorus and potassium levels. Highest in Vitro Dry Matter Digestibility (IVDMD) (47.20 %) was recorded with the application of 60 kg P₂O₅/ha which is significantly superior over control. Highest crude protein yield (1.143 q/ha) was recorded with the application of 60 kg P₂O₅/ha which was on a par with the application of 40 kg P₂O₅/ha (1.075 q/ha). The highest digestible dry matter (7.436 q/ha) was recorded with the 60 kg P₂O₅/ha which was on a par with the application of 40 kg P₂O₅/ha (7.083 q/ha). Green fodder yield, crude protein (%), IVDMD, crude protein yield and digestible dry matter was not notably affected by any of potassium levels. Therefore, the present study indicated that phosphorous level at 60 kg P₂O₅/ha had the best quality and yield in oat among the given treatments.

Keywords: Nutrient, oat, phosphorus, potassium, quality, yield

SUITABILITY OF CUT CORMS AS PLANTING MATERIAL ON GROWTH AND YIELD IN DIFFERENT GLADIOLUS (*GLADIOLUS GRANDIFLORUS* L.) VARIETIES

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The present investigation entitled, “Suitability of cut corms as planting material on growth and yield in different gladiolus (*Gladiolus grandiflorus* L.) varieties” was under taken in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during Rabi season (2016-2017). The experiment was laid out in Factorial Randomized Block Design (FRBD) with 09 treatments and each treatment replicated thrice. The treatments consist of different division of corms (Full, Half and one-third) and 3 varieties (Deepest Red, Jessica and Amsterdam). Early sprouting (5.98 days), maximum plant height (68.67 cm) and maximum number of leaves (7.20) was found when full corms were planted for Amsterdam variety. Number of florets per spike (14.83), diameter of daughter corms (65.16 mm), weight of daughter corms (52.85 g) per plant were found to be best in variety Amsterdam when full corms were planted whereas number of cormels (59.57) were found to be maximum in variety Deepest Red. Therefore based on the results obtained it can be concluded that full corms were better in terms of growth and corm size parameters. Though half and one third corms were found inferior regarding growth and corm size parameters but it can be used for daughter corm and cormels production thereby increasing the planting to many folds in next season and ultimately providing benefit to the farmers.

Keywords: Cut corms, Spike, Florets, Daughter corms, Cormels



PATHOGENIC POTENTIAL OF OROBANCHE AEGYPTIACA PERS.ON BRINJAL (SOLANUM MELONGENA L.)**Gulwaiz Akhter* and Tabreiz Ahmad Khan**

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A number of angiospermic plants have become weeds, posing severe constraints to major crops including legumes, oil seed and vegetables. *Orobanche aegyptiaca* is an achlorophyllous, angiospermic holo-root parasite that depends completely on host to complete its life cycle. Studies have revealed that parasitism depresses growth and yield of infected plants but conclusions as to how *Orobanche* influences growth are obscure, as the majority of studies have been conducted under uncontrolled field conditions with imperfect sampling protocols. To the best of our knowledge, no previous work on Pathogenic potential of *O. aegyptiaca* on *S. melongena* had done. Therefore, objective of this research work was to evaluate the damaging threshold level or Economic threshold level of *O.aegyptiaca* on brinjal. A pot study was conducted to assess the pathogenicity of *Orobancheaegyptiaca* onbrinjal. The damage caused by *O.aegyptiaca* on brinjal was studied at different inoculum levels i.e. 25, 50, 100, 200, 400 and 800 seeds/ pot under the green house condition. The parameters measured were plant length, fresh weight, dry weight and yield per plant. The no. of *Orobanche* shoots per plant, total dry weight of *Orobanche* shoots were also evaluated. The reduction in measured growth parameters of brinjal plant was non-significantly. However, Significant reduction in plant growth parameters compared to uninoculated control plants was observed at an initial inoculum levels of 100 seeds/pot and considered as the damaging threshold level or economic threshold level of *O. aegyptiaca* on brinjal.

Keywords: Pathogenic potential, *Orobanche aegyptiaca*, holo-root parasite *Solanum melongena* and economic threshold level.

TO ASSESS THE SCOPE OF SUMMER MOONG (VIGNA RADIATA L.) IN TERMERIC (CURCUMA LONGA L.)**Balvir Kaur* and Paramjit Kaur Sraw and Kuldeep Singh**

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On farm trial on effect of intercropping of summer moong (*vigna radiata* L.) on growth, yield, and economics of turmeric (*curcuma longa* L.) was conducted at farmer's fields in adopted villages of Krishi Vighan Kendra viz. Kandola Kalan, Kaimwala, Mehsampur and Fatechpur in district Jalandhar during 2012 and 2013. The experiment was laid out in randomized complete block design and each location was considered as replication. The treatments were T₁ - sole turmeric flat (30 cm x 20 cm), T₂ - sole turmeric ridge (45 x 15 cm), T₃ - sole turmeric ridge (60 x 10 cm), T₄ - sole turmeric bed (67.5 cm), T₅ - turmeric : summer moong (1:1) flat, T₆ - turmeric : summer moong (1:1) ridge 45 x 20 cm, T₇ - turmeric : summer moong (1:1) ridge 60 x 20 cm, T₈ - turmeric : summer moong (2:1) bed 67.5 cm and T₉ - turmeric : summer moong (2:2) bed 67.5 cm. In intercropping treatments, the sowing of turmeric was done on the top of ridge and bed and summer moong was sown in furrows. The data on emergence count (30 and 60 DAS), plant height, tillers per plant (No.), dry matter accumulation, number of rhizomes (mother, primary, secondary), total rhizomes plant⁻¹, rhizome yield (q ha⁻¹) (fresh, dry and processed) were recorded and showed significant difference in all the treatment expect emergence count at 60 days of sowing. The treatment T₈ and T₉ where turmeric was sown on bed with summer moong in the furrow was found better for all the characters under study. The highest net returns of Rs 2.27 x 10⁵ ha⁻¹ with B : C ratio 4.89 was obtained in T₉ - turmeric : summer moong (2:2) bed 67.5 cm followed by T₈ - turmeric : summer moong (2:1) bed 67.5 cm and recorded lowest net returns of Rs 1.58 x 10⁵ ha⁻¹ with benefit: cost ratio 3.51 in T₅ - turmeric : summer moong (1:1) flat. The study revealed that summer moong can be better option as intercrop in turmeric than the sole turmeric crop for proper utilization of all resources.

Keywords: Termeric, Summer Moong, rhizome, yield

EFFECT OF GLUCOSE CONCENTRATION ON GROWTH OF BACTERIAL ISOLATES UNDER ALUMINIUM STRESS**Priyanka Arora^{1*}, Geeta Singh² and Archana Tiwari¹**¹School of Sciences, Noida International University, G.B Nagar, Greater Noida, U.P²Division of Microbiology, Indian Agriculture Research Institute (IARI), New Delhi

Aluminium is one of the most abundant metals. This metal is responsible for inhibiting growth and productivity of many cultures thereby affecting the metabolism of most of the microbes. The current study is aimed at examining the effect of glucose addition on bacterial growth under aluminium stressed conditions. For this purpose, nutrient broth was supplemented with different concentration of aluminium viz. 0mM, 20mM, 60mM and 80mM. In addition to above heavy metal supplementation, the nutrient broth was additionally provided with varying concentration of glucose (0.25%, 0.5% and 1% glucose). The *Bacillus* and *Burkholderia* cultures were allowed to grow in all possible combinations of provided aluminium and glucose concentrations. In case of *Bacillus* culture, when media was supplemented with 0.5% glucose, the culture growth was increased upto 2-folds in 20mM aluminium toxic conditions whereas growth of *Burkholderia* strains increased upto 2-folds, 11-folds and 5-folds in case of 20mM, 60mM and 80mM aluminium stressed conditions respectively. The results conclude that under aluminium toxic conditions, 0.5% glucose supplementations could prove to be beneficial for bacterial optimal growth.

THE CHEMISTRY OF ROSE OIL**Manika Barar¹, Anuj Kumar² and Kaviraj³**SIMT, Mawana, Meerut¹, College of Horticulture, Mandsaur², U.P. Agri. Department³

Rose oil (rose otto, attar of rose, attar of roses or rose essence) is the essential oil extracted from the [petals](#) of various types of rose. *Rose ottos* are extracted through steam while *rose absolutes* are obtained through solvent extraction or supercritical carbon dioxide extraction, with the absolute being used more commonly in [perfumery](#). Even with their high price and the advent of [organic synthesis](#), rose oils are still perhaps the most widely used essential oil in perfumery. The most common chemical compounds present in rose oil are: citronellol, geraniol, nerol,



linalool, phenyl ethyl alcohol, farnesol, stearoptene, α -pinene, β -pinene, α -terpinene, limonene, p-cymene, camphene, β -caryophyllene, neral, citronellyl acetate, geranyl acetate, neryl acetate, eugenol, methyl eugenol, rose oxide, α -damascenone, β -damascenone, benzaldehyde, benzyl alcohol, rohdinyl acetate and phenyl ethyl formate.

Keywords: Rose oil, organic components, use.

COMBINED EFFECT OF FLY ASH, ROOT-KNOT NEMATODE AND SIMULATED ACID RAIN ON PUMPKIN (*CUCURBITA MOSCHATA*) CROP

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A pot experiment was conducted in green house to evaluate the effect of fly ash, nematode and simulated acid rain on pumpkin. The experiment comprised of seven treatments such as T1-100 % soil mixture + 0% coal ash, T2-95 % soil mixture + 5% coal ash, T3-90 % soil mixture + 10% coal ash, T4-80% soil mixture + 20% coal ash, T5-70 % soil mixture + 30% coal ash, T6- 60 % soil mixture + 40% coal ash, T7-50 % soil mixture + 50% coal ash and after 15 days at four leaves stage plants were inoculated by 2000 J2 of *M. incognita* with the exposure of different levels of simulated acid rain acidified at pH 6 (control), 5.0, 4.0 and 3.0 twice in a week for two months.

The results indicated that the different growth (shoot and root length, fresh and dry weight of root and shoot), yield (number of flowers and number of fruits), biochemical (chlorophyll, carotenoids, proline, protein and carbohydrates) parameters and leaf relative water content (LWC) of *Cucurbita moschata* were significantly ($p < 0.05$) enhanced at 30% fly ash amended soil with lower level of simulated acid rain (pH 5.0). Perhaps fly ash enhanced all the parameters of the plant due to the presence of macronutrients like N, P, K, Ca, Mg, S and the micronutrients Zn, Mn, B and Mo and which are act as the growth medium for plant. However the lower level of simulated acid rain (pH 5.0) was found negligible. After 30% of fly ash and higher levels of acid rain (pH 4.0 and 3.0) were harmful to plant. So, growth, yield, biochemical parameters and LWC were significantly ($p < 0.05$) reduced as compare to control. This may be due to presence of heavy metals like Cr, Cd, As, Pb and Ni etc. found in fly ash and which are toxic to plants and also nematode. Therefore, by increasing the ratio of fly ash, nematode mortality rates were also increased and resulting into the reduction in disease. From the result it appeared that best level of fly ash was 30% that can be recommended for this crop.

Keywords: Chlorophyll, fly ash, growth, heavy metals, simulated acid rain, yield

BIOLOGY AND MORPHOMETRICS OF ONION THRIPS, *THRIPS TABACI* LINDEMANN ON CABBAGE, *BRASSICA OLERACEA*

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Onion thrips, *Thrips tabaci* is a polyphagous and devastating pest of economically important crops of family Alliaceae, Brassicaceae and Cucurbitaceae. Among these, it is a serious threat to onion and cabbage in field as well as in storage not only in India but throughout the world. It is also a vector of tomato spotted wilt virus and Iris Yellow spot virus. Its damage results in appearance of bronze discoloration which gives rough texture to the leaves with in the cabbage head. Objective of this experiment is to study the biology and morphometrics of *T. tabaci* on cabbage at $22 \pm 1^\circ\text{C}$ and $65 \pm 5\%$ RH in BOD incubator. This investigation depicts that incubation period of egg was varied from 4 to 10 days with an average of 5.46 ± 0.28 days. Average duration for I and II instars, pre-pupal and pupal period was 3.88 ± 0.11 , 3.58 ± 0.07 , 3.5 ± 0.08 and 3.35 ± 0.09 days, respectively with total developmental period of 19.53 ± 0.38 days. Females could produce 80.4 ± 2.62 eggs on an average in its whole life span at the rate of 3.27 ± 0.09 eggs per female per day with adult longevity of 31.5 ± 0.85 days including pre-oviposition, oviposition and post-oviposition period of 3.8 ± 0.25 , 25 ± 0.84 and 2.7 ± 0.3 days. However, total life span varied from 47 – 55 days with an average of 51.6 ± 0.78 days. Length of I and II instars was as 0.67 ± 0.04 mm and 0.87 ± 0.02 and breadth was almost similar to I and II instars 0.19 ± 0.01 and 0.19 ± 0.003 respectively. It was observed that pre-pupal length was recorded as 0.88 ± 0.03 mm, whereas average breadth of 0.20 ± 0.004 mm. Expanse of length and breadth of pupal stage was recorded as 0.87 ± 0.02 and 0.20 ± 0.004 mm, respectively. In order to calculate the average length and breadth of the size of adult, which was measured as 1.11 ± 0.26 and 0.25 ± 0.02 mm, respectively. Understanding relationship between biology and morphometry of *T. tabaci* with the host plant and environmental factor will contribute to the establishing of future management strategies in Integrated Pest Management.

USE OF TILLING IN PLANT DISEASE MANAGEMENT

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Plants were suffer from various plant disease and these disease causes severe loss in terms of money, if we manage the disease through the chemicals then they will be harmful to environment and human health as well as they will highly costly. Resistance through various genomic tools is better for environment and human. Tilling (Targeting Induced Local Lesions in Genomes) is the gene mining tools which is used for identification of allelic variation of target gene in a high throughput manner and disease resistance related gene. In tilling first we use of chemical mutagens to introduce random mutation. Seeds are mutagenized with EMS, which causes G/C-to-A/T point mutations. M1 seeds are selfed to produce M2 seeds. M2 progeny from single seed descent are used for screening, after that pooling of the DNA sample of M2 Plant and analyse the pool disease resistance gene through PCR with gene specific marker, after that heating and cooling of pooled sample to facilitate pairing of wild and mutant strands, are formed by heating and cooling the PCR products. Enzyme cleavage of hetero duplexes with CEL I nuclease is used to cleave at base mismatches, and products representing induced mutations are visualized with denaturing polyacrylamide gel electrophoresis. Sequencing and testing of the resistance mutant plant and selfing of mutant and phenotyping will do. Through tilling we can archive the resistance test genotype that will be used for further resistance breeding programme.



Keywords: Tilling, allele mining, disease management.

GROWTH AND YIELD OF IRRIGATED *BT* COTTON (*GOSSYPIMUM HIRSUTUM* L.) AS INFLUENCED BY DIFFERENT AGRONOMIC PRACTICES

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A field experiment was conducted to study the influence of different agronomic practices on growth, yield attributes and yield of *Bt* cotton at the Main Agricultural Research Station, Raichur during *Kharif* 2016. Nine treatments comprising of normal spaced and fertilized non-*Bt* (cv. RAHH-455) and *Bt* hybrid (cv. Bindas) in addition to closer spacing *Bt* hybrid supplied with 125 % of recommended nutrients (187.5: 92.75: 92.75 kg N:P₂O₅:K₂O ha⁻¹), foliar spray of 1% MgSO₄ twice and 1% KNO₃ thrice, soil application of MgSO₄ (25 kg ha⁻¹) and FeSO₄ (10 kg ha⁻¹) and ZnSO₄ (10 kg ha⁻¹), foliar spray of 1% MgSO₄ + 1% 19:19:19 or 1% KH₂PO₄ and polyethylene mulching replicated thrice. The results revealed that closer spaced *Bt* hybrid + 125 % RDF + 3 sprays of 1% each of MgSO₄ and 19:9:19 and polyethylene mulching recorded significantly higher plant height (159.2 cm), monopodia (2.0), sympodia (27.7), total dry matter production (347.0g), leaf area index (1.81), number of bolls plant⁻¹ (48.27) and seed cotton yield (4122 kg ha⁻¹) compared to other nutritional treatments. It also registered higher net returns (₹ 1,59,296 ha⁻¹), gross returns (₹ 2,22,588) and B:C ratio (3.52). It was followed by closer spaced *Bt* hybrid + foliar spray of 1% KH₂PO₄ thrice.

EFFECT OF POLYTHENE MULCHING AND PLANTING DENSITY ON YIELD AND ECONOMICS OF *BT* COTTON (*GOSSYPIMUM HIRSUTUM* L.) UNDER IRRIGATED CONDITIONS.

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A field experiment was conducted to study the influence of polythene mulching and planting density on yield and economics of *Bt* cotton (*Gossypium hirsutum* L.) under irrigated condition on growth, yield and economics of *Bt* cotton at the Main Agricultural Research Station, Raichur during *Kharif* 2016. Nine treatments comprising of normal spaced and fertilized non-*Bt* (cv. RAHH-455) and *Bt* hybrid (cv. Bindas) in addition to closer spacing *Bt* hybrid supplied with 125 % of recommended nutrients (187.5: 92.75: 92.75 kg N:P₂O₅:K₂O ha⁻¹), foliar spray of 1% MgSO₄ twice and 1% KNO₃ thrice, soil application of MgSO₄ (25 kg ha⁻¹) and FeSO₄ (10 kg ha⁻¹) and ZnSO₄ (10 kg ha⁻¹), foliar spray of 1% MgSO₄ + 1% 19:19:19 or 1% KH₂PO₄ and polyethylene mulching replicated thrice. The results revealed that closer spaced *Bt* hybrid + 125 % RDF + 3 sprays of 1% each of MgSO₄ and 19:9:19 and polyethylene mulching recorded significantly higher plant height (159.2 cm), monopodia (2.0), sympodia (27.7), total dry matter production (347.0g), leaf area index (1.81), number of bolls plant⁻¹ (48.27) and seed cotton yield (4122 kg ha⁻¹) compared to other nutritional treatments. It also registered higher net returns (₹ 1,59,296 ha⁻¹), gross returns (₹ 2,22,588) and B:C ratio (3.52). It was followed by closer spaced *Bt* hybrid + foliar spray of 1% KH₂PO₄ thrice.

EFFECT OF POLYTHENE MULCHING AND PLANTING DENSITY ON YIELD AND QUALITY OF *BT* COTTON (*GOSSYPIMUM HIRSUTUM* L.) UNDER IRRIGATED CONDITIONS.

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Investigation of new cotton production strategies is needed to enhance the productivity and profitability. A field experiment was conducted in clay textured soil during *Kharif* season of 2016-17 to evaluate the effect of polythene mulching and planting density on yield, economics and quality of *Bt* cotton (*Gossypium hirsutum* L.) at the Main Agricultural Research Station, Raichur. The experiment consisting of nine treatments comprising of normal spaced and fertilized non-*Bt* (cv. RAHH-455) and *Bt* hybrid (cv. Bindas) in addition to closer spacing *Bt* hybrid supplied with 125 % of recommended nutrients (187.5: 92.75: 92.75 kg N:P₂O₅:K₂O ha⁻¹), foliar spray of 1% MgSO₄ twice and 1% KNO₃ thrice, soil application of MgSO₄ (25 kg ha⁻¹) and FeSO₄ (10 kg ha⁻¹) and ZnSO₄ (10 kg ha⁻¹), foliar spray of 1% MgSO₄ + 1% 19:19:19 or 1% KH₂PO₄ and polyethylene mulching replicated thrice. The result of experiment indicated that significantly higher seed cotton yield (4122 kg/ha), gross return (1,59,296 ₹/ha), net monetary returns (2,22,588 ₹/ha) and B: C ratio (3.52) was recorded at closer spaced *Bt* hybrid (90cm X 45cm) + 125 % RDF + 3 sprays of 1% each of MgSO₄ and 19:9:19 and polyethylene mulching than rest of the treatments used in the research. The quality parameters were not influenced significantly with plant densities and mulching.

STUDIES ON QUALITY STABILIZATION OF WATER MELON (*CITRULUS LANATUS*) SQUASH WITH THE INCORPORATION OF XANTHAN GUM

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A study was carried out to investigate the effect of xanthan gum in stabilizing the water melon squash in storage. For this locally available water melon fruits (*Citrulus lanatus*) were used in the preparation of bottled squash. Addition of xanthan gum in beverages at concentrations upto 0.5% w/w can help in stabilization and better mouth feel of the product (Nussinovitch, 1997). The squash was prepared using 25% pulp, 45% TSS and 1% acidity. To this different concentrations of xanthan gum were incorporated, viz., 0% (control), 0.1%, 0.2%, 0.3%, 0.4% and 0.5%. The TSS (%), titrable acidity (%) and pH of the prepared squashes were analyzed at 30 days interval upto a period of 90 days. Similarly, organoleptic characteristics of the squashes were evaluated for colour, taste, aroma and overall acceptability using 9 point Hedonic scale rating (Ranganna, 1977).

TSS % and pH showed an increasing trend with the period of storage but the differences were not significant. The level of increment decreased with increasing level of xanthan gum. Similarly, percent acidity decreased at a decreasing level as the level of xanthan gum increased. The organoleptic properties showed a decreasing trend with increase in storage period irrespective of the level of xanthan gum. Xanthan gum levels showed significant effect on the overall acceptability of water melon squash. Highest score of 7.90 was obtained from the treatment with inclusion of 0.3% xanthan gum and the lowest score was recorded from treatment with xanthan gum at 0.2%. Good quality squash with attractive colour can be prepared from water melon fruits which retained acceptability during the storage period. Segmentation or separation of pulp from juice was noticed in all the treatments after few days of storage. Further investigation can be done to obtain a stable product which does not show segmentation.

INDIGENOUS TECHNICAL KNOWLEDGE USED IN PADDY CULTIVATION IN RAJNANDGAON DISTRICT, CHHATTISGARH

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The study was conducted in eight villages of Ambagarh Chowki and Dongargaon block of Rajnandgaon district. Rice is the main crop being cultivated. The paper describes the indigenous technologies used by the farmers in paddy cultivation. For preventing the crop from insect/pest attack in the field and during the storage they apply their rich traditional knowledge. They find the indigenous knowledge very useful, therefore indigenous technical knowledge possessed by the farmers shall be identified and farmers shall be helped to understand and exchanged the cheaper, viable and reliable technologies in their areas.

Keywords: indigenous knowledge, traditional pest control, traditional seed storage

TRADITIONAL USE OF MEDICINAL PLANTS BY RURAL INHABITANTS: A CASE OF POKHRA BLOCK IN DISTRICT PAURI GARHWAL

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People of rural areas have been using medicinal plant for treating various health issues from ancient time but in present scenario traditional knowledge regarding proper utilization of the medicinal plants is continually vanishing due to more dependency on allopathic treatment. Therefore keeping in view the importance of medicinal plants in rural healthcare system, the present study was carried out with the aim to document knowledge on medicinal plants used by rural inhabitants of Pokhra block. Information related to use of medicinal plants was gathered through semi-structured questionnaire survey followed by discussions with aged people. A total of 37 medicinal plants species belonging to 23 families and 35 genera were recorded for curing various health problems such as stomach problems, skin problems, wound, cut etc. The study results reported that medicinal plants in different life forms were 40.5% (herbs), 37.9% (trees), 16.2% (shrubs) and 5.4% (climbers). Among the recorded medicinal plants 17 species were collected in wild, 13 species cultivated by the inhabitants and 7 species collected from both cultivated as well as wild. The use of medicinal plants was observed maximum for stomach problems (9 species) followed by skin problems (7 species), wound, cut, blood pressure and eye problems (4 species each). The documented results of the study will be helpful in exploring the importance of medicinal plant in rural healthcare as well as in creating awareness among the younger generations to preserve the traditional knowledge about medicinal use of particular plant.

Keywords: Healthcare; Medicinal plants; Rural inhabitants; Traditional knowledge

WILD EDIBLE MUSHROOM THEIR USES AND IMPORTANCE TO THE PEOPLE

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Mushroom are characterized by having an apparent reproductive structure, also called the fruiting body. A mushroom (or toadstool) is the fleshy, [spore-bearing fruiting body](#) of a [fungus](#), typically produced above ground on soil or on its [food source](#). The standard for the name "mushroom" is the cultivated white button mushroom, *Agaricus bisporus*; hence the word "mushroom" is most often applied to those fungi ([Basidiomycota](#), [Agaricomycetes](#)) that have a stem ([stipe](#)), a cap ([pileus](#)), and gills (lamellae, sing. [lamella](#)) on the underside of the cap. "Mushroom" also describes a variety of other gilled fungi, with or without stems, therefore the term is used to describe the fleshy fruiting bodies of some [Ascomycota](#). These gills produce microscopic spores that help the fungus spread across the ground or its occupant surface. The use of edible mushrooms for human consumption is probably as old as man himself. Wild edible mushroom have been collected and consumed by people since thousands of year. Many mushrooms are also good sources of selenium, an antioxidant mineral, as well as copper, niacin, potassium and phosphorous. Additionally, mushrooms provide protein, vitamin C, D and iron. The rate of consumption of edible mushroom in many countries has increase in recent year and hence it becomes imperative to explore the treasure of these mushroom.



EXPLOITATION OF MALE STERILITY IN VEGETABLE IMPROVEMENT**S. G. Thakare *, A. P. Wagh and S. V. Bhavar**

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Hybrid varieties play a vital role in increasing vegetable production due to their high yield potential, early maturing, superior quality, disease and pest resistance attributes. Male sterility in vegetables is commercially utilized to develop hybrids and substantial progress has made in understanding the mechanism of male sterility. This review describes different types of male sterility involving GMS, CMS and CGMS respectively are outlined. GMS commercially utilized in chilli and cucurbits crops, while CMS utilized in cole crops and root crops. It is of special interest for plant breeders to produce more efficient and economic hybrid seed through male sterility. Male sterility helps much to reduce the cost of hybrid seed production in vegetables. Onion crop provided early recognition of male sterility its use in hybrid seed production. Since then male sterility has been reported in fairly large number of crop plants including vegetables. These male sterile plants were either isolated in natural populations or were artificially induced through mutagenesis. Now male sterility is also induced through genetic engineering and protoplast fusion. Classification of male sterility on the basis genetic control of male sterility classified male sterility into two groups (i) genetic (male sterility under the control of genes) and (ii) non-genetic (male sterility temporally induced by stresses). Since non-genetic male sterility has not been utilized in vegetable crops.

Keywords: Male sterility, Exploitation, Vegetable improvement.**STUDIES ON EFFECT OF MAGNETIC TREATMENT ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF PADDY (ORYZA SATIVA L.)****Yogita M. Yadav, S.G. Mahadik and S.S. Kamble**

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An experiment entitled “Studies on effect of Magnetic treatment on yield and yield contributing characters of Paddy (*Oryza sativa* L.) was conducted at Agricultural Research Botany farm, College of Agriculture, Dapoli to study on effect of magnetic treatment on biochemical traits and yield of paddy (*Oryza sativa* L.) during *Khariif* 2014-15. Magnetic exposure at different time intervals were applied before sowing of seeds. The experiment consisted of 7 treatments laid out in randomized block design with three replications. The experiment consisted of 7 treatments comprising rotation without magnet for 15 minutes and rotation with magnet for (15, 30, 45, 60 and 90 minutes). Among the all treatments, T₆ (rotation with magnet for 90 minutes) showing higher Yield and yield attributing characters viz. days required for 50% flowering, number of grains, length of panicles, fertility% of grains, 1000 grain weight and yield per plot and yield per ha.

Keywords: Magnetic, growth, paddy.**EXPLORING POTENTIAL OF SUGARBEET AS AN ALTERNATE SOURCE OF BIO-ETHANOL PRODUCTION IN INDIA****Varucha Misra, A. K. Mall* and A. D. Pathak**

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India stands to gain from capitalizing on the potential of sugarbeet for sugar, ethanol and fodder. The amount of ethanol produced from bagasse is more in the case of enzymatic process (0.238 Kg ethanol/Kg bagasse) than the two-stage dilute acid process (0.186 ethanol/kg bagasse) clearly indicating superiority of enzymatic process. Bio-fuels are an important aspect of biomass energy. Bio-ethanol, a high octane number biofuel, is produced from fermentation of number of plants and its residues such as corn, potatoes, grain, sugar beet, sugar cane and vegetable residues. An All India Coordinated Project was launched in 1971 to carry out research on sugarbeet and concurrent with this was the establishment of a sugarcane-cum-sugarbeet sugar factory in Rajasthan. But there was no expansion in the area of new sugar factory with the additional machinery required to process sugarbeet came up. The situation has been confounded by no government policy of incentive for setting up a washing, slicing and diffusion plant in the existing sugarcane factories. The current scenario is no different except that there are now openings for production of ethanol from sugarbeet. The reason for sugarbeet not picking up commercially is mainly the lack of market. Since it is an industrial crop, no seed money or incentives have been given to the sugar industry for installing the additional machinery. The work done at IISR along with other partners from time to time has left no doubt about the agricultural feasibility of sugarbeet in the country. Varieties, machines, agronomy and plant protection technologies have been developed for growing sugarbeet in the sub-tropical and tropical India. Since 1976, there is active participation of IISR in maintenance of sugarbeet germplasm and limited seed production at its breeding outpost at IVRI, Mukteswar. Suitable production technology for high yield of quality beet under Indian conditions has been developed at IISR. Several tools for sowing of sugarbeet, inter culture and harvesting of the crop, e.g., Tractor-drawn sugarbeet ridge planter, T. D. Sugarbeet Raised-bed Planter, etc., were also developed. Varieties, such as, IISR Comp-1 and LS-6 developed by Lucknow and Pant S-10 by Pantnagar centers were also tried in a limited way. Indigenous diploid varieties developed and recommended for general cultivation in India with high temperature (40°–45°) tolerance varieties were maintained. The current project is being investigated on the possibility of ethanol production from sugar beet, a crop which is widely cultivated in western country, and its potential contribution to biofuel uses at mixtures of 5-10 per cent.

Keywords: Sugarbeet, Bio-ethanol, Bio-fuel, Tropical & Sub-tropical and Germplasm

A REVIEW ON INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. This concept of nutrient management assumed greater significance in recent years because of two reasons. First, the need for continued increase in agricultural 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. 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 Rather than focusing nutrition management practices on one crop, INM aims at optimal use of nutrient sources on a cropping-system or crop-rotation basis. This encourages farmers to focus on long-term planning and make greater consideration for environmental impacts. INM relies on a number of factors, including appropriate nutrient application and conservation and the transfer of knowledge about INM practices to farmers and researchers. Boosting plant nutrients can be achieved by a range of practices covered in this guide such as terracing, alley cropping, conservation tillage, intercropping, and crop rotation. Given that these technologies are covered elsewhere in this guidebook, this section will focus on INM as it relates to appropriate fertiliser use. In addition to the standard selection and application of fertilisers, INM practices include new techniques such as deep placement of fertilisers and the use of inhibitors or urea coatings use of area coating agent helps to restart the activity and growth of the bacteria responsible for denitrification that have been developed to improve nutrient uptake.

Key Word:Fertilizer, Nutrient, Conservation, Productivity

ASSESSMENT OF FOOD HABITS AND DIETARY INTAKE OF PUNJABI WOMEN

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Punjab with its rich cultivating lands has traditionally been an agrarian society since the time of the ancient Harappan civilization. The land in the Indian Punjab is ideal for growing wheat and is called the 'Granary of India' or 'India's bread-basket'. The practice of multicropping is quite common in Punjab which also grows sugarcane, bajra jowar, potatoes, vegetables among food others. Traditionally ghee, butter paneer and sunflower oil are used to cook various Punjabi dishes.

Present investigation was carried out in various areas of Kanpur. The following areas were selected for the survey such as Gumti, Govind Nagar, Ashok Nagar, Lajpat Nagar, Lalbangla. 100 Punjabi women were selected randomly for the study. The anthropometric assessment was done by taking height, weight and body mass index of the respondents. The mean nutrient intake was computed by the 24 recall method. The nutritional awareness level and food habit among the Punjabi women was assessed through the questionnaire. 71.0 percent of Punjabi women were interested in taking fruits as an additional food item, 23.0 percent of Punjabi women liked puffed Cereal, 6.0 percent were preferring pop corn as an additional food item, 52.0 percent Punjabi women were daily preferring sweet item after meal, 26.0 percent Punjabi women were sometime preferring sweet item after meal, 22.0 percent Punjabi women preferred sweet item after meal weekly, 57.0 percent Punjabi women were drinking four glasses of water every day, 28.0 percent Punjabi women were drinking five glasses of water every day, 9.0 percent Punjabi women were drinking water eight glasses of water every day, 6.0 percent Punjabi women were drinking three glasses of water every day, 55.0 percent Punjabi women were taking milk sometimes, 32.0 percent Punjabi women were not taking milk, 12.0 percent Punjabi women were taking milk daily, 26.0 percent Punjabi women were taking lassi everyday, 64.0 percent Punjabi women were taking tea everyday, 10.0 percent Punjabi women were taking coffee everyday, 66.0 percent Punjabi women were including chutney in meal, 55.0 percent Punjabi women were including salads in meal, 45.0 percent Punjabi women were including pickles in meal, 65.0 percent Punjabi women were drinking water in between meal, 35.0 percent Punjabi women were not drinking water in between meals. Maximum 84.0 percent respondents were non-vegetarian and 16.0 percent respondents were vegetarian. 62.0 percent were using deep frying, 31.0 percent shallow frying, 5.0 percent boiling and 2.0 percent stewing in their cooking at home it was found that 55.0 percent of respondents were taking snacks daily, 34.0 percent weekly and only 11.0 percent occasionally 100.0 percent respondents were preferring chat, 92.0 percent respondents were preferring samosa while 8.0 percent were not preferring samosa, 72.0 percent were preferring burger, 28.0 percent were not preferring burger, 65.0 percent were preferring junk food, 35.0 percent were not preferring junk food, 50.0 percent were preferring chowmein, 50.0 percent were not preferring chowmein.95.0 percent Punjabi women were keeping fast, 5.0 percent Punjabi women were not keeping fast, 68.0 percent Punjabi women were consuming three meals per day, 32.0 percent Punjabi women were consuming two meals per day, 42.0 percent respondents were consuming outside food most often, 37.0 percent of respondents were consuming outside food daily, 12.0 percent respondents were consuming outside food once in a week, 6.0 percent of Punjabi women were consuming outside food occasionally, 90.0 percent respondents preferred spicy food and 10.0 percent respondents preferred plain food.

MAJOR PEST OF PEA AND THEIR INTEGRATED PEST MANAGEMENT

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Major pest of Pea is a Stem fly (*Ophiomyia phaseoli*) and it cause serious damage in pea. The maggots bore into the stem thereby causing withering and ultimate drying of the affected shoots, thus reducing the bearing capacity of the host plants. The adults also cause damage by puncturing the leaves, and the injured parts turn yellow.The damage is more severe on seedlings than on the grown up



plants. Management of stem fly is including, Avoid sowing of the crop earlier than mid-October to check the attack of the pest. Remove and destroy all the affected branches during the initial stages of attack. Sow the crop in the second fortnight of October to escape the damage of the pest. Apply 7.5 kg of phorate 10G or 25 kg of carbofuran 3 G per ha in furrows at the time of sowing. On the crop, spray three times 750 ml of oxydemeton methyl 25 EC in 750 L of water per ha. The first application should be just after germination and the other two at an interval of 2 weeks each.

INFLUENCE OF EXOGENOUSLY APPLIED SALICYLIC ACID ON PHOTOSYNTHETIC PIGMENTS, ANTIOXIDANT ENZYME ACTIVITIES IN MANGO CV. AMRAPALI

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Mango (*Mangifera indica* L.) a major fruit crop of India, contributes 40.48% of the total world production of mango. At present mango production is severely threatened by increased frequency of abiotic and biotic stresses. Several previous research illustrated that salicylic acid (SA), a natural plant hormone plays pivotal role in modulating physiology of plant against abiotic and biotic stresses. Keeping this in mind an experiment was conducted in Experimental Mango Garden of Plant Physiology, GBPUA&T, Pantnagar, India, with commercial mango cultivar Amrapali. The experiment was laid out in factorial randomized block design during year 2014-15 and 2015-16. Different concentrations (0, 0.5, 1.5, 2.5, 5.0, 10 mM) of salicylic acid were exogenously applied thrice a week as foliar spray at pre-blooming stage. The photosynthetic pigments (Chl a, Chl b, total Chlorophyll and Carotenoid content) and antioxidant enzymes (Catalase and Peroxidase) were estimated. There was a significant increase in CAT, POD, chlorophyll and carotenoid content at 1.5 mM and 2.5 mM SA concentration. At higher concentrations (5.0, 10 mM) CAT and POD activity was gradually decreased. It was also observed that increasing concentrations of SA from 0.5 to 2.5 mM resulted in increase in fruit yield but at high concentration there was no significant increase in fruit yield.

Keywords: Mango, Salicylic acid, antioxidant enzymes, photosynthetic pigments

EFFECT OF DIFFERENT INITIAL POPULATION DENSITIES OF *MELOIDOGYNE GRAMINICOLA* ON THE PLANT GROWTH OF SORGHUM

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An investigation was carried out to ascertain the effect of initial population densities of *Meloidogyne graminicola* on the root-knot development, nematode multiplication and plant growth parameters of sorghum under pot conditions. Sorghum plants were grown in steam sterilized sandy loam soil and after germination was inoculated at different inoculum levels i. e. 0, 10, 100, 500, 1000 and 10000 j₂ of *M. graminicola*. The maximum and significantly highest plant growth parameters were found in non-inoculated check which was statistically at par with inoculum levels of 10 and 100 j₂/kg soil. With the increase in inoculum level of *M. graminicola*, there was a progressive decrease in plant growth parameters viz., shoot length, fresh and dry shoot weight, root length and root weight at all initial population densities as compared to uninoculated control. An initial inoculum level of 500 j₂/kg soil caused significant reduction in plant growth parameters and proved to be pathogenic to the sorghum plants. Number of galls and final nematode population was significantly different from each other at different inoculum levels but minimum number of galls was observed at 10 j₂ /kg soil. Maximum number of galls/plant and final nematode in the population in the soil were recorded in 500 and 1000 j₂/kg of soil, which subsequently decreases at 10000 j₂/kg of soil. The nematode population in soil increases with increase in inoculum levels as well as nematode multiplication rate was inversely proportional to the nematode inoculum level.

Keywords: *Meloidogyne graminicola*, sorghum, initial population densities, pathogenicity, plant growth parameters, nematode multiplication

RECENT ADVANCES IN BEE COMMUNICATION AND ORIENTATION

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The Honeybee, living in its beehive, is a social insect. Scientists studying how bees inform each other of the places they find made a most astonishing discovery. Bees “describe” the location of a distant place by dancing. All the information that other bees need to find the food source its distance from the hive, its direction, productivity—is encoded in this dance. The bee dance takes two distinct forms, depending on the distance of the food source. The form known as the “round dance,” encountered most frequently, doesn’t bother to indicate the food source’s distance and direction. It does, however, tell the workers that the source is closer than 15 meters (50 feet) from the nest. Having located a food source, the bee first gives nectar to the workers in the nest, and then begins her dance, repeatedly making small circles. The other bees then gather around the dancer. Eventually the dance comes to an end. The dancing bee flies off to look for another source of food. The “waggle dance” is used to relay information about more distant food sources. In order to do this, the dancing bee moves forward a certain distance on the vertically hanging honeycomb in the hive, then traces a half circle to return to her starting point, where upon the dance begins again. Honey bees [*Apis mellifera* L. (Apidae, Hymenoptera)] show spatial learning behavior or orientation, in which animals make use of structured home ranges for their daily activities. Worker (female) Orientation has been studied more extensively than drone (male) orientation.



PER SE PERFORMANCE OF STRAINS AND CORRELATION STUDIES IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) UNDER SUBTROPICAL CONDITIONS OF GARHWAL HILLS**Vivek Singh, D.K. Rana and K.N. Shah**

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Evaluation of twenty strains of bitter gourd collected from the different sources was carried out. The observations were recorded on the following parameters like, length of vine, number of primary branches per vine, days taken to opening of first male flower, number of nodes bearing first male flower, days taken to opening of first female flower, number of nodes bearing first female flower, percent of fruit setting, number of fruits per vine, fruit weight (g), fruit length (cm), fruit diameter (cm), fruit yield per vine (kg), carbohydrate (g/100g), Vit. C (mg/ 100g), T.S.S (⁰Brix) and number of seeds/ fruit and analyzed statistically. Among the lines, HP-2 for yield per vine, VRBTG-8 for carbohydrate, RAJ-2 for ascorbic acid, VRBTG-2 for total soluble solids and MN-1 for number of seeds/ fruit recorded highest mean values for different horticultural traits. Correlation analysis revealed that yield per vine had significant positive association at genotypic level for vine length, number of primary branches per vine, number of fruit per vine, fruit length and average fruit weight. However, ascorbic acid showed negative association at genotypic level in some traits viz., fruit diameter and carbohydrate content.

Keywords: Bitter gourd, evaluation, correlation analysis and strain**STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF TOMATO CV. PUNJAB CHHUHARA UNDER COLD ARID CONDITIONS OF KARGIL.****Tahir Saleem¹ and N.A.Ganai²**

Krishi Vigyan Kendra Bandipora, SKUAST-K, Potushee Bandipora. Faculty of Agriculture, SKUAST-K, Wadura Sopore.

Field experiments were carried out to study the effect of integrated nutrient management on growth, yield and economics of tomato variety Punjab Chhuhara at Regional Agricultural Research Sub-Station Kargil, SKUAST Kashmir during 2007 and 2008. The experiment was laid out in randomized block design with nine treatments replicated thrice. The results revealed that application of NPK @ 120:60:60 kg/ha + FYM@20t/ha + two sprays of Copper Sulphate(100ppm) at 40 and 55 days after transplanting significantly influenced the growth and yield of tomato and also gave maximum benefit cost ratio with highest net return.

Keywords: INM, Tomato, growth, yield, Kargil.**EFFECT OF NANOCHITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION****Parul Chaudhary, Priyanka khati**

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Nanoparticles are materials with a particle size of 1- 100 nm. Nanotechnology have led to the creation of various chitosan based nanoparticles. Chitosan have several advantage which are not properly expressed in its bulk size, so nanochitosan is preferable to be used instead of chitosan. Nanochitosan will have essential role in the controlled release of agrochemicals for protection against pests and pathogens, soil fortification, drought tolerance and plant growth. Nanochitosan can also efficiently enhances photosynthesis, promotes plant growth, increases nutrient uptake and seed germination rate. In this study, effect of Nanochitosan was evaluated on plant growth parameters and soil bacterial population. It was observed that Nanochitosan not only enhanced rate of seed germination upto 24 percent over control but all other parameters like root length, shoot length, fresh weight and dry weight, chlorophyll content and protein content of plants were also showing hike by two fold over control. For the soil health assessment Colony Forming Unit was done on Nutrient Agar and Aleksandrow Agar media which showed two fold increase, whereas soil protein was enhanced by 1.5 fold over the control. The above results suggests important applications of Nanochitosan in agriculture which was found to be not only beneficial for the crop productivity but also maintain soil health.

POSTHARVEST MANAGEMENT OF LOSSES IN HORTICULTURAL CROPS**Anuradha*, R.K. Goyal, Arvind Malik**

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Losses of horticultural produce are a major problem in the post-harvest chain. They can be caused by a wide variety of factors, ranging from growing conditions to handling at retail level. Agriculture ministry to say that 25-30 per cent of fruits and vegetables in India are wasted. Not only are losses clearly a waste of food, but they also represent a similar waste of human effort, farm inputs, livelihoods, investments and scarce resources such as water. Many practices can be adopted to control postharvest losses. Initially postharvest handling operations such as pre-cooling, sorting, grading, pre-treatment etc. are very important. Dehydration of fruit and vegetables is one of the oldest forms of food preservation and till today it is widely adopted. Dehydration of fruits and vegetables also lowers the cost of packaging, storing, and transportation by reducing both the weight and volume of the final product. Nowadays technology of postharvest management is growing up day-by-day and many advances are made in storage as well as packaging of fruits and vegetables. Modified atmospheric storage, controlled atmospheric storage, vacuum storage etc. very helpful to extend storage life. A cold chain is a temperature-controlled supply chain. An unbroken cold chain is an uninterrupted series of storage and distribution activities which maintain a given temperature range favouring storage life.

Keywords: post-harvest, horticulture, storage, shelf life

WILT AND PYTHIUM DISEASE MANAGEMENT IN GREENHOUSE**Nisha Jangre¹, Anjit Jangre², Pappu Lal Bairwa¹, Bhanupratap Jangde¹.**¹Department of Vegetable Science, COA, IGKV, Raipur – 492012 (C.G.) India.²Department of Agronomy, COA, IGKV, Raipur – 492012 (C.G.) India

Greenhouse is a great asset to any vegetable plot, enabling gardeners to make the most of the sun. The disease management option under protected cultivation is often different than those recommended for the open field conditions. High host plant densities and the resulting microclimate are favorable to disease spread. Air exchange with the outside is restricted, so water vapour transpired by the plants and evaporated from warm soil tends to accumulate, creating a low vapour pressure deficit (high humidity). Therefore, the environment is generally warm, humid and wind-free inside the greenhouse. Such an environment promotes the fast growth of most crops, but it is also ideal for the development of bacterial and fungal diseases, of insects vectoring viruses and of herbivorous insects. Several cultural, chemical and biological methods have been adopted to control *Pythium* disease of vegetables. Various fungicides such as cuprous oxide, copper oxychloride, carbendazim, thiram, carbendazim + thiram, carboxin have been recommended for the seed treatment to control the disease in the vegetables. Control fungus gnats (*Bradysia impatiens*) and shore flies (*Scatellastagnalis*) which spread *Pythium*. Seed treatment with fungal antagonists like *Trichoderma harzianum* and *T. viride* formulations reduced the incidence of damping off and enhance the plant biomass under field conditions (Basharat *et al.*, 2011). Wilt diseases of vegetables can be controlled by several means like spraying, dusting, seed treatment and soil treatment. Fungicides against *F. oxysporum* Klotz indicated that prochloraz and carbendazim were found the most effective fungicides (Song *et al.*, 2004). Several antibiotics against *R. solanacearum* in which streptomycin and streptopenicillin recorded less bacterial infection (Singh *et al.*, 2000). *Pythium* and wilt diseases are very severe forms of soil-borne diseases and management of these diseases and to increase the vegetable production under greenhouse conditions are possible only by integrating different control measures.

INFLUENCE OF INDOLE-3-BUTYRIC ACID ON ROOTING EFFICACY IN DIFFERENT CARNATION (*DIANTHUS CARYOPHYLLUS* L.) GENOTYPES UNDER PROTECTED CONDITION**Prince^{1*}, Arvind Mailk² and Vivek Beniwal¹**¹Department of Horticulture, CCS Haryana Agricultural University, Hisar- 125004, Haryana, India²Ram Dhan Singh Seed Farm, CCS Haryana Agricultural University, Hisar- 125004, Haryana, India

A study was carried out at Centre for Quality Planting Material, RDS Seed Farm, CCS HAU, Hisar, Haryana during 2016-17, to study the effect of rooting hormone viz., Indole butyric acid on rooting success in different carnation genotypes. In the experiment, terminal cuttings of fifteen genotypes of carnation viz., Friday (T₁), Irene (T₂), Aicardii (T₃), Gaudina (T₄), Ambrose (T₅), White Liberty (T₆), Jureno (T₇), Baltico (T₈), Bizet (T₉), Tasmon (T₁₀), Gwen (T₁₁), Harvey (T₁₂), Golem (T₁₃), Eskino (T₁₄) and IIHR (T₁₅) were treated with 200 ppm and 500 ppm IBA (Indole butyric acid) and were recorded for their rooting success. The experiment was laid out in Completely Randomized Design, with three replications. The study revealed that among the fifteen genotypes experimented, the highest per cent of rooting was recorded in the genotype Gaudina (91.33 %) whereas, the lowest rooting per cent was recorded in the genotype IIHR (44.66 %). As for the concentration of IBA used, 500 ppm resulted in the maximum rooting percentage (72.48%) as compared to that in 200 ppm concentration. Similar tendency of superiority was observed for days for root initiation, number of roots per cutting and length of roots, wherein the genotype Baltico took the least number of days for root initiation (15.83 days) and highest number of roots (18.01) per cutting followed by Golem (16.87).

Keywords: Carnation, genotype, Indole-3-butyric acid, rooting per cent, root length**STUDIES ON BIOFILM DEVELOPMENT AND MULTIFARIOUS PLANT GROWTH PROMOTING ACTIVITIES OF SELECTED RHIZOBACTERIA AND WHEAT ROOT COLONIZATION BEHAVIOR OF BACILLUS SP.****Firoz Ahmad Ansari and Iqbal Ahmad**

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Several beneficial rhizobacteria are known to promote plant growth and protect plant health through their direct and indirect activities and production of metabolites. Use of such rhizobacteria is playing an important role in crop production and protecting crop health. However, performance of such microbial inoculants under field conditions is not always consistent due to various biotic and abiotic factors. One of the factors is the poor rhizosphere colonization due to competition by native microflora. We hypothesize that the biofilm-forming capacity by such rhizobacteria will be an added advantage in better survival in root zone. With this objective we have isolated 50 rhizobacteria from Aligarh soil which include species of *Pseudomonas*, *Bacillus* and *Azotobacter*. These isolates were first screened for their biofilm formation and its related traits (EPS, swarming, swimming motility and cell surface hydrophobicity) and PGP traits (IAA, phosphate solubilization, siderophore, hydrogen cyanide and ammonia). These isolates produced IAA up to 40 µg ml⁻¹ in the absence of tryptophan whereas in the presence of tryptophan the IAA production enhanced up to 230 µg ml⁻¹. *Azotobacter* and *Bacillus* isolates solubilized phosphate in the range of 461-660 µg ml⁻¹ whereas *Pseudomonas* isolates solubilized phosphate in the range of 661- 860 µg ml⁻¹. Varying level of siderophore production was observed in majority of the isolates. Similarly, 35.55 percent isolates produced hydrogen cyanide and ammonia respectively. Exopolysaccharides production was observed in the range of 70-130 µg ml⁻¹. The isolates exhibiting relevant multiple PGP traits were tested for biofilm formation *in vitro* and on root surface of wheat (*Triticum aestivum*). We found that, *in vitro*, these strains showed variations in biofilm formation. However, selected isolate colonized root indiscriminately. Mature biofilm analysis by SEM revealed intense biofilm development by *Bacillus* sp followed by *Pseudomonas* and *Azotobacter*. The *Bacillus* sp. was further evaluated for their effect on survival in the rhizosphere up to 60 days, which showed better survival compared to control strain. The data obtained revealed that *in vitro* biofilm formation has little correlation with root colonization. However,



mature biofilm are formed by selected strains which also form strong biofilm *in vitro*. Further investigation will reveal the advantages of biofilm development in providing enhanced survival under environmental stress conditions.

Keywords: Biofilm, plant root, PGP activities, swarming motility, EPS production, SEM

INFLUENCE OF ORGANIC FERTILIZERS ON PRODUCTIVITY AND MEDICINAL PROPERTIES OF ALOE VERA

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Aloe vera is perennial succulents or xerophytes which one of the oldest plants known to the human mankind for its medicinal properties. Its, one of the species contain manapol which contain vitamin, amino acid, macro and micronutrients and polysaccharides which has an immunostimulant property. It also contain a rich source of saponins which is toxic on herbivores, detergent, and destroy pathogen membranes. It has insect repellent, anti fungal, anti viral and anti bacterial property. In India, Aloe vera is traditionally grown and there is no regular practice of cultivation by improved agro techniques, particularly nutrient management. Aloe vera respond differentially under varying sources and amounts of organic fertilizers. Nutrient management through application of organic fertilizers in aloe vera field is one of the basic strategies for increasing of the yield of aloe vera. Organic fertilizers are considered to safe and yielding good produce by improving water penetration, water holding capacity, improvement in soil structure, microbial biomass, nutrient availability, drought and heat stress resistance as well as increased nutrient uptake, especially macro elements as compare to chemical fertilizer and its influences the medicinal quality. Thus, using of organic fertilizers (vermicompost mixed) substrate in breeding the aloe vera has an effective role in improving quality and quantity leaves and gel antioxidant properties. It also helps in improving the soil pH which has an impact on plant growth and soil microbial activity. Therefore, complementary effect of organic fertilizers on medicinal properties and herbage yield of aloe vera as well as higher profit with sustainability manner in a long term without affects the surrounding ecology and environment.

Keywords: Organic fertilizers, Nutrient management, Yield and aloe vera.

EFFECTS OF DIFFERENT INOCULUM LEVELS OF ROOT KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* ON GROWTH AND YIELDS OF *AMMI MAJUS* L.

Yasar Nishat*, Mohd Danish, Chanchal Chaudhary, Atirah Tauseef, Hisamuddin.

Plant Pathology and nematology Laboratories, Department of Botany, A.M.U. Aligarh.

An experiment was conducted in the Department of Botany Aligarh Muslim University, Aligarh with an aim to study the effect of different inoculums levels viz; 50 J₂, 500 J₂, 1,000 J₂, 2,000 J₂, 4,000 J₂, 8,000 J₂ of root knot nematode *Meloidogyne incognita* per plant on *Ammi majus* L. The results indicated that plant growth and yield characters such as plant length, plant fresh and dry weight, number of branches, number of umbel and seed weight per plant decreased as the nematode inoculum levels increased. Highest and significant reductions plant growth and other parameters were observed when the plants were inoculated with higher numbers of *M. incognita* juveniles. With an increase in inoculums levels of *M. incognita*, significant reductions were observed in chl a, chl b and carotenoid contents of the plants. Thus, from this study it might be concluded that heavier infection of *M. incognita* retarded the growth and yield of *Ammi majus*.

Keywords: *Meloidogyne incognita*, *Ammi majus*, inoculum levels, physiology.

INFLUENCE OF SEEDLING AGE AND PLANT HORMONES ON YIELD AND ECONOMICS OF ONION (*ALLIUMCEPA* L.)

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The response of three seedling age (6, 8 and 10 week old seedling) of onion cultivar N-53 was studied against different plant hormonal treatments viz., Cycocel (500 & 1000ppm), Ethephon (2000 & 2500ppm) and Paclobutrazol (1000 & 2000ppm) along with control in factorial RBD replicated thrice during *Rabi* season of 2014-2015. The results showed that 8 week old seedlings outperformed other aged seedlings with highest yield, quality and plant establishment (86.95%). Data with respect to yield attributes clearly pointed out that 8 week old seedlings performed better and showed statistically highest bulb size (25.34cm²), bulb weight (94.44g) and marketable yield (205.40q/ha). All plant hormones significantly reduce vegetative growth as compared to control. Paclobutrazol @ 2000ppm was found statistically superior in increasing bulb size (25.11cm²), bulb weight (80.73g) and marketable yield (190.38q/ha) as compared to other treatments. Interactive effect of Paclobutrazol @ 2000ppm sprayed on 8 week old seedlings (A₂P₂) produced maximum bulb size (32.13cm²), bulb weight (110.93g) and marketable yield (279.50q/ha). Economics of the experiment showed maximum B: C ratio in 8 week old seedling with 2000 ppm paclobutrazol (4.4) with higher net returns of (Rs. 3,46,869) as compared to other treatment as well as control.

KEYWORDS: B: Cratio, Plant hormones, Seedling age, Yield



ISOLATION OF ZINC SOLUBILIZING BACTERIA FROM DIFFERENT REGIONS OF VARANASI AND MIRZAPUR DISTRICTS**Indrajeet Kumar Mandal^{1*}, Jay Sankar Yadav² and Janardan Yadav¹**¹Department of Soil Science and Agricultural Chemistry, I.Ag.Sc., BHU, Varanasi-221005, UP.²Department of Botany, Institute of Science, BHU, Varanasi-221005, UP.

Many plant species are affected by zinc deficiency on a wide range of soil type in most agricultural regions of the world. It plays a vital role in physiological and biochemical processes of the plant system. Both qualitative and quantitative yield of the plants are strongly dependent on the micronutrient. About 96 to 99 per cent of applied zinc ($\text{ZnSO}_4 \cdot \text{H}_2\text{O}$) is converted to different unavailable forms of zinc like ZnO (Zincite), ZnCO_3 (Smithsonite), $\text{Zn}_3(\text{PO}_4)_2$ (Hopite), ZnFe_2O_4 (franklinite), etc. This can be prevented by the identification of rhizospheric micro-organisms that have the potential to transformed various unavailable forms to available forms. In the present study, about 18 different bacteria were isolated from nine different agricultural fields (pigeon pea, pea, gram, black gram, bean, sesamum, sunhemp, bean and pumpkin). The ZnOB (17)₄ bacterial isolate showed the maximum zinc solubilizing index (9.14) with zinc oxide supplemented medium when compared with the other isolates. Whereas, the ZCB (4)₂ showed the maximum zinc solubilizing index (8.1) in zinc carbonate supplemented medium and the ZPB (8)₂ showed the maximum zinc solubilizing index (6.67) in zinc phosphate supplemented medium.

PEST INCIDENCE AND PREVALENT CONTROL STRATEGIES IN SOME APPLE ORCHARDS OF CENTRAL KASHMIR IN VOGUE DURING BLOOM AND POST BLOOM.**Ishana Qadir and Ayesha Qamar**

Department of Zoology, Aligarh Muslim University, Aligarh U.P, 202002.

This study seeks to describe the pest incidence and control techniques employed by the farmers for controlling these pests during the bloom and post-bloom season of apples. In the bloom period there was a low incidence of apple scabies, red mites and San Jose scale. During the post bloom season which extends from May to September and also includes the harvesting season the incidence of red mites and scabies grew due to increase in temperature and moisture content. The data for red mites was collected using binomial method of sampling and calculating cumulative mite days while as for San Jose scale hand lenses were used to count the number of eggs and other immature stages. Apples grown in these orchards belong to different varieties and have different market values. The main outcome of our study was that the farmers work with chemicals rather than relying on biological or cultural control methods. The prevalence of such method of control is attributed to their cost effectiveness and their flexibility of usage. Farmers mainly apply contact and systemic fungicides to control scabies while as to control San Jose scale, farmers use orchard oils, acting as lubricants, to arrest the further development of the insect.

Keywords: Apples, orchard oils, scabies, fungicides, San Jose scale.**RESOURCE CONSERVING RICE (*ORYZA SATIVA* L.) PRODUCTION TECHNOLOGIES – A REVIEW****Sanjeev Kumar Kashyap*, A.V. Dahiphale, Sandeep Kumar and Hari Singh**

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The area under rice crop is decreasing year by year due to various factors such as increased cost of inputs, labour shortage and less profitability. Rice is grown mostly through transplanting in India, Transplanting of rice seedlings in the traditional way is a labourious, time consuming and causes drudgery. Non-availability of labourers for transplanting at appropriate time leads to late planting, which results in poor yields. In rice, planting methods have an impact on the growth, yield attributes and yield besides cost of cultivation and labour requirement. Rice transplanting is done manually and requires roughly 42 per cent of the total labor requirement of rice production. At transplanting time, acute labor shortage results in increased labor wages and delay in the transplanting operation. Manual transplanting also results in a non-uniform and inadequate seedling populations. The inadequacy of irrigation water and scarce labour coupled with higher wages during the peak period of farm operations, invariably lead to delay in transplanting. These problems necessitated the introduction of mechanized rice establishment and residue retention to achieve timely planting and better crop stands. To overcome this problem, farmers are gradually switching over to direct seeding.

Keywords: Direct seeded rice, Zero tillage, Grain yield, Rice, Transplanting.**CLIMATE CHANGE AND IT'S CONSEQUENCES ON HORTICULTURAL PLANTS****¹Kulveer Singh Yadav, Akhilesh K. Pal, Anil K. Singh, Sandeep K. Mauriya and Sunil K. Maurya**

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Global warming and climate change is the greatest concern of mankind in 21st century. The established commercial varieties of fruits, vegetables and flowers will perform poorly in an unpredictable manner due to aberration of climate. Commercial production of horticultural plants particularly grown under open field conditions will be severely affected. Due to high temperature physiological disorder of horticultural crops will be more pronounced e.g. Spongy tissue of mango, fruit cracking. High temperature and moisture stress also increase sunburn and cracking in apples, apricot and cherries and increase in temperature at maturity will lead to fruit cracking and burning in litchi. High temperatures can cause significant losses in tomato productivity due to reduced fruit set, and smaller and lower quality fruits. Melting of ice cap in the Himalayan regions will reduce the chilling requirement for the flowering of many of the ornamental plants like rhododendron, orchid, tulipa, alstromerea, magnolia, saussurea, impatiens, narcissus etc. Some of them will fail to bloom or flower with less abundance while others will be threatened. Plant species requiring high humidity and water may find them under difficult conditions for survival. Commercial production of flowers particularly grown under open field conditions will be severely affected leading to poor flowering, improper floral development and



colour. In coconut, arecanut and cocoa increased CO₂ led to higher biomass production. But a slight decline in biomass production was apparent at elevated air temperature. In general due to increase in maximum and minimum day temperature and decreasing the annual rainfall the productivity showed decreasing trend in most of the black pepper growing areas of India.

Keywords: Climate change, spongy tissue, moisture stress and horticulture.

RESPONSE OF ENVIRONMENTAL CHANGES AS STRESS ON PLANTS

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Environmental conditions play a key role in defining the function and distribution of plants, in combination with other factors. Changes in long term environmental conditions that can be collectively coined climate change are known to have had enormous impacts on current plant diversity patterns. Plants are bound to places. They, therefore, have to be considerably more adaptable to stressful environments and must acquire greater tolerance to multiple stresses than animals and humans. This is shown very clearly by the limitations in the distribution of particular types of vegetation, for example, the tree line on mountains. The environment affects an organism in many ways, at any time. To understand the reactions of a particular organism in a certain situation, individual external influences, so-called environmental factors, are usually considered separately, if at all possible. Environmental factors can be of abiotic and biotic nature. Biotic environmental factors, resulting from interactions with other organisms, are, for example, infection or mechanical damage by herbivory or trampling, as well as effects of symbiosis or parasitism. Abiotic environmental factors include temperature, humidity, light intensity, the supply of water and minerals, and CO₂; these are the parameters and resources that determine the growth of a plant. Many other influences, which are only rarely beneficial to the plant (wind as distributor of pollen and seeds), or not at all beneficial or are even damaging (ionising rays or pollutants), are also classified as abiotic factors. It is very important to realize that growth is only one of many reactions of a plant to its environment. Flowering and fruiting determine the plant's success in reproduction and propagation and might equally be used as a measure of the plant's reaction to the environment. The value of the factors might, in this case, change but the principal behavior would be similar.

Keywords: Symbiosis, organisms, environmental factors, abiotic and biotic nature.

ROLE OF SINGLE CROSS HYBRID MAIZE IN ENSURING FOOD SECURITY IN THE PRESENT CLIMATE SCENARIO

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Maize, being a C₄ plant fix maximum CO₂ compared to other crop species, and it can be one of the possible solutions for mitigating climate change. Maize production would not be affected by a slight increase in temperature. From the past few years, remarkable growth with respect to area, production, and productivity of maize has been witnessed in the country, which can be attributed to the increased cultivation of the SCH (single cross hybrid) maize. Due to the short duration and high yielding nature, single cross hybrids create an easy, viable and gainful option for the growers. Speciality corn's viz., baby corn, sweet corn, and popcorn hold great promise for ensuring food security in the present situation of peri-urban agriculture. The cultivation of single cross hybrids of quality protein maize, which is enriched with lysine and tryptophan offer a nutritious feed to cattle, poultry and for people who consume maize as their principal food, thereby ensuring food and nutritional security. Maize has great potential for enormous growth of seed sector, and for also in the diversification of cropping system.

Keywords: Maize, Climate change, Food security, Single Cross Hybrid, Productivity, Nutrition

CLIMATE CHANGE AND ITS IMPACTS ON INDIAN AGRICULTURE

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Climate is usually known as a vital biophysical factor influencing vegetation growth and development. Any change in climatic stimuli endangers all sectors of human life including agriculture. Climate change and its variability are emerging as the major challenges influencing the performance of global agriculture. Agriculture sector is one of the most vulnerable sectors to climate change because of its seasonality, the narrow range of weather conditions over which crop production can occur, the presence of significant non-climatic stressors that influence sensitivity to changes in climatic conditions, and the endemic poverty often associated with food production in the developing world, which compounds vulnerability. Each year one or the other part in the world is affected by droughts, floods, cyclones, hailstorm, frost and other climatic events. These altogether have widespread negative effects on soil health and quality, food production, water availability and environmental sustainability. These are directly linked with the deleterious impacts on crop productivity with reference to quantity and quality of crops directly through changes in the growing environment, but also indirectly through shifts in the geography and prevalence of agricultural pests and diseases, associated impacts on soil fertility and biological function, and associated agricultural biodiversity. Climate change is therefore expected to alter the biophysical environment of growing crops coupled with agricultural practices like water use and application of fertilizers, insecticides, and herbicides etc. and environmental influences, particularly in relation to the frequency and intensity of soil drainage which may lead to loss of nitrogen through leaching, increased risks of soil degradation caused by erosion and possible decline in soil organic carbon concentration and reduction of crop diversity.

Keywords: Agricultural Production, Climate Change, Impact, India



CROP RESIDUE MATERIAL RESOURCE MANAGEMENT ROLE OF MODERN AGRICULTURE IN INDIA

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Crop Residue Management: In India, approximately 500-550 million tons of crop residues are produced every year of which 70% are contributed by cereals. While a substantial quantity of these residues are used for animal feed, soil mulching, manuring, roof thatching and fuel purposes, a large portion is burnt on-farm for timely clearance of fields for sowing of the next crop. Burning of crop residues not only causes environmental pollution adding to global warming but also results in depletion of valuable nutrients like N,P,K and S. With the poor availability of labour and increasing cropping intensities in the coming years, the problem is expected to assume greater dimensions. Hence, efficient management of crop residues is vital for long-term sustainability of Indian Agriculture. Though technologies are available for residue use in conservation agriculture, lack of affordable and suitable mechanization remains a constraint. Efforts will be made to quantify the economic, social and environmental benefits of residue management practices under different situations. These can then form a basis for policy decisions in relation to carbon sequestration, erosion control, improving fertilizer-use efficiency and incentives to retain crop residues. The following areas of research will be given immediate attention:

Development of region-specific crop residue inventories, including total production from different crops, their quality, utilization and amount burnt on-farm, for evolving management strategies. Satellite imageries will be used to estimate the amount of residues burnt on-farm. Assessing the quality of various crop residues and their suitability for off-farm (e.g. animal feed, composting, energy, biogas, biochar and biofuel production) and on-farm purposes and analysing the benefit: cost ratio, socio-economic impact and technical feasibility of off-farm and on-farm uses of crop residues, enhancing decomposition rate of residues for in-situ incorporation using efficient microbial strains, quantifying the permissible amount of residues of different crops which can be incorporated/ retained, depending on the cropping systems, soil characteristics and climate without creating operational problems for the next crop or chemical and biological imbalance.

ENVIRONMENTAL IMPACTS OF GENETICALLY MODIFIED (GM) CROP

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Plant genetic engineering offers opportunities for the creation of insect-resistant plants by insertion and expression in plant of entomopathogenic proteins. Resistance to insects has been demonstrated in transgenic plants expressing genes for endotoxins from *Bacillus thuringiensis* (Bt), protease inhibitors, enzymes and plant lectins. Most of the plant derived genes produce chronic rather than toxic effects and some insect pests are not sensitive to some of these factors. The potential of plant derived genes can be realised by deploying them in combination with host plant resistance and exotic genes. Genes conferring resistance to insects have been inserted into crop plants such as tomato, potato, broccoli and some of the agricultural crops. This technology is used for increasing crop production, crop protection, improved nutritional value and environmental benefit. Improving resistance to insects reduces the need for pesticides. This makes the plants safer for the consumer and allows the farmer to save money on chemicals. Transgenic crops are an economically safer method of producing crop products, which makes them appealing and potentially profitable.

Keywords: *Bacillus thuringiensis*-transgenic plants-insect resistance-brinjal-inhibitors etc.

MANAGEMENT OF LAND RESOURCE USING PHYTOREMEDIATING PLANT SPECIES

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Agricultural lands contaminated with heavy metals can be improved by using Phytoremediation technology. Appropriate use of metal accumulator plants can decontaminate the concerned land. So it's an environment friendly technology in which plants are used to clean up the pollutants from their surrounding. Plant species, namely Raya (*Brassica juncea*), Toria (*B. compastris*), were grown in cadmium contaminated soil. The biomass of all the plants was investigated to find out impacts of contamination on growth followed by cadmium concentration. The Cadmium (Cd) concentration in soil, biomass yield and cadmium accumulations were observed in grown plant species.

Keywords: Phytoremediation, cadmium, heavy metals, and plant species

PHYTOEXTRACTION OF CADMIUM: AN INNOVATIVE APPROACH FOR LAND RESOURCE MANAGEMENT

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Appropriate use of metal accumulator plants can improve metal contaminated land. Agricultural lands contaminated due to heavy metals are not supposed suitable for agricultural purpose because there is a lot of chance for entry of pollutants in food chain. To remove the pollutants specially those are non degradable in nature can be accumulated by plants resulting purification of land. This technology is called as



Phytoextraction. It's an environment friendly technology in which plants are used to remediate the soil. During this study plant species were grown and analysed to find out the results.

Keywords: cadmium, heavy metals, and phytoextraction

SOIL AND WATER CONSERVATION

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Soil is the uppermost layer of earth's crust, which supports growth of plants. It is a complex mixture of mineral particles, humus, mineral salts, water, air and living organisms. Major cause of soil degradation is rate of soil erosion increasing every year. The major causes of soil erosion is natural cause and anthropogenic cause. Natural cause includes heavy winds and water. Anthropogenic causes include deforestation, poor farming methods, overgrazing etc. Soil loses its fertility due to erosion. So we need to conserve the soil. Soil conservation means checking soil erosion and improving soil fertility by adopting various methods. Soil fertility restoration is a major step. The fertility can be maintained by adding manure and fertilizers. Grazing should be controlled to an extent in agricultural land. Reforestation is another best way to conserve soil. Terracing and contour ploughing is also practiced to check erosion. Another most important natural resource is water. It is the most important component of all life forms and necessary for sustaining life. It regulates climate, generates electricity and is also useful in agriculture and industries. About 97% of the water on earth is saline in nature, which is found in seas and oceans. The remaining 3% is fresh water. Degradation of water is the decrease in quality and quantity of water on earth surface. The main reasons of degradation of water are to meet the need of increasing population. Sewage, waste water from industries, agricultural wastes are also the major factor for degradation. Conservation and management of water are essential for the survival of mankind, plants and animals. This can be achieved by growing vegetation in the catchment areas, which will hold water in the soil and allow it to percolate into deeper layers. Construction of dam and reservoirs regulates water supply. Industrial wastes should be treated to prevent chemical and thermal pollution. Judicious use of water is very much essential in daily life and certain techniques like rain water harvesting should be done by storing rain water and recharging ground water.

Key words; Soil, natural, anthropogenic, water and reforestation etc.

SOIL CONSERVATION FOR SUSTAINABLE AGRICULTURE

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With the rise of the environmentalist movement, it has become common to speak of conserving natural resources such as trees or fossil fuels. Yet long before humans recognized the need to make responsible use of things taken from the ground, they learned to conserve the ground itself—that is, the soil. The more active and vibrant the soil, the more alive and nutritious the food. Soil conservation should be done not only for farmers and people, but also for all life on earth. Less than 3% of all land on earth has fertile, nutrient-rich soil. Failure to conserve soil has turned many a fertile farmland into temporary dust bowl or even permanent desert. Techniques such as crop rotation aid in conservation efforts, but communities continue to face hazards associated with the soil. There is, for instance, the matter of leaching, the movement of dissolved substances through the soil, which, on the one hand, can benefit it but, on the other hand, can rob it of valuable nutrients. Issues of soil contamination also raise concerns that affect not just farmers but the population as a whole. In combination with water in the hydrosphere (e.g., streams and rivers) as well as water in the form of evaporated moisture and precipitation in the air itself, the blanket of gases we call our atmosphere has been essential to the formation and sustenance of Earth's soil. Soil conservation is the preventing of soil loss from erosion or reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination. The present paper deals with some of the new driving forces, in soil conservation. Increasingly, international efforts to mitigate land degradation are shifting from studies of the biophysical processes to improving the global, national and local enabling policy environment, as well as mainstreaming of soil conservation into national and regional policies and programs. The paper discusses some of the opportunities for soil conservation that accrue from the new driving forces.

ESSENTIALITY OF SOIL AND WATER CONSERVATION

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Soil conservation is the preventing of soil loss from erosion or reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination. Slash-and-burn and other unsustainable methods of subsistence farming are practiced in some lesser developed areas. Soil is the most fundamental and basic resource. Humans cannot survive without soil because it is the basis of all terrestrial life. Soil is a vital resource that provides food, feed, fuel, and fiber. It underpins food security and environmental quality both essential to human existence. Traditionally, the soil's main function has been as a medium for plant growth. Now, along with the increasing concerns of food security, soil has multi-functionality including environmental quality. They naturally display a certain degree of resilience to climatic fluctuations and a high capacity for regeneration, as the region has always faced harsh climatic conditions with limited rainfall and high temperatures. Due to increasing population pressure and climatic fluctuations over the last 50 years, soils have increasingly lost their productivity. The natural vegetation cover has gradually been reduced through deforestation, overgrazing, extension of cultivated land and reduced fallowing. For the future, projections of climate change in the Sahel show that temperatures will increase, mean annual rainfall will either decrease or increase depending on the region, while rainfall variability will become more pronounced in all regions. These changes put additional pressure on agricultural production and the already degraded natural resources in the region. Higher temperatures mean higher water requirements for plants and animals. Increased



temperature reduces the humus content of soils due to faster mineralisation. Further losses of fertile topsoil occur through water and wind erosion. Degraded soils infiltrate less water, have lower water storage capacities and produce less food and fodder. Restoring soils, improving soil fertility and enhancing water availability therefore increases and stabilises agricultural production. Soil and water conservation measures slow down or stop surface runoff and increase the infiltration of water into the soil. The loss of fertile topsoil and fertiliser is reduced, and more water and nutrients are available for plant growth. The infiltrated water is stored in the soil or drains deeper to recharge the water table. Hence, Soil and water conservation techniques not only improve and stabilise food production but they are also effective, low-cost techniques that reduce the impacts of climate variability and rainfall irregularities, thereby improving household resilience.

EFFECT OF GLOBAL WARMING IN AGRICULTURE PRODUCTION

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Modern climate change is dominated by human influences, which are now large enough to exceed the bounds of natural variability. The main source of global climate change is human-induced changes in atmospheric composition. Global warming has come across as a monumental factor of discussion among different countries. Wide-scale use of non-renewable energy resources has exponentially increased the levels of pollution. This has upended environmental stability and started increasing the global temperature, the surface temperature has raised by almost 5°C in the last 25 years. This has resulted in the rising rate of melting of the ice cap on mountains and thus the rise of oceanic levels. This also has a direct influence on rains and weather fluctuations. Over the last 15 years, many G30 summits have been on the matter. Most countries have adopted potent Renewable Energy Targets for the next 20 years and are planning to go partially or wholly off the grid. 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. Present study shows that the crop production is dependent on temperature. Temperature vs. crop production shows a funnel shape for all the seasons. There are several acclaimed researchers who assert that agriculture in developing countries will face bigger repercussions and lose more from the impact of global warming as compared to the developed countries. There need to do more effort for release of such crop in cereals and pulses, which can gave more response in stress condition.

Key words : Global warming, Climate change, G30 summits, Non-renewable energy

BIOCHEMICAL RESPONSES OF RICE (ORYZA SATIVA L.) VARIETIES UNDER SODIC SOIL

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The investigation entitled “Biochemical and nutrient responses of rice varieties under sodic soil” was conducted during the kharif season in 2015 at the experimental site of Department of Crop Physiology at Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad-224 229 (U.P.) in randomized block design with three replications and eight varieties, four tolerant (CSR36, CSR43, Narendra Usar 3, NDR 2009) and four susceptible (Swarna sub 1, IR28, IR64, IR29). Evaluate the performance of tolerant varieties and susceptible varieties in sodic soil. Observations were recorded at 60, 90 DAT and maturity. Results indicate the biochemical characters such as chlorophyll content, proline content and catalase activity was increased in tolerant varieties and decrease in susceptible varieties. CSR36 and CSR43 had a greater tolerance to sodic soil than IR64 and IR29.

Keywords: Salinity, rice, chlorophyll, proline and catalase.

SURVEY ON NATURAL OCCURANCE OF ENDOPHYTES IN MAIZE ECOSYSTEM (*Zea mays* L.)

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Fungi that occur inside a asymptomatic plant tissue are known as fungal endophytes. Since a decade there has been high focus on artificial establishment of entomopathogenic fungi as an endophyte in various agri-horticultural crops for pest management. But little focus has been given to identify their natural occurrence. So we have conducted the survey in maize at definite phenophases of crop growth i.e. Seedling stage, knee height stage and reproductive stage, where entomopathogenic fungi were continuously applied for pest management. A surface sterilization and isolation technique was used for the isolation of fungus from roots, stem and leaves. 9 genera of fungus i.e., *Aspergillus* spp., *Beauveria* spp., *Fusarium* spp., *Metarhizium* spp., *Mucor* spp., *Penicillium* sp., *Rhizopus* spp., *Trichoderma* spp. and *Lecanicillium* spp. have been isolated as naturally occurring entomopathogenic fungal endophytes. Among them *Lecanicillium* sp. found to be the dominant fungus with 33.33 % colonisation followed by *Rhizopus* sp. with 25.66 %, *Mucor* sp. with 23.66 %, *Aspergillus* sp. with 19.66 % and *Fusarium* sp. with 13.33 % and the least less than 10 % colonisation was observed in *Penicillium* sp. with 7.66 %, *Trichoderma* sp. 6.33 %, *Beauveria* sp. with 5.33 % and *Metarhizium* sp. with 2.66 %. Among the different plant part colonised, percent colonisation was high in roots with average of 30.78 ± 7.22 % followed by stem with 12.33 ± 2.28 % and least in leaves with 27.77 ± 0.77 %. Thus, the study indicates the potential of natural establishment of endophytes after repeated and continuous use of entomopathogenic fungus for pest management. In addition to this, understanding the fungal



diversity, extent of colonization and their association with various plant parts at different phenophases will provide a baseline data for better exploitation of this fungus as a new paradigm in biological control.

Keywords: Colonisation, Endophyte, Entomopathogenic, Maize and Phenophase.

POTASSIUM-SOLUBILIZING BACTERIA AND THEIR IMPORTANCE IN SOIL HEALTH

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Potassium (K) is one of the major macronutrients which play an important role in plant growth and development. Total soil potassium reserves are generally huge; however, major section (about 90–98 % of total potassium) in soil exists in unavailable mineral form. Silicate minerals such as K-feldspars and biotite are the most general minerals in the earth's crust and are a source of inorganic nutrients in soils to provide optimal nutrition for crops. There are certain microorganisms which use a number of biological processes to make potassium obtainable from unavailable forms. Recently, K-solubilizing bacteria have been isolated from rhizosphere soil of different crops, which cause potassium solubilization by production of organic/inorganic acids or by production of polysaccharides. Efficient K-solubilizing bacteria have been reported to enhance potassium uptake in plants leading to plant growth stimulation under pot-house and field conditions. These K-solubilizing bacteria (KSB) could be applied as potential biofertilizer along with application of rock K materials to provide a continuous supply of available potassium for increasing the crop yield and improve soil health.

Keywords: KSB, soil health, crop yield, mineral

STRATEGIES TO IMPROVE INTEGRATED WEED MANAGEMENT AND TO MAINTAIN SOIL HEALTH

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Integrated weed management (IWM) is a system for managing weeds over the long term, and is particularly useful for managing and minimising herbicide resistance. An integrated weed management plan should be developed for each management zone.

Based on five steps: (1) Review past actions (2) Assess the current weed status (3) Identify weed management opportunities within the cropping system (4) Match opportunities and weeds with suitable and effective tactics (5) combine ideas using a rotational planner. In a well-integrated weed management plan, each target weed will be attacked using different tactics. Each tactic provides a key opportunity for weed control and is dependent on the management objectives and the target weed's stage of growth. A long-term integrated weed management plan, that considers all available management control techniques or tools to control weeds, can be developed for a particular area. Any integrated weed management plan or strategy should focus on the most economical and effective control of the weeds and include ecological considerations.

Integrating tactics and different mode of action groups will reduce weed numbers, stop replenishment of the weed seedbank and minimise the risk of developing herbicide resistant weeds. Along with Integrated weed management it's necessary to maintain soil condition and improve soil health. Integrated Weed and Soil Management explores the connection between soil science and weed control, major areas where weeds and soil interaction can be defined as follow: surface residue, tillage, weed and soil management, integration of soil and weed management to reduce environmental degradation, modeling weed emergence, interference and management of new technology.

BIOSTIMULANTS: A BOON FOR PLANT AND SOIL HEALTH

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Excessive use of chemical fertilisers leads to deterioration of soil health. In the light of this problem, the use of organic fertilizers, biostimulants and other microbial products are crucial to make the agriculture industry a viable component of a healthy and pleasant ecosystem. Biostimulants/biofertilisers are substances and/or microorganisms applied to plants or the rhizosphere is to stimulate natural processes to benefit nutrient uptake, nutrient use efficiency, maintain soil fertility, tolerance to abiotic stress, and/or crop quality, independently of its nutrient content. It plays an important role towards recycling of plant nutrients. They liberate growth promoting substances and vitamins and help to maintain long term soil fertility. Long term use of biostimulants is economical, eco-friendly, more efficient, productive and accessible to marginal and small farmers over chemical fertilizers. There is a general consensus on the benefit of biostimulants usage particularly for small farmers in the context of current climate change concerns as a cheap and safe source of input for agriculture.

SULPHUR MANAGEMENT IN MUNGBEAN (*Punt mung* L.) THROUGH SPLIT APPLICATION OF SULPHUR

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Sulphur (S) is a major nutrient in crop production and is constituent of various metabolic compounds that have potential to modulate the physiological processes of plants. Among the pulses, Mung bean is one of the most important pulse crops known. The present study was conducted to study the effect of S application as single basal dose or split dose on growth and photosynthetic parameters of mung bean (*Punt mung* L.). Exogenous application of 1mM sulphur to plants resulted in increased growth parameters and photosynthetic characteristics.



But two split application of S of 0.5 Mm sulphur at 10 and 20 days after sowing (DAS) showed more prominent results than that of one time S application of 1 mM sulphur at 10 DAS or split application of 0.5 mM sulphur at 10 and 30 DAS. Based on the results, it can be concluded that sulphur proved more efficient in improving growth and photosynthesis when applied in split dose providing adequate amount of sulphur to crop during the entire period of its growth and development.

Keywords: Photosynthesis, Growth, Sulphur

IMPORTANCE OF SOIL AND WATER CONSERVATION

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Total geographical area in India is 329 million hectares, out of which 68 million hectares is critically degraded and another 107 million hectares is severely eroded. Soil and water are the two basic resources which are under intense pressure from increased population and degradation has already set in at many fragile watershed ecosystems. These two natural resources management greatly affect the social and economic structure of our villages and whole nation. 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 problems in management of these resources are continuous soil erosion and runoff inflicting permanent damage to the land and water systems. Soil erosion, the displacement of soil particles from soil surfaces is a serious problem in our country. 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. In steep land farming areas such as Western Ghats, topsoil losses are very high. Major objective of soil conservation is to keep everything in the soil in its place. Assessing the effectiveness of conservation practices under changed climatic conditions has proven to be invaluable in selecting the adaptation practices. Conservationists are concerned that past effective practices may no longer be effective in the future climate change. Implementing conservation practices under climate change can reduce the sediment yield of watershed up to 7.2% and for the sub-basin scale up to 46.4%. Many conservation programmes have failed because the technology was inappropriate or misapplied or because they did not take account of the social situation and did not involve the people. Mixed cropping and interplanting are widely applied traditional techniques. A combination of crops with different planting times and different length of growth periods spreads the labour requirement of planting and of harvesting, and also allows mid-season change of plan according to the rain in the early part of the season.

Keywords: Geographical area, Watershed ecosystem, Conservation, Soil erosion

COMMERCIAL APPLICATION OF INDIAN UNDERUTILIZED FRUIT AND VEGETABLE CROPS FOR ENVIRONMENT SUSTAINABILITY

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Underutilized crops are the plant species that are used for many years or even centuries for food, fodder and medicinal uses in a particular region or country. India is a hub of many exotic tropical and sub-tropical fruit and vegetable species especially in the regions of eastern ghat, western ghat and north eastern regions. The underutilized species have the potential to grow in harsh environmental conditions but they are neglected due to unawareness and lack of knowledge. The underutilized fruit and vegetable crops are commercialised by value addition through food processing because these are highly nutritious, containing various vitamins, minerals, fibers & antioxidants and also have medicinal properties. Variety of underutilized fruits like Aonla (*Emblica officinalis*), Bael (*Aegle marmelos*), Jackfruit (*Artocarpus heterophyllus*), Jamun (*Syzygium cumini*), Ber (*Zyziphus mauritiana*) and underutilized Vegetables like amaranth (*Amaranthus spp.*), drumstick (*Moringa oleifera*), bitter gourd (*Momordica charantia*) can be used for the production of commercial processed products like jam, jelly, candy, beverages, confectionary items, sauce etc., they are also used as nutraceuticals because of their anti-diabetic, anticancer, antipyretic, antiaging, hypertension lowering and other properties. The unsustainable market pressure that is aroused due to rapid population growth and urbanisation on routine fruits and vegetables can be minimised through commercial use of underutilized fruit and vegetable species and thus it is crucial for attaining environment sustainability.

Keywords: Underutilised, fruit and vegetable, food processing, sustainability

WATERBORNE COATINGS IN ECONOMICS WITH POLLUTION FREE ENVIRONMENT

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In eco friendly coatings, water borne coatings are currently the subject of major concern and these have been many new developments in recent years. The reason for this concern has been the desire to restrict the use of organic solvents for a mixture of environmental and economic reasons. The increasing attention to environmental preservation by health and safety agencies has led to an improved growth in the development and adoption of water-based resins. In most cases, waterborne coatings contain up to 80% water with small quantities of other solvents, such as glycol ethers. Economically too, water borne coatings are attractive because water is the cheapest solvent available and organic solvents based on crude oil are becoming increasingly expensive.

These coatings have excellent flexibility and adhesion to metal substrates and good resistance to a wide range of chemicals. The new formulations of water based coatings are as good as those obtained with conventional solvent containing coatings. With so many different options available to the coating industry and with different balances and compromises being of relevance in each sector, the Volatile Organic Compounds (VOCs) issue is quite complex, and is addressed in part by coating industry. The regulators are increasingly focusing on the



definition of the environmental quality standards to be achieved whilst industry is developing the best means of achieving those standards.

DECOMPOSITION OF KITCHEN ORGANIC WASTE

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Kitchen organic waste includes vegetable & fruit peelings, used tea leaves, leftover etc. It is an organic source of nitrogen which should be recycled into manure instead of going into garbage. This waste, if collected at municipality kura sangrah and thrown at dumpsite in large heaps, it starts releasing carbon di oxide, ammonia, methane and hydrogen sulphide. These actions not only damage ecosystem, it reduces the nutritional and economic value of the food waste. By adopting decomposition at domestic level, we can save the all values of food waste. With the aim of decomposition of food waste as soon as it is generated at source, present study was undertaken. 10-12 holes were carved in an empty wrapper of wheat flour and placed it under sunlight. Daily kitchen waste was thrown in it which was then covered with 3-4 handful of bio decompose mix (BDM). Every day, over this material, same process was repeated. When one wrapper was filled, process was done in another wrapper. Bio decompose mix was the mixture prepared by mixing 45 kg of cow dung manure, 8 kg of dry leaves manure and approximately 1 kg of sand. As soon as the BDM spread on nutritive peeling, microorganisms and physical decomposer present in the mix started eating and taking their growth cumulatively. Within four days after filling the wrapper, whole food waste was found decomposed completely. In the above process, cow dung manure acted as starter culture. Dry leaves and sand helped to maintain moisture level and oxygen level for decomposition respectively. C:N ration of the compost was 30:1. Finished compost gave Nitrogen=6%, Phosphorus=4%, Potassium=2%. pH was near neutral. Microbial load varied between 2.4×10^6 to 2.0×10^7 cfu/ml for bacteria and 3.5×10^4 to 2.0×10^7 for fungi.

AGRO PHYSIOLOGICAL CHARACTERISTICS OF QPM GENOTYPES IN DIFFERENT CLIMATIC CONDITION

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QPM (Quality Protein Maize) is a C₄ crop, produce along with numerous modifiers gene (Opaque-02) in different climatic condition. QPM has high nutritive value of endosperm protein, with higher content of two essential amino acids (Lysine and Tryptophan). The improved QPM varieties are tolerate drought, heat and low soil fertility; and help a stress prone area. An experiment was conducted to assess the response of agro-physiological characters of QPM genotypes to plant population under irrigated and rain-fed climatic condition. The trials were conducted at the irrigation Agricultural Farm BHU Varanasi and rain-fed Agricultural Farm RGSC Barkaccha during Kharif season 2015-16. The treatments were replicated two times. Fertilizers were applied at the rate of 60kgN, 30kgP and 30kgK along with 5 kg zinc per hectare after germination and flowering condition. QPM genotypes are evaluated after irrigation during germination and flowering condition. On the basis of stander heterosis only five hybrids (HKI-164-7-6 x HUZZM-185, HKI-164-7-6 x HUZZM-478, HKI-164-7-6 x CM-141, DMR-QPM-58 x HUZZM-478, DMR-QPM-58 x HUZZM-185) are best selected in F1 generation. Based on the obtained results, it can be conclude that QPM genotypes are better at low dose of fertilizers in different climatic condition.

Keywords: Agro-physiological characteristics, Climate, Irrigate, Rain-fed, non QPM, QPM.

ASSESSMENT OF CYTO-GENOTOXICITY CAUSED BY HEAVY METAL (CD) IN *LYCOPERSICON ESCULENTUM* MILL.

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Heavy metals are among the most toxic and environmentally hazardous pollutants. Cadmium is very toxic among heavy metals and geno-toxicity of Cd is associated with its effect on structure and function of DNA. Analysis of the genotoxic potential of a substance by the investigation of induced chromosomal alterations represents an effective method for biomonitoring studies and for estimation of the degree of pollution. The present study was designed to study the cyto-genotoxic effect of cadmium in terms of seed germination, pollen fertility and meiotic behavior in tomato (*Lycopersicon esculentum* Mill.), one of the most widely cultivated vegetable crops of the world. For this seeds of tomato were treated with different concentrations (20ppm, 40ppm, 60ppm, 80ppm, and 100ppm) of Cadmium nitrate ($\text{Cd}(\text{NO}_3)_2$). Seed germination and pollen fertility were significantly reduced at higher concentrations of Cd. Chromosomal abnormalities were dose dependent and found to increase with increasing dose of Cd. Various chromosomal aberrations such as univalents, multivalents, stickiness, bridges, laggards, precocious separations, stray bivalents, disturbed polarity, micronuclei etc were recorded during meiotic analysis of pollen mother cells (PMCs). However, these aberrations were found to be more frequent at higher doses. On the basis of these results, it was concluded that the higher concentrations of Cd were more effective and genotoxic for the plant.

Keywords: Heavy metals, Cadmium, Chromosomal aberrations, Biomonitoring, Cyto-genotoxicity.

RISK ASSESSMENT IN NANO-FOOD PACKAGING

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The use of nanomaterials is increasing in nano-food packaging. Nanomaterials have been applied to food packaging films for improving polymeric properties of packaging film. Several nanomaterials (AgNP, nano-ZNO, nano-TiO₂, nano-TiN etc.) have distinct properties



that enhance the mechanical, barrier and heat resistant properties. It also increases the sterilization and antimicrobial property in packaging films. Although these materials have several novel properties, several studies challenge the use of nano-food packaging stating migration of nanomaterials from packaging to food stuff raising concern of food safety. In recent investigations, it was found that the amount of silver migration (AgNP) was significantly increased with increase in time and temperature in all food simulating solutions (ultrapure water, 5% acetic acid, 95% ethanol). A question therefore arises whether nano-food packages are safe for public health or a risk? Therefore there are many challenges that restrict the number of nanomaterial consumption in the food related applications due to undefined toxicity level of nanomaterials. The lack of knowledge on human health effects and risk assessments needs to be bridged by extensive research and requires strong scientific evidence which could guarantee safe utilization of nano-food packages.

INNOVATIVE APPROACH FOR SUSTAINABLE AGRICULTURE, LIVELIHOOD AND ENVIRONMENTAL SECURITY

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Salinity and heavy metal (HgCl_2) toxicity depicts a global agricultural problem. The present experiment was designed to study the role of enzymatic homeostasis and protein deformation in response to abiotic stress tolerance in mustard (*Brassica juncea* L.). Toxicity enhanced with increase in concentration of both NaCl and HgCl_2 , but HgCl_2 responded more in morphological and bio-enzymatic parameters. Biomass accumulation (BA) was retarded in congruity with root length, shoot length and chlorophyll content under NaCl and HgCl_2 treatments. Superoxide dismutase (SOD) activity was 3.46-fold and 2.16-fold increased at 20 μM HgCl_2 and 100mM NaCl doses respectively to mitigate the oxidative damage. Ascorbate peroxidase (APX) to reduce the cellular H_2O_2 , was high at 100mM NaCl, whereas the glutathione reductase (GR) provide reduction potential, was also 2.73-fold at 100mM NaCl and 1.30-fold at 20 μM HgCl_2 to provide stress tolerance in plants under abiotic stress. Protein content and large subunits of Rubisco (LSU) were decreased with dosage increase in both salinity and heavy metal, but the deformation of two low molecular weight protein bands may be suggested to provide tolerance potential. The ultrastructure revealed that the stomatal responses and wriggled disposition of guard cells under abiotic stresses may face irreversible physical damage. The results suggest that plants may tolerate under abiotic stresses upto the innate potential of enzymatic homeostasis, without irreversible ultrastructural damage.

Keywords: enzymatic homeostasis, deformed protein band (DPB), stomatal response, tolerance.

BIODIVERSITY AND ITS VALUES

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Biodiversity refers to the variety of life on Earth and the natural patterns it forms. The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we so fully depend. This diversity is often understood in terms of the wide variety of plants, animals and microorganisms. So far, about 1.75 million species have been identified, mostly small creatures such as insects. Scientists reckon that there are actually about 13 million species, though estimates range from three to 100 million. Biodiversity also includes genetic differences within each species - for example, between varieties of crops and breeds of livestock. Chromosomes, genes, and DNA - the building blocks of life - determine the uniqueness of each individual and each species. Yet another aspect of biodiversity is the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes. In each ecosystem, living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them.

GOLD COATED NANOPOROUS MEMBRANE BASED SOLID PLATFORM FOR RAPID DETECTION OF MESOTHELIN AS A POTENTIAL CANCER BIOMARKER

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Biocompatible functional solid state nanopores (SSN) have emerged as an excellent biorecognition element for electrochemical sensing of biomolecules in recent years. In this study a gold coated nanoporous (30, 50, 80, 100 nm) polycarbonate track etched (PCTE) membrane based electrochemical biosensor was developed for label free detection of a mesothelin; a tumor biomarker. To select the best nanopore, varying pore size membranes having immobilized anti-mesothelin were exposed to mesothelin antigen and resistance was compared. The antigen-antibody interaction was monitored with the aid of specially designed electrochemical cell with electronic circuit. A partial blockade in ionic trafficking across the nanoporous membrane observed upon binding of antigen-antibody on to the coated nanopore. The reduction in pore diameter was observed as a function of resistance with respect to time across nanopore matrix. Cancer biomarker mesothelin was successfully assayed up to nano-gram level in phosphate-buffered saline (PBS) and cross selectivity was adjudged by prostate specific antigen. The developed biosensor shows astounding ability to sense the biomarker with better resolution with pore size of 30 nm than 50, 80 and 100 nm. The reproducibility showed that the device is capable to detect up to nano scale (1 ng/ml) with a significant detection range of 20 $\mu\text{g/ml}$ to 1 ng/ml.



BIOCHEMICAL EVALUATION OF OPAQUE2 INTROGRESSED LINES IN MAIZE FOR FE, ZN AND TRYPTOPHAN: PARAMOUNT STAPLE FOOD IN CONTEXT TO GLOBAL NUTRITION**Shamly Gupta and S. Lata**

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Food insecurity and hunger affect over 900 million people globally each year with the most at-risk populations living in poor, underdeveloped nations. Maize, being a versatile grain, has found several commercial uses now. The nutritional quality and integrity of maize kernels are influenced by many factors including genetic background, environment and kernel processing. Maize kernels supply many micronutrients necessary for human metabolic needs, the amounts of some essential nutrients are ill balanced or inadequate for consumers that rely on maize as a major food source. For instance, maize kernels lack the essential amino acids lysine and tryptophan, and are deficient in some micronutrients such as iron and zinc. Food-based approaches for combating under nutrition, such as maize fortification, provide promising evidence for dramatically improving the health of many. In this context, study was conducted during *khari* 2015-16 and 2016-17. The experimental material comprised of 30 F_1 hybrids along with parents (ten *opaque2* introgressed inbred lines and 3 diverse testers for iron, tryptophan and zinc, respectively) and evaluated in an alpha-RBD using two replications at experimental farm, department of crop improvement, CSKHPKV, Palampur where both warm and cool conditions prevails during the season. Cobs were dried under shade for micronutrient estimation and post harvest data was recorded. As per biochemical analysis, lines 580, 631, 642 and 658 their hybrids viz., 580 $\times$ KI-29, 631 $\times$ KI-29, 642 $\times$ KI-29 and 658 $\times$ KI-29 were identified superior in terms of nutritional traits and can be used in the further fortification programmes.

Keywords: Food insecurity, *opaque2*, alpha-RBD, Fortification**SMART BREEDING: A NEW PLATFORM FOR CROP IMPROVEMENT****Mukesh Kumar^{*1}, Manish Kr. Choudhary, Ganesh Kr. Koli, Gayatri Kumawat And Renu Yadav**

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"Stuart Breeding", Sometimes Also Called "Clever Breeding" Or "Precision Breeding". Stands For Methodical Alternatives To Genetic Engineering In Modern Plant Breeding. Classical Methods - Such As Crossbreeding Of Different Parent Varieties And Subsequent Selection Of Progeny - Are Combined With Novel Molecular Biological Approaches. Smart Breeding Uses Molecular-Biological Methods (E.G. Gene Mapping, Mutagenesis) To Characterize Initial Plants With Desirable Breeding Properties. Methods Of Vegetable Tissue Culturing And Subsequent Regeneration Of Intact Plants Essentially Reduce The Steps Among Classical Crossbreeding, Selection Of Desirable Breeding Results And Subsequent Propagation. The Breeding Targets, Such As E.G. Resistance To Diseases And Pest Infestation, Stress Tolerance (E.G. Against Dryness, Salt, Heat) Or Changed Components (E.G. Fatty Acid Pattern) Are Lastly Achieved By Means Of Classical Breeding, I.E. By Combination Of Suitable Parent Varieties, Thus Leading To Useful, Not Genetically Engineered Plants.

Keywords: Stuart Breeding, Clever Breeding, Crop Improvement**SOME STEPS TOWARDS GREEN CHEMISTRY****Deepshikha**

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Green chemistry, also called sustainable chemistry, is an area of chemistry and chemical engineering focused on design of products and processes that minimize the use and generation of hazardous chemical substances. It plays a critical role in harmonising ecology for sustaining life, as Chemicals are one of the most disastrous pollutants causing maximum damage to atmosphere and to mother earth. If we do not adopt the appropriate measures to check this, the day is not far ahead to see the total destruction. Thus by adopting principles of "Green Chemistry" we can certainly develop sustainable technologies to minimize the impact of chemicals and their adverse effect on to the environment. Furthermore, considering the limited natural resources, proper utilization of natural resources for progress of mankind without hampering the environment is crucial. Thus there is stressing need to develop greener and sustainable technologies.

PROBLEMS, PROSPECTS AND ADVANTAGES OF TRANSGENIC CROPS**Maurya and Shiv prasad**Department of Genetics & Plant Breeding, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur – 208002
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Transgenic crops are those crops which have genes inserted into them that are derived from another species. The inserted genes come from species within the same kingdom (plant to plant) or between the kingdoms (bacteria to plant). In biotechnology, a number of genetically modified (GM) crops or transgenic crops carrying novel traits have been developed and released for commercial agriculture production. These include insect pest resistant (*Bt* cotton, *Bt* maize, potato, *Bt* brinjal etc), herbicide glyphosate resistant crops (soybean, tobacco), improved self-life (flavr-savr tomato), improved nutritional quality (golden rice, black rice) and disease resistant. Some of the major genes have utilized for development of various transgenic crops. There are certain concerns of transgenic crops viz potential to environmental hazards, economic hazards, and human health risk etc. Genetically modified crop technology has revolutionized agriculture in the United States, Canada, China, Argentina and India. It exhibits the potential to have much wider impact, solving many of the current problems in agriculture worldwide. The types of GM crops that may become available in the future could boost crop yields while enhancing the nutritional value of staple foods and eliminating the need for inputs that could be harmful to the environment. Ecofriendly, need based GM crops may prove beneficial to agriculture and even to environment, without evidence of adverse health or environmental impacts.



STUDIES ON HYBRIDIZATION AND GENETIC DIVERSITY IN COWPEA (*VIGNA UNGUICULATA* L. WALP.)

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Characterization of genetic diversity among cultivated cowpea (*Vigna unguiculata*) varieties using RAPD markers and assessment of crossability within the species. Three parameter i.e. pollen fertility, pollen germinability and pollen tube growth rate were measured on both selfing and crossing to assess the crossability. Pollen fertility exhibited less significant correlation with fruit set and high significant correlation was found in between the pollen germinability and pollen tube growth rate with the fruit set. In both selfing and crossing, pollen germination and pollen tube growth increased in a constant rate. The crossability level was found to be better on selfing when compared with crosses. A total of 15 RAPD primers were randomly selected to assess genetic diversity of 40 accessions of cowpea. Based on the polymorphism information content value, primer OPC 14 was found to be more informative. The PIC value showed a ranged from 0.590 to 0.770 with the primer OPC 14 having the highest PIC value of 0.770. Based on the Euclidean similarity matrix, a clustered dendrogram was made by following ward's method (Ward, 1963), which indicated that PL-3 and CP-10 were found to be more distinct from IC-33922. Those two pairs of accession (PL-3 & CP-10) could be useful for breeding program.

Keywords: Crossability, genetic diversity, RAPD, dendrogram.

NUCLEOTIDE DIVERSITY ANALYSIS OF PATHOGENIC GENES OF *FUSARIUM OXYSPORUM* F. SP. *LYCOPERSICI*

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Fusarium oxysporum f. sp. *lycopersici* (Fol) is a soil borne fungal 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. Through various literature reviews, five genes *fpr1*, *fmk1*, *pacC*, *chsV* and *tom1* were found to be responsible for the virulence in both plant and mammals. The aim of this study is to perform computational study to investigate the potent gene is involved in fungal pathogenicity. The nucleotide/protein sequences have been retrieved from NCBI database. STRING database is used for prediction of relation between input proteins with other proteins which are likely contributing to a common biological purpose. Through clustal omega sequence analysis is done and their result is analysed through BioEdit software to study the variations between pathogenic and co-expressed/co-occurred gene. Further, variable sites, the average number of nucleotide substitution per site between two sequences (π) and nucleotide diversity (K) analysis for each gene was performed using DnaSP tool. It was found that 314, 524 and 271 variable sites are present in *fpr1*, *fmk1* and *tom1*, respectively and 118 informative sites were also present in *tom1*. The gene *tom1* has the highest average π value (0.59) and lowest was found in *fpr1* (0.51). The analysis of K shows that *tom1* (2.99) is highly varying gene and *fpr1* (1.67) found to be the lowest varying gene of *Fol* among five genes of interest. Thus it is concluded that *tom1* gene is found to be highly virulent gene and plays an important role during infection process.

TRANSCRIPTOMICS TECHNOLOGY

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Transcriptomics is the study of the transcriptome i.e. complete set of RNA transcripts produced by the genome under specific circumstances or in a specific cell using high-throughput tools, such as microarray analysis and next generation sequencing. Comparison of transcriptomes allow the identification of genes that are differentially expressed in distinct cell populations or in response to different treatments. Unlike the genome, which is roughly fixed for a given cell line, the transcriptome can vary with external environmental conditions because it includes all mRNA transcripts in the cell. The transcriptome reflects the genes that are being actively expressed at any given time. Transcriptomics techniques include DNA microarrays and next-generation sequencing technologies called RNA-Seq. Transcription can also be studied at the level of individual cells by single-cell transcriptomics. Techniques have been evolved from the initial expression sequencing tag (EST) strategy to gene chips and now the RNA-seq. To analyse the transcriptome, cost effective, high throughput, better sensitive, and less starting RNA requiring technologies are EST and microarray, RNA-seq, advance of RNA-seq and bioinformatics analysis. During last decade, great achievements have been made for better understanding of the transcriptome due to the genomics research needs and omics technology innovation. Implementation of NGS based RNA-seq technology changed our thought on the transcription of genome and its regulation. Transcriptomics study has several challenges like to reduce the cost for low input RNA-seq for which experimental design and bioinformatics analysis remain to be optimized for efficient and accurate characterization of the transcriptome and RNA-seq technology which needs to be improved to overcome the bias introduced by library construction.

Keywords: Transcriptomics, RNA-seq and microarray.

MECHANISM OF INORGANIC, NITRATE AND AMMONIUM TRANSPORT SYSTEM IN PLANTS

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Inorganic nitrogen concentration in soil solutions vary across several orders of magnitude among different soils. In order to respond to this heterogeneity, plants have evolved mechanisms to regulate NO_3^- and NH_4^+ influx. There is a co-ordinate regulation of all component fluxes within the root. Two classes of gene, NRT1 and NRT2, have been found to be potential involved in the high and low affinity inorganic nutrient, nitrate transport system. Both NRT1 and NRT2 classes are represented by multigene families. Physiological studies have demonstrated the presence of two high affinity transport system HATS for NO_3^- and one HATS for NH_4^+ in roots of higher plants. In *Arabidopsis thaliana* there exist even members of the NRT2 family encoding putative HATS for NH_4^+ . The induction of high affinity NO_3^- transport and *Nrt2.1* and *Nrt2.2* expression occurs in response to the provision of NO_3^- , while down regulation of these genes appear to be due to the effects of glutamine. High affinity NH_4^+ transport and *AMT1.1* expression also appear to be subject to down regulation by glutamine. There is a evidence that accumulated NO_3^- and NH_4^+ may act post-transcriptionally on transport function and also in *Aspergillus nidulans*.

Keywords: multigene, flux regulation, nitrate, ammonium, AMT1, NRT2

GENETIC CORRELATION ANALYSIS IN JATROPHA GENOTYPES BASED ON MORPHOLOGICAL TRAITS

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Jatropha curcas appeared as a major potential candidate crops for biodiesel production. The genus *Jatropha* belongs to tribe Joannesieae in the Euphorbiaceae family. The genus *Jatropha* comprises 160-170 species. *J. curcas* is also known by other names viz., ratanjyot, chandrajyot, Jamal gota, Jangli arandi, Kala aranda and physic nut etc. The chromosome numbers of *J. curcas* was found to be $2n=22$. The crop is a native to Mexico and Central American region and later naturalised in many parts of the tropic and sub-tropic regions of the world. The water requirement of the plant is extremely low. It can stand long periods of drought by shedding most of its leaves to reduce transpiration loss. The plant is propagated by seeds or by cuttings. The plant propagation by seeds shows greater resistance to drought and disease in comparison to those propagated by cuttings. The methods of cultivation are: direct seedling, nursery raising and transplanting and cuttings. Wider spacing is reported to give larger yields of fruit and the seed yields of *Jatropha* may range from 0.1 to 15 tonnes per ha per year. This investigation therefore suggested that considerable variability existed among twelve characters which offer opportunity for the selection of superior plants. Additive genetic control of inheritance was observed in plant height, collar diameter, seed yield per plant, fruit cluster per plant, fruit per cluster, primary branches per plant, secondary branches per plant and 100- seed weight. The correlation study revealed that increase in seed yield would be established by a direct proportionate increase in number of primary branches per plant, number of fruits clusters per plant and number of fruit per cluster (non-significant positive high values) but reduced 100- seed weight. Number of fruit cluster per plant emerged as a major direct and indirect contributor for seed yield in path analysis, at phenotypic and genotypic level. From the study of mean values Pant JCP-2, Pant JCP-1, CRJ-29 and LBJJ-23 were identified as promising genotypes and could be utilized for genetic improvements in breeding of *Jatropha* population.

CYTOKININ REGIME FOR IN VITRO PROPAGATION AND ASSESSMENT OF ANTIOXIDANT ACTIVITIES DURING EX VITRO ESTABLISHMENT OF ANTI DIABETIC PLANT (TECOMA STANS L.).

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An efficient in vitro propagation system was developed for an antidiabetic plant (*Tecoma stans*) using nodal explants. Effect of cytokinins (BA or Kin) either alone or in combination with different concentrations (0.1 – 2.0 μM) of auxins, NAA or IAA on regeneration and multiplication was evaluated. All tested concentrations facilitated shoot bud induction and best organogenic potential (89%), maximum mean shoot number (6.40 ± 0.92) with average mean shoot length ($3.70 \pm 0.20\text{cm}$) per explant was achieved on (MS + 5 μM BA + 0.5 μM NAA) after 4 weeks of incubation. To stimulate the *in vitro* rhizogenesis healthy microshoots ($\geq 4\text{cm}$) were excised and inoculated on root induction medium enriched with different (0.1- 2.0 μM) concentration of IBA or NAA. Finally, 93% of the regenerated microshoots rooted with, mean root number (9.66 ± 0.88) and root length ($2.66 \pm 0.33\text{cm}$) was achieved on MS medium supplemented with (1.0 μM) IBA after 4 weeks of incubation. About 75% of the regenerated plantlets were acclimatized in culture room and successfully established in earthen pots containing garden soil and manure (2:1) and maintained in greenhouse with 90% survival rate. An attempt was made to obtain basic information on different antioxidant enzymatic activities such as Superoxide dismutase (SOD), Ascorbate peroxidase (APX), Catalase (CAT) and protein estimation during acclimatization process. Results obtained from the studies would be beneficial in the mass multiplication, sustainable development and in assessing the physiological parameters in *Tecoma stans*.

Keywords: Anti oxidant activities, *In vitro* rhizogenesis, Micropropagation, Nodal explants

ADVANCES IN FOOD AUTHENTICITY TEST

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Food authenticity is rapid growing field due to increasing public awareness concerning food quality. The process which can verify food is in a compliance with its level description, can be defined as food authentication¹. Recent food scares such as bovine spongiform encephalopathy and avian flu outbreaks, olive oil adulteration with hazelnut oil or the adulteration of milk with melamine have led to media and public attention regarding the origin of food and the more general concept of food authenticity². A variety of analytical techniques, for verification of food stuff origin have been developed and tested. Advanced tools like ELISA, Genomics, Proteomics, Metabolomics, NMR, IR, GC-MS, LC-MS



etc. are being emerged as major authentication methodologies for discrimination of authentic food products from adulterated product³. A total of honey samples (polyfloral and acacia) from different countries have been analyzed in terms of ¹H-NMR spectroscopy coupled with multivariate statistical methods⁴. FT-IR spectroscopy has been used as accurate and valid technique for the detection and quantification of the adulteration of goat or sheep milk with cow milk in both binary and tertiary mixtures⁵. A DNA based method coupled with High Resolution Melting (HRM) analysis has been reported to differentiate Basmati rice from non-Basmati rice varieties using microsatellite markers⁶. The future applications will cover more food commodity by using newer technologies such as NMR, isotopic methods, IR-MS and DNA-based technologies.

IMPACT OF AGRICULTURE ON BIODIVERSITY

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Biodiversity is vital to agricultural production and food safety apart from being an exquisite constituent of environmental conservation. But there occurs an unavoidable clash between the two. Due to agriculture extension there is a continuous loss of biodiversity in 'natural habitats'. Changes in cultivation practices and technologies and expansion in farmlands has significantly increased the global production but at the same time resulted in severe degradation of natural resources including soil, water and biological diversity in and around agricultural farmlands. The prevailing models of agricultural growth have resulted in wear away of massive biodiversity including plant genetic resources, insects, livestock, soil organism and many other flora and fauna at highly alarming rate leading to economic losses endangering the food productivity and food security. Thus, to maintain equilibrium between biodiversity and agriculture there is a need to integrate agricultural practices with well-planned strategies that not only conserve biodiversity through sustainable agriculture but also enhance it at all levels in farming systems. One such practice includes the replacement of conventional agriculture with conservation agriculture that involves the use of 3 basic principles: zero tillage for minimal soil disturbance; expanded crop rotation and a stable organic soil cover. These practices will help in much more sustainable use of biodiversity resources and ultimately an increased crop production for proper management of natural resources and to achieve sustainability in agriculture.

BODY TEMPERATURE, CLOACAL PROTUBERANCE, GONADAL SIZE AND NUPTIAL COLOURATION IN MATING SUCCESSION IN BLACKHEADED MUNIA (*LONCHURA MALACCA*)

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Variation in colouration has been related to sexual selection in most of avian fauna, even though such a relationship has been proven for many other vertebrate taxa. Male and female blackheaded munia (*Lonchura malacca*) juveniles have a uniform pale brown upperparts, lack the dark head and have white to pale buff under parts, but adult has a stubby pale grey-blue bill, shiny black head, and brown body, with a brick red patch on the lower back, visible only when it flies. The adult develops body molt and molt primaries a conspicuous nuptial colouration during the pre-reproductive season. To investigate the possibility that colouration plays a role in sexual selection in this species, in month of January three groups of juvenile blackheaded munia birds exposed 12L: 12D photoperiods, each group has 30 juveniles and third group added extra 5 adult male birds. In the first group temporal variation in pale brown of upperparts change shiny black colouration on head in five juveniles, in second group all non-colouration juveniles were present and in third group, five adult male (which has shiny black head) put with juveniles, determined this shiny blackness affected gonadal size, cloacal protuberance or body temperature of birds and investigated if shiny blackness of males could be related to their mating success. Results confirmed previous observations that females start to develop follicles, body temperature and cloacal protuberance in first and third groups for a very few time points. Colouration group first and third exhibiting higher in follicular size, body temperatures and cloacal protuberance size of were somewhat than non-colouration second group birds with lower body temperatures, follicles, and cloacal protuberance. Finally, mating success was positively related to juvenile birds, whereas in non colour of birds no such relationship was detected. While our results align with the hypothesis that the shiny black colouration of birds in a group may be a target of sexual selection, alternative explanations are also discussed.

Keywords: blackheaded munia, photoperiods, juveniles, cloacal protuberance, Follicular diameter, reproduction, sexual selection.

GENETIC ENGINEERING ROLE TO IMPROVING QUALITY AND PRODUCTIVITY OF CROPS

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Ability to modify plants at the genomic level by advanced molecular technology has enhanced the scope of improvements in plant traits attempted earlier through conventional breeding methods. Agricultural innovation has always involved new, science-based products and processes that have contributed reliable methods for increasing productivity and sustainability. Over the next 25 years, 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. Biotechnology has introduced a new dimension to such innovation, offering efficient and cost-effective means to produce a diverse array of novel, value-added products and tools. Genetically-modified (GM) crops can prove to be powerful complements to those produced by conventional methods for meeting the worldwide demand for quality foods. Crops developed by genetic engineering can not only be used to enhance yields and nutritional quality but also for increased tolerance to various biotic and abiotic stresses. Although there have been some expressions of concern about biosafety and health hazards associated with GM crops, there is no reason to hesitate in consuming genetically-engineered food crops that have been thoughtfully developed and carefully tested. Integration of modern biotechnology, with conventional agricultural practices in a sustainable manner, can fulfil the goal of attaining food security for present as well as future generations.



Keywords: Genetic engineering, Genetically-modified, Abiotic stresses, Biosafety

EPIGENOMICS PROJECTS ON CROP PLANTS

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Epigenomics is the study of the all the epigenetic modifications on the genetic material of a cell, known as the epigenome. Epigenetic modifications viz chromatin modifications, DNA methylation, RNAs (coding and noncoding) etc. are reversible modifications on a cell's DNA or histones that affect gene expression without altering the DNA sequence. Epigenomic maintenance is a continuous process and plays an important role in stability of eukaryotic genomes by taking part in crucial biological mechanisms. Epigenomics research in plants emerged after discovery of impact of epigenetic events in plant physiology viz vernalization, DNA repair, response to abiotic and biotic stresses etc. Various epigenomics studies have been done on crop plants to improve abiotic and biotic stress resistance. Currently, various research projects are in progress worldwide; to better understand the plant epigenomics, so that it can be applied for crop improvement programs in near future. Plant epigenomics is still in its budding state and needs high throughput research and development for its application in crop improvement programs. Most of the currently ongoing epigenomics projects are contributed towards understanding all the possible epigenetic events that occur in plant genome. Various researchers have encouraged the development of epigenomics databases like pENCODE, Esembl, EPIC and many others; to enhance collaboration and collect the information of various epigenomics projects being conducted worldwide. With the availability of plant genome information and recent technologies, the future of epigenomics is promising to apply this area of research for the crop improvement programs.

Keywords: Epigenetics, epigenomics, plant genome annotation, DNA methylation, Histone modifications.

CONSERVATION EFFORTS IN WHEAT GENETIC RESOURCES AT THE NATIONAL GENE BANK, ICAR- NBPGR

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The National Genebank located at Indian Council of Agricultural Research- National Bureau of Plant Genetic Resources is one among the largest genebanks in the world, with a germplasm holding of 4, 32,787 accessions belonging to 37 crops represented by more than 1500 species. The genebank conserves a very large collection of wheat germplasm, comprising of 33,429 accessions of both indigenous and exotic origin. This wheat germplasm collection is a gold mine of genetic diversity that has been collected and conserved over a period of more than 30 years. The wheat collection has accessions representing the entire species diversity (55 species). The total wild wheat germplasm collection is around 2300 accessions. Among the cultivated genotypes (*Triticum aestivum*, *T. durum* and *T. dicoccum*), there are more than 300 genetic stocks having economically important traits and around 400 varieties released and notified by the central variety release committee. Among the exotic accessions, the major imports have been received from CIMMYT, Mexico, followed by the United States Department of Agriculture (USDA) and ICARDA, Syria. The entire conserved germplasm of cultivated wheat (around 22,000) was subjected to characterization and evaluation at multi-location sites, and this mega programme was cited in the Limca Book of Records. The major outcome of this effort was (i) development of a core set of wheat germplasm comprising 2760 accessions representing the total genetic diversity, (ii) identification of sources of rust and spot blotch resistance and (iii) development of a reference set for terminal heat stress tolerance in wheat germplasm. The germplasm accessions are also utilized by wheat breeders across the country in their research programmes.

ROLE OF BIO-INDICATORS IN SUSTAINABLE AGRICULTURE

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Protecting the diversity is our moral and spiritual duty. Biodiversity plays a central role in making life sustainable on this planet for all organisms. The fate of human species is interlinked with fates of all organisms whether plant, animals or microbes living around us and directly or indirectly affecting our lives. The impact of biodiversity loss may have most severe consequences for people living in poverty, directly because they have few livelihood options to rely on and indirectly because of functions they perform in the ecosystem. Bio-indicator is nothing but an organism used as an indicator of the quality of an ecosystem, especially in terms of pollution. Applications of the bio-indicator concept include providing of base-line data in pre-development situations; monitoring ecosystem recovery and status of conservation areas. The presence or absence of plants or vegetative life can provide important clues about environmental health, or they can be accumulators of metal or their metabolism product, for example, the total algal biomass in aquatic system serves as an important metric for organic pollution and nutrient loading such as nitrogen and phosphorous. The present paper gives the introduction and background information regarding bio-indicators and their types.

ROLE OF GOVERNMENT POLICIES FOR SUSTAINABLE DEVELOPMENT IN AGRICULTURE

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Sustainable development is a process in which the social, economic and environmental issues should be complementary and interdependent in the development process. Agriculture play a crucial role in the sustainable development, the challenges faced by agriculture in the sustainable development is in working out ways of bringing about a society that is materially sufficient, socially equitable and ecologically sustainable. Sustainable agriculture faces economic, social and ecological challenges these challenges are closely related. The main tools towards sustainable agriculture are policy and agrarian reform, participation income diversification, land conservation and improved management of inputs. As a nation that has been actively associated with the global pursuit of sustainable development, India's commitment to agenda 21 re-emphasises the principles that have long guided development planning in the country. Agenda 21 adopted at the conference, represents a global consensus and political commitment at the highest level on socio economic development and environmental corporation. India's agriculture trade policy mainly from the perspective of public policy especially providing food security to the poor within the overall goal of inclusive and sustainable development. There has been a tendency on the part of the state government to spread them in the available financial resources by taking too many irrigation projects in hand. Given that providing economic access to food for the poor is a major concern, the central government has promulgated the National Food Security Ordinance on July 2013. In the current era, balance among industry, services and agriculture sectors is necessary for strategizing trade policies. This is difficult for pluralist countries such as India pressure from various constituencies. India now has comparative advantage in agriculture products such as oilseeds, rice, sugar and tea but the growth drivers also lie elsewhere in the services and industry. Striking the right balance can be hard with more than two-thirds of the national employment in agriculture.

Keywords: Sustainable development, challenges, public policy, food security

IMPROVEMENT OF CROP QUALITY THROUGH SUSTAINABLE HOLISTIC PRODUCTION SYSTEM

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Holistic production system also called as Organic farming. It's not new to our country; from time immemorial several types of organic practices have been followed. For almost the last fifty years Indian agricultural practices have mainly concentrated on increasing yield, leading to the cultivation of more mono crops. In which avoid or largely excludes the use of synthetically produced inputs like fertilizer, pesticides, amendment growth regulators livestock feed etc. This, in turn, has made the crops highly vulnerable to pest attacks, soil becoming barren and ground water toxic. Organic farming grown about 7.23 lakh ha in India and among the hill States Sikkim (0.61 lakh ha) has the highest area under organic farming now called as organic states. Sustainable holistic production system means need of research and development to encourage the farmers for organic farming for sustainable development by which needs of the present generation could be met without compromising the ability of future generations to meet their own needs. Organic farming is the best practices improves Soil Quality not only help in sustaining higher productivity but also help in maintaining good soil health, soil quality, biological productivity, maintain environment quality and promote plant, animal health & maintenance of biodiversity, water quality & nutrient cycle. Increasing the water holding capacity, porosity, than improve food quality and increase crop production. The efficient soil management strategies such as selection of suitable crop rotation, balanced nutrition of crop, integrated plant nutrient supply, liming of acid soils, recycling of crop residues, modifying soil condition of salt affected soils by amendments, improved tillage practices not only help in sustaining higher productivity but also help in maintaining good soil health.

Keywords: Organic Farming, Soil Quality

SOIL MOISTURE CONSERVATION FOR SUSTAINABLE MANAGEMENT IN THAR DESERT REGION

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Soil moisture conservation in Western India such as Rajasthan and Gujarat states are influenced by the high evapo-transpiration. The soils of this region are sandy to sandy loam and low vegetation & high biodiversity. Mostly Kharif field crops are grown in this region (pearl millet, clusterbean, mothbean), rabi field crops (Cumin, mustard, barley etc.) and arid horticulture (date palm, ber, pomegranate, lasoda) and others i.e. ker, Isbgol because high evapo-transpiration of all the unstressed crop and low water requirement (A.K. Paroda et al). The soil moisture stress severely affects by the physiological activities, growth and development of plant and yield. The losses of soil moisture can be minimized by the moisture conservation practices i.e. mulching, crop residue, PVC, use of anti-transpirants, cemented farm and village pond, etc. The application of grass mulch (6-8 t/ha) decreased the maximum soil temperature by 1 to 10°C day and minimum soil temperature by 1 to 6°C night, reduced evaporation loss and increase infiltration rate and maintain soil moisture. Mulching increased the yield of greengram, mothbean and clusterbean. Significantly higher grain and straw yields of sorghum in straw mulch + anti-transpirant (kaolin). Mostly suitable for grass in region *Lasiurus sindicus* and *Cenchrus ciliaris* are use for straw mulch and 40 micron transparent polythene used for a mulch during June to July months. All the soil moisture conservation practices maintain the soil moisture and drip & matka irrigation methods are suitable for this condition.

Keywords: Soil Moisture Conservation, Sustainability Agricultural, Polythene etc.



IMPROVEMENT OF CROP QUALITY THROUGH SUSTAINABLE HOLISTIC PRODUCTION SYSTEM**S S Thori¹, Arun kumar², S K kakaraliya³, M K Jat¹ and S.L. Khaswan**¹National Research Centre on Seed Spice ,Tabiji, Ajmer (Rajasthan) -305206³Choudhary Charan Singh Hariyana Agriculture University , Hisar (Hariyana)-125004²Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (Utter Pradesh)-250110⁴Rajasthan State seeds corporation, Jaipur Rajasthan India

Holistic production system also called as Organic farming. It's not new to our country; from time immemorial several types of organic practices have been followed. For almost the last fifty years Indian agricultural practices have mainly concentrated on increasing yield, leading to the cultivation of more mono crops. In which avoid or largely excludes the use of synthetically produced inputs like fertilizer, pesticides, amendment growth regulators livestock feed etc. This, in turn, has made the crops highly vulnerable to pest attacks, soil becoming barren and ground water toxic. Organic farming grown about 7.23 lakh ha in India and among the hill States Sikkim (0.61 lakh ha) has the highest area under organic farming now called as organic states. Sustainable holistic production system means need of research and development to encourage the farmers for organic farming for sustainable development by which needs of the present generation could be met without compromising the ability of future generations to meet their own needs. Organic farming is the best practices improves Soil Quality not only help in sustaining higher productivity but also help in maintaining good soil health, soil quality, biological productivity, maintain environment quality and promote plant, animal health & maintenance of biodiversity, water quality & nutrient cycle. Increasing the water holding capacity, porosity, than improve food quality and increase crop production. The efficient soil management strategies such as selection of suitable crop rotation , balanced nutrition of crop, integrated plant nutrient supply, liming of acid soils, recycling of crop residues, modifying soil condition of salt affected soils by amendments, improved tillage practices not only help in sustaining higher productivity but also help in maintaining good soil health.

Keywords: Organic Farming, Soil Quality**ORGANIC FARMING A KEY OF SUSTAINING SOIL HEALTH****Hemant Kumar Jangde*, Dinesh Kumar Marapi and Saurabh Kumar**

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Soil health is the potential of a living soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain air and water quality, and promote plant and animal health. Knowledge of physical, chemical, biochemical, and microbiological status of the soil is key to understanding short and long-term effects of farming systems on soil-plant interactions. Soil health management practices in agriculture show great potential for limiting soil loss, reducing run-off, enhancing biodiversity, and providing economic benefits to farmers and landowners through short-term reductions of costly inputs and long-term sustainability of the land. Continuous monoculture cropping systems and excessive cultivation for seedbed preparation and pest control have led to unacceptable erosion loss of our limited topsoil. The positive effects of organic farming on soil physical properties viz. soil structure, water holding capacity, soil aeration and soil temperature are well-reported that organic management can improve soil structure, organic matter content, and porosity in soil. Rotation of crop in a field is an important component under organic farming which influences the physical structure of soil. Accumulation of organic matter in soil during the lean phase has a direct influence in the modification of soil structure. Organic farming adds more organic matter to the soil, which is the basic requirement for improving soil health. Soil health and quality indicators, and the changes in those indicators, can be a major link between the strategies of conservation management practices and achievement of the major goals of sustainable agriculture. Therefore organic farming systems are being highly complex and integrated biological systems could be the potential technology option to maintain of soil health in long term.

Keywords: Soil health, Sustainable agriculture, Organic farming and Environment**STRATEGIES FOR PROMOTING AND DEVELOPING FARMER-LED-INNOVATIONS****Akanchha Singh¹ and VLV Kameswari²**

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Sustainability and food security are two of the most prominent issues all across the globe. Most countries are facing the challenges of malnutrition, hidden hunger, climate change, nutritional security etc. In case of India the conditions are so diverse that each and every region has its own specific problems and they cannot have the same solutions. Earlier approaches to finding solutions were top-to down that did not work for specific and local situations. Pro-innovation bias and compatibility issues were also major barriers and this led to realization of the importance of farmer wisdom. Participatory approaches took birth after this and one such approach is farmer-led-innovation. Farmer-led innovation are slowly getting recognition as it promotes social learning, recognition of farmers, effective utilization of local resources and harnessing of local potential. Cost consideration, gap between farmer and researcher, lack of documenting agencies are some of the major challenges hindering the wider acceptance of this approach. However, by adopting innovative strategies to involve farmers in innovation-generation process, rewarding and awarding farmers, like promotion through mass media, organizing national, international conferences, exhibitions and adoption of villages can change the situation. Considering this pertinent issue the paper is an attempt to provide an insight into farmer- led –innovation process, need to encourage this approach of innovation-generation and ways and means of speeding up farmers' engagement in generation of innovation.

Keywords: Farmer-led-innovation, Innovation-generation process, Urgency, strategies, Limitations, Organizations

BIO-COMPOSTING; TAKING OVER FYM

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Bio compost is used on agriculture field for taking care of plant health by boosting up the fertility of the soil through increased level of organic matter and reducing the amount of chemical fertilizers. The C:N ratio of a good compost is relatively low, thus allowing to provide a better growth and development of a crop and reducing the competition for minerals and nutrients between microorganism and crops. *Trichoderma* as a bio control agent is widely used in the field of agriculture and its allied practices mostly because of its antagonistic properties such as higher metabolism rate and production of secondary metabolites that helps in controlling certain soil borne and seed borne pathogens as well. But new research extends the use of *Trichoderma* in preparation of compost as a bio inoculant. Instead of its antagonistic properties *Trichoderma* got an ability too to reduce the soil pH and C:N ratio by its organic acids and also solubilise mineral cations like Fe, Mg, Mn makes *Trichoderma* fit in compost making. Inoculating *Trichoderma* in compost increases the decomposition rate and decreases the duration (up to 20%) by producing cell degrading enzymes like cellulose, hemicellulose, and proteases. *Trichoderma* incorporated compost proves better yield in crops like Tomato. It may also reduce the input of N:P:K in the field save us financially and ecologically.

ADVANCES IN SUSTAINABLE AGRICULTURE

Sunil Kumar Malik & Surender Mittal

Sustainable agriculture is vital in today's world as it offers the potential to meet our agricultural needs, something that conventional agriculture fails to do. This type of agriculture uses a special farming technique wherein the environmental resources can be fully utilized and at the same time ensuring that no harm was done to it. Thus the technique is environment friendly and ensures safe and healthy agricultural products. Microbial populations are instrumental to fundamental processes that drive stability and productivity of agro-ecosystems. Several investigations addressed at improving understanding of the diversity, dynamics and importance of soil microbial communities and their beneficial and co-operative roles in agricultural productivity. However, in this review we describe only the contributions of plant growth promoting rhizobacteria (PGPR) and cyanobacteria in safe and sustainable agriculture development. They are excellent model systems which can provide the biotechnologist with novel genetic constituents and bioactive compounds having diverse uses in agriculture and environmental sustainability. PGPR and cyanobacteria offer an environmentally sustainable approach to increase crop production and soil health.

NATURAL RESOURCE MANAGEMENT FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT

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The term of natural resources includes “all resources” that exist in natural state and all systems that are or can be useful to the man in the actual technological, economical and social circumstances. The use of natural resources into the productive technological processes means the direct consumption of resources for satisfaction of needs of products and services. Natural resources provide mankind with important ecosystem services such as clean water, energy, minerals and biological resources in terrestrial, aquatic and marine ecosystems which are essential for the survival and development of mankind. The idea of agricultural sustainability centers on the need to develop technologies and practices that do not have adverse effects on environmental goods and services, and that lead to improvements in food productivity. Here we show the extent to which 286 recent interventions in 57 poor countries covering 37 M ha (3% of the cultivated area in developing countries) have increased productivity on 12.6 M farms while improving the supply of critical environmental services. The average crop yield increase was 79% (geometric mean 64%). Agricultural yields continue to increase through better soil management, irrigation methods, genetic engineering, and environmental protection measures. Sustainable agriculture focuses on producing food in a way that does not degrade the environment and contributes to the livelihood of communities. However, this simple statement conveys a complex concept: that agriculture must balance production, environmental, and community development goals. Sustainable Agriculture and Natural Resource Management activities seek to increase agricultural productivity through adoption of practices that maintain the long term ecological and biological integrity of natural resources. Activities in this sub-sector cut across the rural, social, and environmental issues of natural resource management to sustain significant increases in farm productivity through the efficient use of land and other resources.

Keywords: Natural resources, soil management, ecosystems, sustainable management.

SUSTAINABLE ECONOMIC DEVELOPMENT IN RURAL INDIA BY FINANCIAL INCLUSION

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As the most of the rural population is still not using formal banking system so they are not aware about micro finance instrument that is why they are not included in the inclusive growth story of India. The concept of financial inclusion becomes quite challenging for the Indian rural economy. Since 2006, many focused initiatives are taken by NABARD and Government of India in favor of financial inclusion but the impact of these did not result satisfactory outcome. The paper aims to focus on using the existing resources such as Mobile and smart phones, Banking Apps, India Post Office, Internet banking and Non banking financial institutions (NBFCs) thereby making it more healthy and user friendly for the interest of the rural population as well as the formal sector. My study focused on 250 students studying in Monad University and



most of student are lacking in basic financial literacy. So knowing the facts behind backwardness in rural population of different part of India .we frame questionnaire and use simple statistical tools and analyze the problem and found that most of Government and private schemes related to financial inclusion(crop insurance, Beema youjna.jandhan account, sukanyia, rural mutual funds,kisan vikas patra) are not properly convinced to the masses. Usually government official goes to rural areas and hold a formal talk in difficult language and so on. For making them aware about financial instrument we can use SMS service in local languages. What my study found that they have enough money but in absence financial literacy they are putting into debt instruments which are not yielding enough to beat inflation. Their saving can be channelized into well diversified mutual by way of SIP .**Keywords:** Financial inclusion, Business correspondents, Micro finance schemes Indian Economy ,SIP

EXTENT OF PARTICIPATION AND DECISION MAKING OF MAN ALONE AND JOINTLY WITH WOMEN IN DIFFERENT AGRICULTURAL ACTIVITIES.

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A survey based study was carried out in the month of April to August, 2017 in the district Deoria of Uttar Pradesh to know participation and decision making of man alone and jointly with female in different agricultural activities. A personal interview schedule was developed and used. One hundred twenty farmers were selected. Data collected included the extent of participation and decision making of man alone and jointly with women in various agricultural activities. Study revealed that in agricultural activities various intervention points are addressable such as activities done by male alone include ploughing, farm yard manure application, formation of ridges and furrows, and plant treatment. The operations done by male jointly with female dominations are cleaning of land, hoeing and weeding, transplanting of nursery, storage of seed and processing of cereal pulse and vegetable. The works dominated by male are seed treatment, raising vegetable nursery, application of pesticide and weedicide and marketing. The activities in which both the groups showed their equal participation are sowing of seeds, scaring of birds, rodents and animals, nursery after care and harvesting. Non participation of women in various operations is due to high fatigueness, requirement of more muscle power and lack of knowledge and awareness. With respect to decision making it is also observed that prominent role was performed by male, women played only supportive role. Less participation of women in decision making could be attributed to custom, tradition social barrier, their illiteracy ignorance and less participation in extension programmes. Women education, technical training and adequate extension facilities can create a positive impact leading to a better tomorrow.

Keywords: Extent of Participation, Agricultural activities, decision making, man, woman.

EFFECT OF DIFFERENT HOST CROPS ON THE BIOLOGICAL PARAMETERS OF *HENOSEPILOCHNA VIGINTIOCTOPUNCTATA* (F.) (COLEOPTERA: COCCINELLIDAE) UNDER LABORATORY CONDITIONS

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The effect of different host crops including brinjal, bittergourd, black nightshade, tomato and winter cherry was studied on biological parameters of *Henosepilachna vigintioctopunctata* (F.) in the laboratory at 27 ± 1 °C and $85 \pm 5\%$ RH. The results indicated that host plants significantly affected the life history, i.e. survival of developmental stages, oviposition period of *H. vigintioctopunctata*. Comparative study on different host plant revealed that hadda beetle required minimum of 50 days to complete generation on brinjal followed by 51 days on winter cherry, black nightshade, and bitter gourd and 55 days on tomato. The survivorship and expectation of life declined gradually with the advancement of age. However, the fluctuations of mortality parameter were seen on all the host crops. On brinjal and bittergourd, 100% hatching of eggs with low larval mortality were noticed. The highest net reproductive rate (R_0) was observed on brinjal (52.64), followed by black nightshade (17.77), winter cherry (16.85), bitter gourd (15.36) and tomato (1.56 females/ female/ generation). The smallest intrinsic rate, r_m (0.009185 females per female per day) occurred on tomato which showed that *H. vigintioctopunctata* did not perform well on tomato. In addition, *H. vigintioctopunctata* may become double in 6.33 days on brinjal followed by 8.49, 9.26, 9.56 days on black nightshade, winter cherry and bittergourd respectively. Therefore, it can be concluded from the present study that *H. vigintioctopunctata* prefers brinjal for fast and healthy development with low larval mortality and highest number of adult yield than other host crops.

Keywords: fertility life table parameters, host plants, mortality, development stages, *Henosepilachna vigintioctopunctata*

EFFECT OF POTASH DOSE AND APPLICATION METHODS ON YIELD AND QUALITY OF POTATO TUBERS (*SOLANUM TUBEROSUM* L.)

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Field trial was conducted to evaluate the effect of different potash levels and methods of application on yield and quality of potato (*Solanum tuberosum* L.) at Vegetable Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) during Rabi season of 2013-2014. The experiment with eleven treatments replicated thrice was done in Randomized Block Design layout. Observations for yield parameters i.e., number and yield of tubers per plant at de-hauling stage and quality parameters i.e., specific gravity, dry matter content, starch content and protein content of tubers after harvest were recorded. There was significant effect found under various potash treatments in terms of number and yield of tubers per plant, as well as the quality parameters were also affected. The split application (basal + spray) of potash gave the



maximum tuber number (12.5) and yield (1274.5 g) per plant. As per the quality is concerned, the findings revealed that the quality and yield of potato crop was significantly influenced by different split potash levels.

VIRULENCE AND REPRODUCTIVE POTENTIAL OF *STEINERNEMA ABBASI* AGAINST GREATER WAX MOTH (*GALLERIA MELLONELLA*) IN LABORATORY CONDITION

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Entomopathogenic nematodes (EPNs) have been identified as being promising biological control agents of key insect pests. The two EPN genera i.e. *Steinernema* spp. and *Heterorhabditis* spp. have great potential for use as biological control agents within an integrated pest management programme are *S. abbasi* (isolate CS₃₉) was isolated from the soils around the rhizosphere of spinach from village Puwarka, Saharanpur, Uttar Pradesh, India. For the evaluation of the efficacy of *S.abbasi* (isolate CS39) against *Galleria mellonella*, four different concentrations viz. 25, 50, 100, 200 IJ/ Larva were used. Mortality was observed after every 12 hour post infection period (PIP) and continued till all larvae were dead. Mortality at 24 hour PIP, 0%, 10%, 20%, and 30% and at 60 hour PIP, 90%, 90%, 100% and 100% was recorded from lower to higher concentration. LC₅₀ was calculated as 356.059 IJ/Larva at 24 hour, 21.230 IJ/Larva at 36 hour, 7.806 IJ/Larva at 48 hour and 5.741 IJ/ Larva at 60 hour PIP. No mortality was recorded in control group. A positive correlation was observed between nematode penetration and progeny production. The mean IJ production observed in *S. abbasi* CS39 was 101.5×10^3 and the range of IJ production was $(14 \times 10^3 - 168.7 \times 10^3)$. Study revealed that the present isolate of *S. abbasi* (isolate CS39) proved enough virulent and showed good reproductive potential against target insect pest. Trials on other insects both in *in vitro* and *in vivo* conditions need to be done so that it may be used in IPM in future.

Keywords: Entomopathogenic nematodes, pathogenicity, LC₅₀, *Steinernema abbasi*.

IN VIVO PRESERVATIVE POTENTIAL OF NEEM GILOY-TINOSPORA CORDIFOLIA(WILLD.) MIERS EX HOOK. F. AND THOMS LEAF ESSENTIAL OIL FOR PIGEON PEA [CAJANUS CAJAN (L.) MILLSP.] SEEDS

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The mycological analysis of stored seed of *Pigeon pea* [*Cajanus cajan* (L.) Millsp.] through agar plate as well as blotter paper methods of study revealed presence of 16 fungal species viz., *Alternaria alternata*, *Aspergillus candidus*, *Aspergillus flavus*, *A. niger*, *A. ochraceus*, *A. phoenicis*, *A. tamari*, *A. terreus*, *A. sydowi*, *Fusarium moniliforme*, *F. oxysporum*, *F. solani*, *P. glabrum*, *Rhizopus nigricans*, *Trichoderma viride* and *Trichothecium roseum*. Out of 20 essential oils extracted from leaf of plants and assessed for their antifungal potential only leaf oil of *Tinospora cordifolia*, (Willd.) Miers ex Hook. F. & Thoms exhibited absolute toxicity (100%) against dominant fungi *Aspergillus flavus*, *A. niger* at 400 ppm concentration. This showed fungicidal activity at 600 ppm. It showed MIC against 10 fungi at 500 ppm, controlled 15 fungi at 800 ppm. There was no ill effect of physical factors viz., temperature treatment up to 100° C, autoclaving at 15 lb/square inch pressure at 120° C and storage up to 120 days on activity of leaf oil. *In vivo* studies depict that oil of *T. cordifolia* as seed dressing agent and as a fumigant was able to preserve seeds of *Pigeon pea* up to 120 days separately in polyethylene containers with minimal changes in organoleptic behaviour during storage.

Keywords: *Pigeon pea*, *T. cordifolia* leaf oil, biodeterioration, neem giloy, synthetic fumigant

A REVIEW: POST HARVEST PHYSIOLOGY AND TECHNOLOGY IN LILIUM

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Lilium is one of the most important ornamental bulbous plant. It is mainly grown in cool moist conditions. In India, the entire chain of Himalayas including Jammu and Kashmir, Himachal Pradesh, Uttarakhand and North-Eastern states offer a tremendous potential for lily cultivation. Besides, it is also grown in the hilly areas of south India such as Nilgiri, Palney and Shevaroy hills. They have taken a fourth position in cut flower industry due to its attractiveness, diversity in forms, shape and color, high productivity, right season of bloom, and easy packing and transportation. Postharvest life of *Lilium* cut flowers is influenced by pre-harvest factors like varietal or species differences light intensity, sugar level of flowers, temperature and water loss. It is also affected by harvest factors such as time and stage of harvest and postharvest factors viz. ethylene production, precooling, pulsing, use of preservatives, packaging and storage. *Lilium* cv. Brindisi inflorescences were stored at 2.5 °C for 5–20 d, and then placed in water at 20 °C. Flower senescence was hastened after cold dry storage for more than 5–10 d. A sucrose pulse (100 g L⁻¹) prior to cold storage alleviated the effects of storage on tepal senescence and bud desiccation. Lily cv. Brindisi inflorescences are prone to chilling injury. Conditioning (24 h) with GA₃ (500 mg d.m.⁻³) immediately after harvest delayed chlorophyll loss in leaves. The standard preservative composed of 8HQC (200 mg·dm⁻³) and sucrose (20 g·dm⁻³) improved lily keeping qualities only in complete leafy inflorescences. Now-a-days, we increase the post harvest life by different preservatives, control temperature and reduce pre and post harvest factors etc;



EFFECT OF DIFFERENT HERBICIDES ON WEED DYNAMICS OF SEMIDRY RICE**K. Hemalatha and N.R. Sandhya**

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The experiment was conducted to study the effect of different herbicides on weed dynamics of semidry rice. The treatments consisted of ten different weed management practices viz., Weedy check, weed free check, Pendimethalin as pre-emergence, Orthosulfamuron as pre-emergence, Orthosulfamuron as post-emergence, Ethoxysulfuron as post-emergence, Metsulfuron methyl + Chlorimuron ethyl as post-emergence application, pendimethalin *fb* orthosulfomuron, pendimethalin *fb* ethoxysulfuron, pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl. The lowest total weed density among the herbicide treatments was registered with Orthosulfamuron as pre-emergence, pendimethalin *fb* orthosulfomuron and pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl which were on par with each other and weed free check. Significantly lower total dry weight of weeds and weed index was noticed with weed free check which was however, comparable with pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl at harvest. Pendimethalin *fb* metsulfuron methyl + chlorimuron ethyl registered the highest weed control efficiency which was comparable with weed free check. This might be due to the fact that the successive application of two herbicides at an interval of 20 days created an adverse environment for a fairly long period for the weeds to emerge and grow, which was comparable with weed free check.

Keywords: Herbicides, semidry rice, weed density, weed control efficiency, weed index.

EFFECT OF AMBIENT WEATHER ON POPULATION DYNAMICS OF MAJOR INSECT PESTS OF TAMARIND**Akhilesh Kumar, Manoj Kumar Painkra**

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The present investigation was conducted at Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur, Chhattisgarh during *kharif-rabi*, 2015–16 to saw the effect of different abiotic factor on major insect pests of tamarind. Three species of different insect pests viz. fruit borer, mealy bug, scale insect was recorded as a major pests. Maximum fruit borer infestation of 19.91 infested pods / unit area was recorded during second week of October. Peak population of mealy bugs was recorded during second week of October with 29.58 nymphs and adults / unit area. Two peaks of scale insects were observed, first in the fourth week of September followed by second week of November with 28.83 and 29.95 scale insects / unit area. Morning relative humidity around 95 per cent and evening relative humidity around 60 per cent were found congenial for the fruit borer multiplication on tamarind. Mealy bug and scale insects were also significantly positively influence with morning relative humidity.

Keywords: Abiotic factor, insect pests, population dynamics, peak population, tamarind.

EFFECT OF AM FUNGI ON THE GROWTH AND DEVELOPMENT OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER LEAD STRESS**Fariha Raghib, Fareed A. Khan, Mohd Irfan Naikoo**

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Arbuscular mycorrhizal fungi (AMF) can play important role in soil management and helps plants by stimulating the production of growth regulating substances under environmental stress conditions. The present work was designed to study the influence of AM fungi in improving growth, biochemical and physiological parameters in wheat under Lead (Pb) stress. The experiment was conducted in the sterilized earthen pots filled with soil and farmyard manure in a completely randomized block design arrangement with control, 50, 100, 150, and 200 mg Pb Kg⁻¹ soil, inoculated with or without AMF. Growth, biochemical and physiological characteristics were measured at 30 day growth stage. It was found that AMF inoculation improved the growth, biochemical and physiological parameters and reduced Pb toxicity in wheat.

Keywords: Lead, Wheat, AM Fungi, Toxicity, Growth, Physiology.

INFLUENCE OF ORGANIC FERTILIZERS ON PRODUCTIVITY AND MEDICINAL PROPERTIES OF ALOE VERA**Dinesh Kumar Marapi, Hemant Kumar Jangde and Saurabh Kumar**

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Aloevera is perennial succulents or xerophytes which one of the oldest plants known to the human mankind for its medicinal properties. Its, one of the species contain manapol which contain vitamin, amino acid, macro and micronutrients and polysaccharides which has an immunostimulant property. It also contain a rich source of saponins which is toxic on herbivores, detergent, and destroy pathogen membranes. It has insect repellent, anti fungal, anti viral and anti bacterial property. In India, Aloe veras traditionally grown and there is no regular practice of cultivation by improved agro techniques, particularly nutrient management. Aloe veras respond differentially under varying sources and amounts of organic fertilizers. Nutrient management through application of organic fertilizers in aloe vera field is one of the basic strategies for increasing of the yield of aloe vera. Organic fertilizers are considered to safe and yielding good produce by improving water penetration, water holding capacity, improvement in soil structure, microbial biomass, nutrient availability, drought and heat stress resistance as well as increased nutrient uptake, especially macro elements as compare to chemical fertilizer and its influences the medicinal quality. Thus, using of organic fertilizers (vermicompost mixed) substrate in breeding the aloe vera has an effective role in improving quality and quantity leaves and gel antioxidant properties. It also helps in improving the soil pH which has an impact on plant growth and soil microbial activity. Therefore,



complementary effect of organic fertilizers on medicinal properties and herbage yield of aloe vera as well as higher profit with sustainability manner in a long term without affects the surrounding ecology and environment.

Keywords: Organic fertilizers, Nutrient management, Yield and aloe vera.

COMPARATIVE EFFECT OF UN-IRRADIATED AND IRRADIATED CHITOSAN ON THE ESSENTIAL OIL AND CITRAL PRODUCTION IN *CYMOPOGON FLEXUOSUS* (STEUD.) WATS.

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Cymbopogon flexuosus (Steud.) Wats. (lemongrass) essential oil (EO) is highly valued for its aromatic and medicinal properties as it holds an important share among volatile oils traded worldwide and exhibits massive assortment in commercial and consumer utility. The last decade witnessed several experiments to test the ability of radiation-processed polysaccharides like sodium alginate, carrageenan and chitosan as a plant growth elicitor. Keeping this in mind, a pot experiment was carried out to study the comparative effect of different concentrations of un-irradiated chitosan (UCH-40, 60, 80, 100 mg L⁻¹) and irradiated chitosan (ICH-40, 60, 80, 100 mg L⁻¹) along with the control. Biochemical parameters were analyzed spectrophotometrically. Chlorophyll fluorescence (F_v/F_m) was measured using Pulse-Amplitude Modulated Chlorophyll Fluorometer. The EO was extracted using Clevenger's apparatus and was analyzed using Gas Chromatography. Foliar application of varying doses of ICH (ICH-80 mg L⁻¹) in comparison to UCH on lemongrass manifested noteworthy outcome and showed significant enhancement in F_v/F_m , activities of nitrate reductase and carbonic anhydrase, EO content and yield. Further, there was a significant improvement in citral content and yield due to ICH application, compared with the control and UCH. Thus, this technique can be effectively used for the economical production of EO and citral in lemongrass.

Keywords: Chitosan, Essential oil, Citral, Lemongrass, Chlorophyll fluorescence.

INFLUENCE OF DIFFERENT HARVESTING TIMES ON POST-HARVEST QUALITY OF GARLIC DURING STORAGE

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The pre-harvest inputs influence the storage behaviour and quality of garlic directly or indirectly. The garlic crop is less perishable and also has better storage life than other vegetables but various cultural practices like choice of variety, soil type, irrigation frequency, fertilizer application, harvesting stage, etc. affects the shelf life of garlic. As early or delay in harvesting could increase post-harvest losses and deteriorates the quality during storage, therefore the investigation was done at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *rabi* 2013-14 to observe the influence of different time of harvesting on quality of garlic during storage (*Allium sativum* L.). The experiment was laid out in Randomized Block Design with four replications. Five treatments of harvesting time viz., harvesting the garlic crop 150, 157, 164, 171 and 178 days after planting were applied. The total soluble solids (%) were recorded at monthly interval during 240 days of storage. The total soluble solids at the end of storage period i.e. 240 days were found better (40.11 %) with treatment where harvesting was done 171 days after planting, which was found statistically at par with treatment where harvesting was done 164 days after planting (39.78 %). The minimum total soluble solids (35.13 %) at 240 days of storage were recorded with treatment where harvesting was done at 150 days after planting. Therefore, based on the present investigation, it may be conclude that for better quality of garlic, harvesting should done 164 days after planting.

Keywords: Garlic, bulb, harvesting time, quality, total soluble solids

EFFECT OF TYPES OF MULCH AND AMMONIUM MOLYBDATE SPRAY ON ABIOTIC STRESSES AND YIELD OF CAPSICUM CV. CALIFORNIA WONDER UNDER COLD ARID CONDITIONS OF KARGIL.

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Field experiments were carried out to study the effect of three mulches (black polythene, transparent polythene and saw dust) and three concentrations of ammonium molybdate (0.25%, 0.50% and 0.75%) on growth and yield of capsicum cv. California Wonder at Regional Agricultural Research Sub-Station Kargil, SKUAST Kashmir during 2007 and 2008. The experiment was laid out in split plot design with three replications. Results revealed that black polythene was superior in smothering of weeds and conservation of moisture thereby improving the microclimate for improving the growth of capsicum plants. The analysis of data of both the years revealed that application of 0.5% ammonium molybdate sprayed at 40 days after transplanting to plot with black polythene mulch significantly influenced the growth and yield of capsicum and also gave maximum benefit cost ratio with highest net return.

Keywords: Mulch, ammonium molybdate, capsicum, Kargil.

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Keywords: Mulch, ammonium molybdate, capsicum, Kargil.

STUDIES ON CHARACTERIZATION OF GUM GUAR GENOTYPES FOR SEED QUALITY PARAMETERS

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Field experiment was carried out during *khari*, 2015-16 to study the characterization of gum guar genotypes for seed quality parameters at Dry land farm, on sandy loam soils of Sri Venkateswara Agricultural College, Tirupati. The experiment was layout in randomized block design with ten treatments and three replications. Ten treatments consist of ten genotypes of guar. The results revealed that there was a significant difference between the varieties for total carbohydrate content. Phenotypic variability for total carbohydrate content among genotypes ranged from 32.09 to 39 per cent. RGC-1003 (39%) recorded highest total carbohydrate content followed by RGC-986 (38.08%) whereas GA2G-0503 (32.09%) recorded lowest total carbohydrate content followed by RGC-936-1 (32.1%).

Genotypic variability for protein content among genotypes ranged from 29.23 to 34.62 per cent. Among the genotypes significant variability for protein content was observed. RGC-986 (34.62%) recorded highest protein content followed by RGC-1003 (32.68%) whereas GA2G-0503 (29.23%) recorded lowest protein content followed by RGC-936-1 (30.04%). Variability for total free amino acids among genotypes ranged from 1.89 to 2.23 mg g⁻¹. Among the genotypes significant variability for total free amino acid was observed. GAUG-4703-1 (2.23 mg g⁻¹) recorded highest total free amino acid followed by RGC-13-4 (2.2 mg g⁻¹) whereas RGC-936-1 (1.89 mg g⁻¹) recorded lowest total free amino acid followed by RGC-936 (1.95 mg g⁻¹). RGC-936-1 have lowest content of total carbohydrates content, protein content and total free amino acids in seeds.

Keywords: Guar, carbohydrate content, protein content and total free amino acids

EFFECT OF FYM AND GYPSUM ON SEED PRODUCTION IN CARROT IRRIGATED WITH HIGH RSC WATER

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The present study entitled, "Effect of high RSC water, FYM and gypsum on seed production in carrot (*Daucus carota* L.)" was conducted at Research Farm, Department of vegetable science, CCS Haryana Agricultural University, Hisar over a period of two years (2015-16 and 2016-17). The cultivar used for the investigation was Hisar Garic. The treatments comprising three levels of FYM (0, 10 and 20 t/ha) and gypsum (0, 50 and 100% neutralization of RSC) and its combinations were laid out in a factorial randomized block design with three replications keeping a net plot size of 3.0 x 3.0 m. The data were recorded on various parameters, which were influenced by different levels of FYM and gypsum. The maximum seed yield (5.49 q/ha), highest net Rs. (203960.00) return and benefit:cost (1:3.84) ratio was recorded in combination of FYM at 20 t/ha and 100% neutralization (F₂G₂) of RSC by gypsum while the minimum seed yield (1.31 q/ha), lowest net return Rs. (35190.00) and benefit:cost (1:2.27) in control (F₀G₀) treatment where no FYM and gypsum was applied. The various seed quality parameters were also recorded maximum with F₂G₂ treatment and minimum with F₀G₀ treatment. The results suggested that the combination of FYM at 20 t/ha and 100% neutralization of RSC by gypsum has shown the best economical treatment in carrot for higher seed yield at commercial scale under semi-arid condition of Hisar (Haryana).

Keywords: Farm yard manure, Gypsum, Carrot, RSC water, Economics and Seed yield

THE EFFECT OF DIFFERENT SOIL AMENDMENTS ON GROWTH OF MUNG BEAN (VIGNA RADIATA L.) IN COAL MINE OVERBURDEN DUMPS

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The surface mining activities in the past and in recent times has resulted into existence of number of overburden dumps through excavation and depositing removed soil and rock debris. These dumps require environmental stabilization/restoration, through proper revegetation. To achieve this aim, a study was conducted to find the efficacy of Mung bean (*Vigna radiata* L.), an economically important leguminous crop plant, for revegetation. The objective of the present study was to evaluate the effect of different soil amendments such as chemical fertilizer,



biocompost, vermicompost, bio-fertilizer and fly-ash in appropriate combination to support vegetation. The physicochemical parameters of the overburden soil sample at the time of experiment and after the harvesting have been analyzed. Plant growth in terms of different parameters was measured. The experimental results indicated that all the combinations were significantly increase plant growth and soil fertility. No significant differences were observed among the combinations. The appropriate combinations would be conducive for greater nutrient uptake by the crop and also would improve the soil health and soil fertility status. According to the finding of this research and regarding economic matters and environmental anxieties, it may be recommended that the appropriate proportion of chemical fertilizer, organic fertilizer, vermicompost, bio-fertilizer and fly ash can be used as a soil amendment and Mung bean (*Vigna radiata* L.) can be used in revegetation of coal mine dumps.

Keywords: bio-efficacy, bio-fertilizer, overburden dumps, re-vegetation, vermicompost, *Vigna radiata*

EFFECT OF TWO SPECIES OF CYANOBACTERIA AS BIOFERTILIZERS ON SOME METABOLIC ACTIVITIES, GROWTH, AND YIELD OF PEA PLANT

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Two cyanobacterial species (*Nostoc entophyllum* and *Oscillatoria angustissima*) were tested as biofertilizers, substituting the normally used chemical fertilizer, for pea plant. Inoculation of soil with a suspension of each species or a combination of the two species significantly increased the germination percentage and stimulated the other measured growth parameters and photosynthetic pigment fractions of pea. However, the soil inoculation with one cyanobacterial species and the addition of the recommended dose or half the recommended dose of chemical fertilizer were usually more effective and also increased carbohydrate and protein contents of produced pea seeds. However, biofertilization combined with half the recommended dose of the chemical fertilizer was usually more effective than the addition of the full rate of the chemical fertilizer, and this may allow saving 50% of the used chemical fertilizer. The protein profile of the produced seeds showed appearance and disappearance of some protein bands in response to fertilization treatments compared to the control. Blue green algae analyses show that *N. entophyllum* fixed more N, produced more exopolysaccharide, and contained more auxin and cytokinin than *O. angustissima*, the latter contained more gibberellins. These data may explain their different influences on growth and yield of pea.

Keywords: Cyanobacteria Biofertilizers Plant growth Pea Phytohormones

EFFECT OF NITROGEN AND PHOSPHORUS ON GROWTH, FLOWERING AND YIELD OF ROSE IN POLYHOUSE CONDITIONS IN WESTERN UP

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An field trial were conducted at nearby vill -pinna in polyhouse under supervision of Dept . Of horticulture C.C.R. (P.G.) College, Muzaffarnagar. During the year July 2016 to January to study the effect of nitrogen and phosphors on growth, flowering and yield of Rose growth under polyhouse conditions. The result revealed that, the superior plant height was observed with an application of 50g nitrogen along with 40g phosphorus per sq meter where as fresh and dry weight of Bud and flower per plant and per bud were recorded maximum in application of 40g nitrogen along with 30g phosphorus per sq meter

Keywords: Rose, nitrogen, phosphorus, polyhouse

EFFECT OF SPECIALITY FERTILIZERS ON GROWTH AND OF NUTRIENT FERTILITY OF COTTON

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A field experiment was conducted in the year 2011-2012 to study on effect of speciality fertilizers on growth, yield and quality of cotton. The experiment was laid out in Randomized Block Design, with ten treatments and replicated trice. The soil and plant samples were collected at various stages of plant growth. The result obtained in the study indicated that the physico chemical properties viz., EC, OC, CaCO₃ in soil did not vary significantly during different nutrient combination treatments, while pH of soil affected significantly at harvest stage. The nutrient combination of 100 % RDF + two spray of starter and booster showed maximum height, number of leaves, LAI. Treatment T₅ (100% RDF + two spray of starter and booster) showed higher availability of N, P and K throughout the growing period of crop. The treatment combination 100% RDF + Grade II noticed maximum availability of micronutrients (Zn, Fe, Mn and Cu).

EFFECT OF SULPHUR NUTRITION ON QUALITY PARAMETERS OF GARDEN PEA (*PISUM SATIVUM* L.) VARIETIES

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The effect of sulphur nutrition on quality of garden pea (*Pisum sativum* L.) varieties was carried out during *kharif* 2016-17 at Horticulture Unit, University of Agricultural Science, Dharwad. The experiment was laid out in split plot design with three replication involving twelve treatments. The experiment consisted four varieties of garden pea viz., AP-3 (V_1), PSM-3 (V_2), GS-10 (V_3) and Arkel (V_4) along with three levels of sulphur i.e., without sulphur (S_0), sulphur at 10 kg ha⁻¹ (S_1) and sulphur at 20 kg ha⁻¹ (S_2) through gypsum. Among the levels of sulphur nutrition to garden pea, the application of 20 kg ha⁻¹ sulphur (S_2) recorded significantly higher protein (22.14 %), TSS (17.19 °B), vitamin C (26.11 mg/100g) and carbohydrate (15.69 %) followed by application of sulphur at 10 kg ha⁻¹. Among the varieties studied, the variety AP-3 (V_1) recorded significantly higher protein content (22.23 %), TSS (17.78 °B), vitamin C (25.62 mg/100 g) and carbohydrate (15.83 %) followed by variety PSM-3 (V_2). Considering the interaction effect, variety AP-3 along with 20 kg ha⁻¹ sulphur nutrition (V_1S_2) recorded significantly higher protein (23.17 %) but non significant on TSS (17.75 °B), vitamin C (26.43 mg/100 g) and carbohydrate (16.25 %). For getting good quality of garden pea the combination of AP-3 variety with 20 kg ha⁻¹ sulphur nutrition can be recommended for cultivation.

EFFECT OF SPACING AND NUTRIENTS MANAGEMENT ON GROWTH AND YIELD ATTRIBUTES IN *HIRSUTUM* COTTON IN CENTRAL PLAIN ZONE OF U.P.

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Cotton is the back born of textile industry. A field experiment was conducted, with *hirsutum* cotton genotype H-1300 during *Kharif* season to study the effect of spacing and nutrient management system on growth, yield attributes, yield, quality and economics. The treatment combinations comprising with T_1 - Control without fertilizer + normal spacing (67.5*30 cm), T_2 - 100% RDF + normal Spacing, T_3 - 100% RDF + 25% less than normal spacing, T_4 - 125% RDF + 25% less than normal spacing, T_5 - 125% RDF + 25% less than normal spacing + soil application of ZnSO₄, T_6 - 125% RDF + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP, T_7 - 125% RDF + 25% less than normal spacing + foliar spray of MgSO₄ and ZnSO₄. 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, number of monopodia and sympodia, fresh and dry weight/plant, yield attributes viz., number of bolls/m², number of bolls/plant and boll weight, yield, quality characters viz., ginning out turn, span length, uniformity ratio and fibre strength it was closely followed by 125% RDF + 25% less than normal spacing + foliar spray of MgSO₄ and ZnSO₄. 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.

EFFECT OF FERTIGATION AND RESIDUE MANAGEMENT ON PERFORMANCE OF DIRECT SEEDED RICE AND SOIL HEALTH IN RICE - WHEAT ROTATION

Robin kumar, Vivak kumar and Ashish Driwedi

Since systematic studies have been conducted on field crops especially on rice and wheat and considering the problem associated with the flood irrigation and importance of residue incorporation for sustainability of rice-wheat system and soil health particularly in puddled condition, the present investigation was carried during *kharif* 2012 and 2013 to study the effect of fertigation and residue management on soil health and performance of direct seeded rice in rice - wheat rotation. Ten treatments consisting fertigation (5) and residue management (2) were tested in a split plot design with three replication considering irrigation techniques as a main plot and residue management sub plot. The soil of experimental field was alkaline in reaction with 0.33 percent organic carbon, 180 kg ha⁻¹ available nitrogen and 47 kg ha⁻¹ available phosphorous and 346 kg ha⁻¹ potassium. Hybrid rice variety Arize 6129 was sown as a test crop. Data were recorded for growth, yield, plant were analyzed for N,P,K to workout uptake and some chemical, physical and biological properties were determined. Available data were subjected to statistical analysis on which basis treatments effect were explained. Results reveal that grain, straw, N and K content was significantly higher with drip fertigation while no effect was found in case of grain P content. Periodic availability of N and K was significantly higher with drip fertigation than the other combination. However, P availability remained unaffected during both the years. Soil reaction, salt concentration also remained unaffected during both the years. Measured physical properties after rice harvest viz bulk density at various depths and infiltration also remained unaffected due to different combination. A significant interaction effect of fertigation and residue management on grain yield of rice was found. Significantly higher water use efficiency than the remaining combinations were found with drip fertigation. Water use efficiency was lowest with flood RDF. Grain and straw yield, grain and straw nutrient content and availability of nutrients in soil. Infiltration rate, bulk density and water use efficiency increased significantly with residue incorporation while soil reaction and salt content remained unaffected. The net return and benefit cost ratio was higher with drip fertigation. The study reveal that drip irrigation coupled with fertilizer application could be option of precise nutrient and water management of direct seeded rice since it yielded more with higher benefit cost ratio.

POPULATION DYNAMICS OF MITE (*POLYPHAGOTARSONEMUS LATUS* BANK) AND CORRELATION WITH WEATHER PARAMETERS ON PROCESSING VARIETIES OF POTATO*

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Potato is a major non-cereal food crop consumed by more than a billion people in the World. India is the 2nd largest producer of potatoes and over the years potato has become a source of energy and food especially in the developing countries. Pests are the major constraints in achieving full yield potential in food crops. Amongst them, mite (*Polyphagotarsonemus latus* Banks) causes severe damage to early planted potato crop. Nymphs and adults of mite suck the plant sap from apical leaves which roll and bend with consequent arrest of growth. *Polyphagotarsonemus latus* Banks commonly known as broad mite, tarsonemid mite, tropical mite and yellow tea mite has a cosmopolitan distribution. The field experiments were carried out at Central Potato Research Institute Campus, Modipuram for two years to record the population of mite (*Polyphagotarsonemus latus* Banks) on processing varieties of potato and its correlation with weather parameters. Early crop of potato planted in September was affected the most whereas the main crop planted in October and spring crop planted in December did not show any mite symptom. A distinct varietal difference was observed in appearance and buildup of mite. The incidence of mite was found to be influenced by abiotic factors. Multiple regression equation based on temperature, relative humidity, wind velocity and sunshine period could explain mite population ranging from 98-99 per cent.

Keywords: *Polyphagotarsonemus latus*, mite, potato, weather parameters, buildup

BIOCHAR APPLICATION FOR SUSTAINABILITY OF SOIL HEALTH AND PRODUCTIVITY

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Soil organic matter is one of the most important factor for soil physical, chemical and biological health of soil. Crop residues are produced in huge amount in India (approx. 500 million t annually). Conversion of crop residues into biochar and its use in agriculture can increase organic carbon content and improve soil quality. The best method of biochar application is mixing of biochar with composts and manures and incorporating the mixture into top soil. Biochar has potential to increase nutrient retention, cation exchange capacity, fertilizer use efficiency, improve soil structure. Biochar has also been used to raise the pH of soil and reducing the lime requirements. Biochar increases soil microporosity thus provides a suitable habitat for microorganisms. In addition it also meets their energy and mineral requirements. Most studies have shown positive effect of biochar on crop yield also. Soil conditions and quality of biochar applied i.e. the plant type to produce it, affect the results in terms of influence on crop yield and soil properties. However, biochar application is more effective than its equivalent crop residues due to its resistance to decomposition by microbe and more persistence of carbon present in it.

Keywords: Biochar, soil pH, soil biological properties

ROLE OF PLANT HORMONES ON VEGETATIVE GROWTH OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

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A field trial on the effect of different plant growth regulators viz., GA₃, NAA and 2,4-D was conducted on tomato cv. Azad T-6 during the *rabi* season of 2014-15. The different concentration of GA₃ (10, 20 and 30 ppm), NAA (20, 25 and 30 ppm) and 2,4-D (5, 10 and 15 ppm) were sprayed on the crop to study the vegetative growth behaviour attributes of tomato. It was found that there was a linear increase in growth parameters like plant height and number of branches per plant with increasing level of GA₃ and NAA. The maximum plant height was recorded as 99.03 cm and 85.47 cm with the application of GA₃ @ 30 ppm and NAA @ 30 ppm, respectively at the time of harvesting. Similarly, the other growth attributes were also affected significantly with increasing concentrations of GA₃, NAA and 2,4-D.

Keywords : *Lycopersicon*, GA₃, NAA, 2,4-D, growth attributes, concentrations, Azad T-6.

EFFECT OF LOW DOSES OF DIFFERENT FORMS OF SELENIUM ON BIOCHEMICAL AND ANTIOXIDANT SYSTEM OF TRACHYSpermum AMMI UNDER MELOIDOGYNE INCOGNITA STRESS AND PSEUDOMONAS FLUORESCENS

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Greenhouse experiment was carried out to provide insight into the effect of low doses of different forms of selenium viz; selenium solanite, selenium selenate and selenium nanoparticles induced changes in *Trachyspermum ammi*, inoculated with *Meloidogyne incognita* and *Pseudomonas fluorescens*. The data from the results revealed that application of selenium nanoparticles in the plant infected with *Meloidogyne incognita* and *Pseudomonas fluorescens* caused significant increase in both plant growth as well as physiological parameters, in comparison to nematode inoculated plants; the values were at par with the values observed in healthy plants. Higher concentrations were found to produce inhibitory effects from which it was inferred that the responses were concentration dependent. Colonization of *P. fluorescens* in the rhizospheric environment of *T. ammi* was also increased with reduced nematode infestation and number of galls at low concentration of selenium nanoparticles, together with inoculation of *M. incognita* and *P. fluorescens*.

Key words; Selenium, *Trachyspermum ammi*, *Meloidogyne incognita*, Biochemical.



SUSPENDED SEDIMENT LOAD MODELING USING SOFT COMPUTING BASED MODEL FOR PATHAGUDEM AND POLAVARAM SITES OF GODAVARI BASIN**Ashish Kumar^{1*}, Vijay Kumar Singh², Bhagwat Saran³ and Sachin Kumar Singh⁴**^{1, 2,3,4} Department of soil and water conservation engineering, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, INDIA

The accurate prediction of sediment outflow from the field is desired for better planning and utilization of soil and water resources in various fields like as water storage structure, irrigation, conservation of soil, aquatic life, water quality etc. In present study, predict of sediment load at Polavaram and Pathagudem sites of the Godavari basin in India using artificial neural network (ANN) and Adaptive neuro-fuzzy inference system (ANFIS) was carried out. For both techniques different combinations of model architecture were trained to select the most accurate model architecture for prediction of sediment load for both sites. The selection of the appropriate input parameters, gamma test (GT) was used and on the basis of minimum values of gamma, standard error and v-ratio, input variables were selected to train the model for sediment prediction. It was obtained from results of ANN and ANFIS model, that the ANFIS (Triangular-3) model architecture performed better than rest of the ANN and ANFIS models for the Pathagudem site. While for the Polavaram site, it was acquired that the ANFIS (Gauss-3) model architecture performed better than other ANN and ANFIS models. To acquire the information about effect of input parameter on the sediment outflow, sensitivity analysis for the both sites was carried out and it was showed that the current day runoff is the most influent parameter for the prediction of sediment outflow at Pathagudem and Polavaram sites.

Keywords: Gamma test, Triangular, Trapezoidal, Gaussian and Generalized bell membership function, Sensitivity analysis

PANCHGAVYA AN ESSENTIAL TOOL OF ORGANIC FARMING**Rahul Sah*, Sharvan Kumar*, Dheeraj Yadav and Satish Yadav***

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Panchgavya is an organic formulation prepared by mixing five product of cow .The three direct constituent are cow dung, urine, and milk, the two derived product are curd, ghee and other ingredient. *Panchgavya* is a Sanskrit word blend *Panch* means five and *gavya* means cow; hence the name of *Panchgavya*. It is a mixed culture of naturally occurring, beneficial microbes, lactic acid, bacteria (lactobacillus), yeast (saccharomyces), actinomyces (streptomyces), photosynthetic bacteria (Rodopseudomonas) and certain fungi (Aspergillus) which promotes the growth and yield and different crops. Component are used for making *Panchgavya* is fresh cow dung (7kg), cow urine (3litter), cow milk (2litter), cow curd (1kg), cow ghee (1kg), sugarcane juice (3litter) or 500g jaggery, tender coconut water (3litter), ripped banana (12 no.), 100g yeast+100g dissolve in two litter of warm water. For the preparation of *Panchgavya* taken a wide mouthed mud pot and first put fresh cow dung and ghee into the pot and mixed it throuly for three days. On the fourth day add rest of the ingredients and stir it twice daily for 15 days. Stock solution of *Panchgavya* will be ready after 28th day. It should be kept in the shade and covered with wire mesh or plastic mesh net to prevent solution from houseflies laying eggs and formation of maggots (worms) in the solution. Physio -chemical studies revealed that *Panchgavya* possess almost all macro, micronutrients and growth hormones (IAA, GA) required for plant growth. Predominance of fermentative microorganism like yeast and Lacto bacillus are due to combined effect of low pH milk products and adding of jaggery/sugarcane juice as substrate from their growth. In general 3-4% solution of *Panchgavya* has been found effective for most of the vegetable crops. This solution can be mixed with irrigation water @ 50 per hectare either through drip or flow irrigation. This solution is also used to treat the seeds, seedlings or other plants part before sowing/planting. The main object of balanced the eco-logical, soil health, soil fertility and free from chemical substances. It is cheapest source of nutrients for Indian growers.

BREEDING FOR BROWN PLANTHOPPER (NILAPARVATA LUGENS STÄL.) RESISTANCE: A SUSTAINABLE APPROACH FOR RICE IMPROVEMENT**Shoukat Ahmad Rather, Indra Deo and Neha Joshi**

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Brown planthopper (BPH) is one of the serious insect pests causing severe damage to rice crop, either directly through sucking of sap from the phloem or transmitting important viral diseases (ragged and grassy stunt viruses). In order to develop a sustainable insect pest management system, there is a need to find correct balance among breeding and management strategies to keep the pest population under economic threshold levels. Conventional procedures to reduce BPH damage including the use of chemical insecticides are costly, ineffective under some weather conditions and the chemicals can kill BPH predators. Host plant resistance is the most valuable, environment friendly and sustainable approach to prevent the losses caused by BPH. Therefore, it is imperative to recognize BPH resistance genes from diverse sources and integrate them into rice cultivars. The authors investigated 44 advanced breeding lines and eight stable lines of rice to identify the resistance sources against Pantnagar biotype of BPH. The findings revealed that MRST 3 and PHS 29 were resistant, whereas, TN 1 and Pusa Basmati 1 were found to be susceptible. Different F₁s produced by crossing BPH susceptible and resistant genotypes were advanced to F₂, F₃ and backcross generations. Upon phenotypic evaluation of F₂ and backcross generations of these crosses, the genetic segregation of resistant and susceptible plants was subjected to goodness of fit and it was found that BPH resistance in PHS 29 and MRST 3 was governed by one and two recessive genes, respectively. The generation mean analysis using Hayman's five and six parameter models indicated that BPH resistance in PHS 29 and MRST 3 donors is governed by additive and dominance gene action, respectively. These results indicate that selection for BPH resistance may be effective in case of segregating generations derived from crosses using PHS 29 as one of the parents.



STUDIES ON GENETIC VARIABILITY FOR QUANTITATIVE CHARACTERS IN GARLIC (*ALLIUM SATIVUM* L.)

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Garlic (*Allium sativum* L.) is one of the most important remunerative bulbous vegetable grown after onion. The present investigation was conducted to assess the genetic variability among 25 garlic genotypes collected from different area/institutes during rabi season (2014-2015). At morphological level, ANOVA showed significant variation for all traits indicating greater variability in germplasm. High estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for number of dry leaves per plant, number of green leaves per plant, pseudostem height, weight of single clove, bulb yield, weight of bulb, number of cloves per bulb, and phenotypic coefficient of variation (PCV) were higher in extent than genotypic coefficient of variation (GCV). High heritability were obtained for all traits (>60%). High heritability coupled with high genetic advance was recorded for plant height. Based on correlation coefficients, bulb yield showed positive and significant association with length of longest leaf, width of longest leaf, number of green leaves per plant, pseudostem height, bulb diameter, bulb weight, weight of clove and days to maturity. Path analysis revealed that highest positive effect on bulb yield was noted by bulb weight followed by days to maturity, number of green leaves per plant and plant height. Mahalanobis D^2 analysis revealed considerable amount of diversity in the germplasm. The genotypes were grouped into six clusters. Cluster VI (07), Cluster I (07) followed by Cluster IV (06) constituted maximum number of genotypes. The maximum inter cluster D^2 value (1142.147) was recorded between cluster V and III and the minimum average inter cluster D^2 value (87.991) was recorded between cluster VI and IV. The intra cluster distance were found 33.461 for cluster VI, 42.543 for cluster III, 46.325 for cluster II, 61.434 for cluster IV, 75.488 for cluster I, 113.877 for cluster V. Suggesting that the genotypes constituted in these clusters may be used as parents for future hybridization programme. Traits like clove weight and bulb weight per plant were the major contributors to genetic divergence.

IMPROVED PRACTICES OF BROCCOLI UNDER SUSTAINABLY MANAGED SOIL OF PUNJAB

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Broccoli is a vegetable from Brassicaceae family generally grown in Rabi season. It is a Cole crop which fetch good market price and enrich with various types of nutrients, vitamins and antioxidants. In India it is generally grown in region with temperature requirement of 10-25 degree Celsius. When considering Punjab region, few varieties were grown here among them Fiesta is one of the most popularly grown by maximum of farmers of Punjab. In a survey, it was noticed that few major constraints of Broccoli cultivation faced by growers were inadequate yield, head size, lack of improved cultivation practices and absence of suitable cultivar in Punjab, India. Therefore to know the reason of variability in productivity of same variety under different field condition of farmers- our aim was to study Fiesta variety of *Brassica oleracea* var. *italica* under different treatments in field to optimize the proper dosage of nutrients. It was studied along with the acknowledgement of maintaining sustainability by using various agro practices during the growth period of the crop in Punjab for sustainable increase of yield in Broccoli. Under this, Fiesta cultivar of *Brassica oleracea* var. *italica* were grown under chemically managed and organically managed condition and compared with control. The growing condition of soil is sandy loam in nature with moderate range of N, P, and K in soil which is suitable for normal plant growth. Results of vegetative growth and yield per plot were established of same cultivar. Our result suggested significantly more yield percentage on organically managed plot than inorganically managed plot. Study suggested sustainable and improved package and practice of *Brassica oleracea* var. *italica* causing selected cultivar Fiesta which may be potentially benefitted to local Broccoli growers.

KEYWORDS: Organic and Inorganically managed, Sustainability, Fiesta

GENETIC VARIABILITY FOR YIELD AND YIELD ASSOCIATED TRAITS IN F_2 SEGREGATING POPULATIONS OF RICE

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The investigation was carried out with 200 lines of F_2 segregating generation of Rice in RCBD design with three replications in kharif 2016. The analysis of variation revealed significant differences in the genotypes for all the characters studied. Per se performance of the progenies revealed that F_2 progenies derived from the crosses Danteswari $\times$ CANP549-5, NPT13-01 $\times$ CANP318-8, and JR 201 $\times$ CANP 212 -1 were promising in respect of grain yield and its components. High GCV and PCV exhibited by flag leaf width followed by panicle index, grain yield/plant, number of tillers/plant, panicle weight/plant. High heritability was observed in panicle weight/plant followed by thousand grain weight, spikelet density, days to flowering, days to maturity. flag leaf width and thousand grain weight showed maximum genetic advance as percentage of mean followed by stem thickness, flag leaf length, grain yield/plant, spikelet density, number of productive panicles/plant, number of tillers/plant, number of productive tillers/plant, panicle weight/plant, fertile spikelets/plant, stem length, number of spikelets/plants, biological yield. Grain yield has high co-heritable with flag leaf length, spikelet density, decorticated grain length and thousand grain weight. Grain yield/plant possessed significant positive correlation panicle index, biological yield/plant, number of tillers/plant, number of productive tillers/plant, number of panicles/plant, harvest index while it had significant negative correlation with days to 50% flowering, decorticated grain breadth and thousand grain weight. Panicle weight/plant imparted maximum direct effect on grain yield followed by panicle index biological yield/plant, number of tillers/plant.

Keywords: Genetic variability, heritability, co-heritability, genetic advance, direct effect



STAY GREEN : AN INDICATOR TRAIT FOR HEAT TOLERANCE IN WHEAT (*TRITICUM AESTIVUM* L.)**P. Thakur^{*1}, Namrata¹, Om Prakash¹, B. Loitongbam¹, R. Prasad¹ and L.C. Prasad¹**

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Wheat is the most widely grown crop worldwide. In this era of climate change wheat production is threaten by many abiotic and biotic stresses, heat and drought stress being the most devastating abiotic stress. Early maturing and stay green are two such traits which are dependent on the crop growth duration. An early maturing variety escapes the terminal heat stress but, the studies have shown that long duration variety yield more than early maturing one. Hence the varieties which can stay green even at heat and drought stress condition by altering its physiology and morphology needs to be exploited for development of stress tolerant varieties. These types of selection and exploitation are still awaited in wheat cultivars. Stay green is classified into two classes , functional stay green : in which leaves photosynthesize longer contributing to higher yield and non-functional stay green : in which plants remain green but lack photosynthetic competence. The stay-green trait is the result of alterations in hormone metabolism and signalling, particularly affecting pathways involving cytokinins and ethylene. Members of the WRKY and NAC families, and other senescence-associated transcription factors result in stay-green. Along with yield, association of stay-green trait with other traits like Canopy Temperature Depression, spot blotch resistance *etc.* have also been reported. Stay green trait can be measured by various methods like Leaf Area under Decline (LAUD), Normalized difference vegetative index (NDVI)/ Spectral reflectance measurement, leaf area under greenness (LAUG). *etc.* QTLs for stay green on the chromosomes 1AS, 3BS and 7DS have been reported. The QTLs were named as QSg.bhu-1A, QSg.bhu-3B and QSg.bhu-7D. The QTL QSg.bhu-3B and QSg.bhu-7D were placed in the 3BS9-0.57-0.78 and 7DS5-0.36-0.61 deletion bins, respectively. All the above studies show that stay green trait can be exploited to develop heat tolerant wheat cultivars in the near future.

Keywords: *stay green, heat stress, QTL, Triticum aestivum***UNFAVORABLE EFFECT OF INTENSIVE CHEMICAL FERTILIZERS ON SOIL AND HUMAN HEALTH IN CURRENT CHANGING CLIMATIC CONDITIONS****¹Sunil Kumar, ²Surendra Singh Jatav, ²Radheshyam Jangir and ¹Tarun Verma**¹Department of Agronomy ²Department of Soil Science and Agriculture Chemistry,
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During the last two decades fertilizers have develop into indispensable for supplying the required food for increasing populations. Between 1950 and 1970 world fertilizer utilization has increased fourfold and it is probable that this upward tendency will continue and causes the possible side effects of severe fertilizer use on the environment. Considering the significance of applied plant nutrients in stepping up agricultural production it is imperative that any conclusions on the relationships between intensive fertilizers apply and the quality of the environment be pinched on the basis of fact. Expert recommendation was sought from countries where fertilizer consumption is relatively towering since it is certain that any ill-effects will first emerge in areas where fertilizers are intensively applied. Information was also obtained from research carried out by the nitrogen, phosphate and potassium fertilizer industries. These indicate that the sound effects of intensive fertilizer exercise on the environment are mainly positive. Where negative effects were observed, they were mostly due to inappropriate use of fertilizer which could be corrected by rational soil management practices. In this respect it was noted that the amounts of fertilizers used at present in developing countries are still very low and that local excesses in some of the industrialized countries should in no way prejudice the intensification of agricultural production in the developing world. The contacts established with investigate organizations will be maintained so that the most up-to-date information on effects of fertilizer use on the environment can be made to serve agricultural development.

Key words :- Fertilizer, Health, Soil, Environment**PRE-HARVEST POLYAMINE TREATMENTS MODULATE FLOWERING AND FRUIT DROP PATTERNS IN LITCHI (*LITCHI CHINENSIS* SONN.)****Swati Sharma*, S.K. Singh, S.D. Pandey, Alemwati Pongener, S.K. Purbey and Vishal Nath**

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The ubiquitous presence of polyamines in all living organisms and important role in numerous biological processes *viz.* flower initiation, growth of floral buds, organ development, fruit set, fruit drop, ripening, quality and yield among others, promoted us to study its influence on flowering, fruit set and fruit drop patterns of litchi. Putrescine and spermine (0.5 and 1.0 mM) sprays on Shahi and China litchi cultivars at three stages; 30 days before anthesis, full bloom and pea size fruit were done. The preliminary results illustrated that initial fruit set was higher in treated compared to control panicles. Fruit drop patterns were noted and it was found that all the treatments were effective in reducing the fruit drop rates over the panicles in control trees. The results illustrated no significant difference among putrescine and spermine treatments or their doses on the modulation of flowering characteristics or fruit set behaviour. However, all the treatments showed higher fruit retention in comparison to untreated panicles. The panicle length was observed between 29 – 47 cm. Moderate fruit set was recorded in all the trees whether treated or control.



DESCRIPTION OF THE BACTERIOVORUS NEMATODE *CURVIDITISMICROSPICULA* SP. N. (NEMATODA: RHABDITIDA)**Shikha Ahalavat & Qudsia Tahseen**

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Curviditismicrospicula sp. n. is characterised by a medium-sized body; double, finely striated, punctated cuticle; slightly raised labial papillae; stoma with anisomorphic metastegostom; presence of epiptygma; slightly protruded vulval lips with flaps; and males with small, stout, slightly arcuate spicules with hood-like capitula and genital papillae in 1/2/1+3+1+1+P configuration. The oviparous females of *Curviditismicrospicula* sp. n. lay eggs single-celled stage, 1.5 – 2 h after fertilization. In cultured females, the uterine tract was observed to accommodate occasionally as many as 4 – 10 eggs. The eggs are smooth-shelled, elongate with rounded poles, measuring 37-42 x 20-24 µm in dimension. The pole of entry of sperm marks the posterior end of the developing embryo. The embryonation time has been recorded to be 15.5-20.0 h at 25 ± 2 °C. The first moult occurs inside the egg and the juvenile hatches as second stage juvenile. The gonad development follows the trends found in most rhabditids, however, five prime cells of the 12 vulval precursor cells have been observed to be involved in vulva formation.

EFFECT OF DIFFERENT MULCHING TREATMENTS ON SEED PRODUCTION OF RADISH (*RAPHANUS SATIVUS* L.)**Anurag Malik*, D.K.Mehta, Pradeep Singh and Smriti Guleria**

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Radish (*Raphanus sativus* L.) is the one of the most important root crops belonging to the family Cruciferae. It is grown both in tropical and temperate regions of the world. The present investigation entitled “Effect of different mulching treatments on seed production in radish (*Raphanus sativus* L.)” was carried out using cv.Japanese White. The experiment was laid out in Split-Split Plot Design in the field and with three replications of each treatment combination at Department of Seed Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during *Rabi* 2014-15. The treatment combinations comprised of four different mulches (M) viz., no mulch (M₁), black-plastic mulch (M₂), silver-black plastic mulch (M₃) and crop residue mulch (M₄). The observations in field were recorded on plant height (cm) at 30, 60, 90 days after replanting and at final harvest, days to 50% bolting, length of pod (cm), breadth of pod (mm), number of seeds per pod, number of pods per plant, seed yield per plant (g), seed yield per plot (Kg) and seed yield per hectare (quintals). The result revealed that among the mulching treatments, M₂ (black plastic mulch) was found superior for enhancing the plant height (cm) at 30, 60, 90 days after replanting and at final harvest, days to 50% bolting, length of pod (cm), breadth of pod (mm), number of seeds per pod, number of pods per plant and seed yield per plant/plot and per hectare followed by M₃ (silver-black plastic mulch) and minimum growth and seed yield was found for the treatment M₁ (no mulch). Therefore, black plastic mulch (M₂) can be recommended for commercial seed production of radish in Himachal Pradesh after multiyear and multi-location testing.

Keywords: Mulching, radish, growth and yield**BIO-EFFICACY OF *TRICHODERMA* SPP. AGAINST *ALTERNARIA BRASSICAE* (BERK.) SACC.ISOLATES COLLECTED FROM DIFFERENT *BRASSICA* HOST CROPS****Vaibhav Pratap Singh* and R. U. Khan**

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Alternaria brassicae (Berk.) Sacc. is a devastating and widespread pathogen of *Brassica* crops in India. It causes considerable reduction in quality and quantity of these crops. The present investigation was carried out *in vitro* to evaluate the bio-efficacy of five *Trichoderma* spp. viz., (*Trichoderma koningii*, *T. viride*, *T. harzianum*, *T. atroviride* and *T. virens*) using dual culture technique against four *A. brassicae* isolates collected from different *Brassica* host crops i.e. mustard, cauliflower, cabbage and radish. These isolates were designated on the basis of their host crop as Acae M, Acae Cf, Acae Ca and Acae R from mustard, cauliflower, cabbage and radish, respectively. The observations revealed that all these isolates exhibited significant variation in their radial growth inhibition in presence of *Trichoderma* spp., but *Trichoderma harzianum* proved to be most effective among all five *Trichoderma* spp. followed by *T. viride*, *T. koningii* and *T. atroviride* against all four tested isolates of *A. brassicae*. Maximum radial growth inhibition was noted in Acae Cf (70.37%) followed by Acae R (66.96%), Acae M (64.07%) and Acae Ca (62.56%). While as, *T. virens* was found to be least effective in this study against all isolates of *A. brassicae*.

Keywords: *Trichoderma* spp., *Alternaria brassicae*, Isolates, Dual culture, *Brassica* crops**POPULATION GROWTH AND CHANGES IN LAND USE BY AGRICULTURE IN INDIA****Veena Kumari**

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The paper uses the available secondary information sources for carrying out its exploration. The present paper tries to study trends of population growth, draw attention on increasing urbanization as well as pattern of land uses during the period lying between 1950-51 and 2013-14(P) of country. It tries to highlight that though presently, in absolute terms, the urban population is relatively much lesser than the rural population, still we cannot afford to overlook the shifting rural to urban population trends. The pressure of human being on land is higher because the net area sown has been around 46 percent of the total reporting area, which has not changed much after seventies but increase in population has trebled. However, area sown more than once, on which crops are cultivated more than once during the agricultural year, has moved up sharply in



the last fifty years from 13.14 million hectare in 1950-51 to 59.43 million hectares in 2013-14(P). It also tries to find out the nature of changes in gross cropped area in the country during the reference period. During the study period the area under the food crop has been declined in each decade while the area under non food crop has increased steadily. Thus, the main reason appears to be an association between population growth and declining gross cropped area of total food crops that gain attention to focus on the agricultural production to meet the needs of growing population. The paper stresses that land use data produced by Indian government sources should be strengthened and publication should be made timely.

Keywords: Population, Urbanization, Land Use Pattern, Gross Cropped Area, Total Food Crops, Total Non Food Crops

EFFECT OF SPACING AND FERTILIZERS ON SEEDS VIABILITY OF HISAR UNNAT AND HBT-49-1 VARIETY OF OKRA IN HARYANA

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Tetrazolium test (TZ) is the easiest and fastest evaluation for seed viability and alternative quick method for seed's germinability. The effect of spacing and fertilizers plays significant role in the yield and viability of seeds. The main aim of this study was to determine the effects of spacing and fertilizers helps to understand the impact on seed viability parameters. The unavailability of much work on these aspects provides the opportunity of better results and innovative techniques in seed productions. In present study of spacing and fertilizer with two varieties (Hisar Unnat and HBT-49-1), highest normal viable seed percentage of 85.15%, 82.10% and 78.58 % was recorded in spacing 30 × 15 cm and 30 × 10 cm as compared to 30 × 5 cm, respectively. Application of the treatment 187.5 kg N + 75 kg P₂O₅ + 60 K₂O per hectare was recorded highest seed viability percentage (84.77%) as compared to the treatment of 225 kg N + 90 kg P₂O₅ + 60 kg K₂O per hectare and 150 kg N + 60 kg P₂O₅ with 81.94 % and 79.12%, respectively. Among the two varieties, the highest seed viability percentage (83.95%) was reported in Hisar Unnat as compared to the HBT-49-1 with (79.94%).

Keywords: Spacing, Fertilizer, Varieties, Viability percentage.

INTERACTIVE EFFECT OF PHOSPHORUS AND SULPHUR APPLICATION ON YIELD AND YIELD ATTRIBUTING CHARACTERS BY BLACK GRAM [*VIGNA MUNGO* (L.) HEPPEL]

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The experiment comprising of four levels of phosphorus, i.e., 0, 20, 40 and 60 kg ha⁻¹ and three levels of sulphur, i.e., 0, 15 and 30 kg ha⁻¹, was conducted at Research Farm of the Division of Soil Science and Agricultural Chemistry, SKUAST-J, Main Campus, Chatha during summer of 2015 to investigate the interaction effect of phosphorus and sulphur application on nutrients uptake and yield of black gram cv. Uttara. The treatments were laid in Randomized Block Design (Factorial) with three replications. The results revealed that combined application of phosphorus and sulphur showed synergistic effect on seed and Stover yield of black gram with increasing levels of phosphorus and sulphur up to highest level. The seed and Stover yield were 955.50 and 2398.30 kg ha⁻¹ with combined application of 60 and 30 kg ha⁻¹ phosphorus and sulphur respectively. The yield attributes of black gram viz. plant height, number of pods plant⁻¹ and 100-seed weight also increased significantly with increasing levels of phosphorus and sulphur up to highest level and the optimum values were recorded with combined application of 60 and 30 kg ha⁻¹ phosphorus and sulphur respectively. The application of phosphorus significantly and markedly increased mean seed and Stover yield of black gram by 27.55, 48.16, 74.84 and 26.56, 47.55, 72.45 per cent, with the successive application of 20, 40 and 60 kg phosphorus ha⁻¹ over control, respectively. The application of sulphur also significantly increased the Seed and Stover yield. The per cent increase in mean seed and Stover yield was 14.31, 26.46 and 13.92 and 26.74 per cent, with the successive application of 15 and 30 kg sulphur ha⁻¹ over control, respectively. The magnitude of response was found more in case of phosphorus as compared to sulphur.

Keywords: Phosphorus, sulphur, interactive effect, black gram, yield and yield attributing characters.

IMPACT OF ZINC NUTRIENTS ON CROP GROWTH

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Zinc is one of the important essential micronutrients for plants growth and its development. The zinc uptake is facilitated as diffusion through membranes specific for zinc ion; lateral movement of zinc is highly dependent upon the soil moisture. Zinc is sometimes applied broadcast to correct the zinc level in soils in one treatment. Zinc sulphate must be sprayed as foliar application or applied to the soil. Zinc oxide should always be applied through the soil application in crops. The excess amounts of zinc sulphate can cause severe leaf damage. Zinc is dissolved in the soil solution in ionic or complex form and may be found on the exchange sites of clay minerals and organic matter. Zinc can also be found as adsorbed divalent cation, zinc hydroxide, or zinc chloride. The solubility of zinc is highly dependent upon soil pH. Presence of calcium carbonate decreases the availability of zinc due to higher soil pH. Zinc is transported in the xylem tissues from the roots to the shoots. However, high levels of zinc have been detected in the phloem tissue, which indicates that zinc moves through both transport tissues, and maybe remobilization of zinc towards the grain during ripening. Substantial translocation of zinc takes place from the older leaves to the younger ones during grain development phase. Zinc has received a great deal of importance in crop production especially in a rice-wheat cropping system during



the last few years, Various factors associated with Zn deficiency are acid sandy soils low in total zinc, neutral or alkaline soils having higher amount of fine clay, silt and available phosphorus, organic soils etc. Intensive cultivation and growing of exhaustive crops have made the soil deficient in macro as well as in micronutrients. Now a day the use of only nitrogenous and phosphatic fertilizers also create nutrient imbalances particularly of Zn in soils. The problem seems to be more acute for rice and other crops area found to be severely affected by Zn deficiency. Zinc application plays an important role in different plant metabolism processes like development of cell wall, respiration, photosynthesis, enzyme activity, auxin synthesis, protein synthesis, and other bio chemical and physiological functions of the plant and its effective activities responsible for better crop growth and development.

MAPPING OF BACTERIAL LEAF BLIGHT RESISTANCE GENE USING MICROSATELLITE MARKERS IN GUAR

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Cyamopsis Tetragonoloba (L.) is an important member of *leguminosae* family and is a rich source of high quality galactomannan which has industrial applications. In India, guar is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat, and Punjab and to a limited extent in Uttar Pradesh and Madhya Pradesh. India produces more than 85% of world guar seed production i.e. 27.51 million tonnes (Ganesh Prajapat, 2016). The cultivated cluster bean suffers from highly devastating bacterial leaf blight (BLB) disease. There is a critical requirement for development of BLB resistant guar breeding lines. In present study we have segregating population of 165 plants from interspecific cross (HG563 x *Cyamopsis serrata*), in which *C. serrata* is highly resistant wild species and HG563 is moderately resistant cultivated variety of guar. The linkage map for BLB resistance gene will be constructed using the EST SSRs from guar and SSRs from other legumes. A total of 165 SSRs were screened in which 44 SSRs were found polymorphic. These SSRs will be further screened in population. The data will be recorded for presence or absence of band and polymorphism will be analyzed using MAP MAKER 3.0 version for developing linkage map.

Keywords: Bacterial Leaf Blight, Guar, SSR, Linkage map

LONG TERM EFFECT OF INM ON SOIL PHYSICO-CHEMICAL PROPERTIES AND PRODUCTIVITY OF COTTON + GREENGRAM INTERCROPPING SYSTEM IN VERTISOLS OF MAHARASHTRA

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A study was conducted on the long term experiment initiated during 1987 on Vertisols at Research field of AICRP for Dryland Agriculture, Dr PDKV, Akola, Maharashtra. The study was conducted with the objective to assess the long term impact of integrated nutrient management on physico-chemical properties of soil and yield sustainability under cotton+greengram (1:1) intercropping system in Vertisols. The eight treatments comprised of control, 100% RDF (50:25:00 NPK kg ha⁻¹) through chemical fertilizer, 50% RDF through chemical fertilizer, 50% N through FYM/giricidia, 50% N through fertilizers + 50% N through FYM/giricidia + 100% P₂O₅ ha⁻¹ fertilizers and 100% N ha⁻¹ giricidia + 100% P₂O₅ ha⁻¹ fertilizers in randomised block design with three replications.

The results after 30th cycle indicated the significant improvement in physico-chemical properties of soil and enhanced productivity of crops under integrated nutrient management comprising of 50% N through FYM/giricidia + 50% N through inorganics + 100% P₂O₅ ha⁻¹, while the lowest improvement was observed in control, indicating considerable enhancement in soil quality due to integrated nutrient management. Hence, it is concluded that long term integrated use of 50% N through FYM/giricidia + 50% N through inorganics + 100% P₂O₅ ha⁻¹ not only significantly improved physico-chemical properties of soil but it was found as the most promising approach from the view point of yield sustainability of cotton+greengram (1:1) intercropping system under rainfed condition in vertisols.

Keywords: INM, soil physico-chemical properties, cotton + greengram intercropping system, Vertisols

COLOUR ANALYSIS OF MINIMALLY PROCESSED MANGO UNDER DIFFERENT TREATMENTS

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Mango (*Mangifera indica* L.) is one of the most important tropical fruit worldwide in term of production and consumer acceptance (FAO STAT, 2005). Colour parameters play important role in marketability of mango. In this study was conducted to investigate the changes in hue angle of minimally processed mango under thermal and chemical treatments. In thermal treatments, Dasher mango was treated in hot water bath at three different temperatures (40, 45 and 50°C) for three dipping time (30, 40 and 50 min). After hot water treatment mango was cooled at ambient temperature for 15 min. The chemical treatments of calcium chloride (2.5 and 3.5% concentration) were applied to whole heat treated mango for 25 min. Then heat and CaCl₂ treated mangoes were peeled off, sliced into cubes and dipped in malic acid concentration (0.5 and 1.0%) for 1 min to inhibit the enzymatic changes during processing. The experimental result showed that the change in hue angle was found to be significantly influenced by all parameters except to calcium chloride concentration. The best result was obtained for heat treatment found at higher temperature with high dipping time (50°C with 50 min). In thermal treatments i.e. temperature and dipping time both are increased value of hue angle but temperature is more effective to increase the value of hue angle. It has been observed that the trends of hue angle increased with respect to the malic acid concentration (0.5% < 1.0%). In this study hue angle was changes from minimum to higher value (64.48 to 69.96 respectively)



DECLINE OF WHISKERED TERN NEST SUCCESS: RELATIONSHIP WITH PREDATORS AT HOKERSAR AND HAIGAM WETLANDS, KASHMIR**ISHRAT JAN*, G. MUSTAFA SHAH, AND ULFAT JAN.**

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However, our understanding of the relationship between habitat characteristics and nest loss and how predation affects nest-site selection is limited. Predators are not often identified, yet their behaviour greatly influences nest loss patterns. Most studies of nest-site selection make unrealistic assumptions about the ability of birds to identify and access preferred habitat and few use unambiguous measures of selection. We studied how wetland management with fire and grazing influences predator-specific patterns of nest loss and whether predation influenced nest-site selection by Whiskered tern. We used video cameras to identify nest predators. Predation by corvids and raptors increased with little cover surrounding the nest. Predators were less likely to prey upon nests with increased macrophyte cover. Though nest sites did not differ from available habitat. Reductions in litter and increasing macrophytic cover can reduce predation as well. Whiskered terns belonging to the genus *Chlidonias* nest on water plants and inhabit shallow, frequently small reservoirs, such as inland marches, fish ponds and flooded meadows, consequently, they may be unpredictable in terms of their suitability as a breeding habitat. Present study was carried out at Hokersar and Haigam wetlands from May 2013 to August 2015. This study focused on predation of eggs and chicks of whiskered tern at Hokersar and Haigam wetlands in relation to vegetation height, habitat conditions and nest distribution. It breeds from May to early June in monospecific colonies of 10-100 pairs. The species nests in colonies, neighbouring pairs spaced between 1-5 m apart and may forage between 1-9 km away from breeding sites. The species suffers nest destruction from local fisherman who collect their eggs for sale and local consumption. The major predators found were common crow, yellow-billed blue magpie, Black kite, night heron and humans.

Keywords: Hokersar, Haigam, predation, Common crow, whiskered tern.

EFFECT OF SEED PRIMING ON YIELD ATTRIBUTES OF RICE**Mahesh Kumar^{1*}, Ravi P. Singh² and Bandana Bose¹**¹Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 221005, India.²Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, India.

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In the present investigation two rice genotypes i.e. HUBR 10-9 and HUR-105 were selected to see the effect of seed priming on growth and development of rice. Priming of seeds has been done with distilled water (hydro), $Mg(NO_3)_2$ salt (halo) and Kinetin and Salicylic acid (hormonal) and different yield parameters, such as Grain per panicle, test weight, harvest index, panicle length and panicle number hill⁻¹ were studied at maturity with respect to two sowing dates, representing timely (12 June) and late (2 July) sowing of rice crop. Priming of seeds was found to improve all the yield parameters over non-primed (control) sets in timely as well as in late sown conditions. The work therefore presents the late sown stress ameliorating role of seed priming in rice genotypes.

EFFECT OF SEED PRIMING ON GERMINATION AND SEEDLING GROWTH OF RICE UNDER HEAVY METAL STRESS**Navneet Kumar*, Mahesh Kumar, Rajesh Kumar Singhal, Satish Chand Shukla**

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In the present investigation rice genotypes HUR-105 was selected to see the effect of priming on growth and development of rice under heavy metal stress ($CdCl_2$). Priming of seeds has been done with distilled water (hydro), $MgCl_2$ and Kinetin and different germination and growth parameters, such as seed germination %, α -amylase activity, seedling growth, fresh and dry weight of seedling were studied at different study periods. Priming of seeds was found to improve all the growth parameters over non-primed (control) sets. The work therefore presents the heavy metal stress ameliorating role of seed priming in rice.

GDOT- A NEW SOIL MOISTURE MONITORING TECHNICAL TOOL FOR FARMER GROUPS**¹Meenakshi Sangwan*, ²J. cummins and ³V. S. Hooda**^{1&3}Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana, India;²International Agriculture for development, Australia

Water is an expensive resource and prime requirement for all aspects of life. Renewable quantity of water is finite and is a major limiting factor in the production of irrigated grains, and efficient water management is paramount for growers to achieve high yields and profits. Efficient use of water resources in agriculture through improving irrigation techniques is, therefore, one of the most urgent needs and prerequisites for sustainable food production. The use of soil moisture sensors (SMS) is one of the best and simplest ways to improve on-farm water management decisions. Soil moisture monitoring devices provide useful information that can help guide and improve irrigation decisions but they should always be used in conjunction with other tools such as weather data, field observations or growth monitoring. Soil moisture sensors are used to measure moisture in the soil either as tension, percentage or relative content. Depending on the soil type, soil moisture sensor readings are an indication of the readily available water (RAW) in the root zone. The GDot displays soil moisture tension represented by fluorescent yellow flip dots. The more yellow dots showing, the wetter the soil is; the fewer lit yellow dots, the drier the soil. It uses a granular matrix sensor, a type of gypsum block. Electrodes embedded into gypsum blocks are used to measure the electrical resistance between them under the presence of moisture and those signals are related to soil moisture tension, that is, how hard it is for the plant to extract water. It can be used in most soil types (although



not recommended for use in light sands and heavy or cracking clays) and have an operational range of 0-100 kPa. It will run for several years on a pair of alkaline AA batteries. It never needs adjustment or calibration and can be installed in minutes with the most unsophisticated equipment.

Keywords: Water resources, moisture sensor, GDot and easy installation

CHARACTERISATION OF CHROMIUM RESISTANT *MESORHIZOBIUM CICERI* STRAIN RZ2 RECOVERED FROM ROOT NODULES OF CHICKPEA GROWN IN METAL CONTAMINATED SOILS

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The strain RZ2 exhibited multiple plant growth promoting activities and produced ammonia, siderophore, EPS and ACC deaminase and also solubilized phosphorus. The strain RZ2 showed maximum resistance to Cr(VI) (200 µg/ml) and reduced 100 µg/ml Cr(VI) completely after 120 h. The optimum conditions for Cr(VI) reduction was: pH 7, 30°C and 100 µg Cr(VI) /ml. Besides viable cells, the dead biomass adsorb 82% of 100 µg/ml initial Cr(VI) at pH 6 and 28°C and immobilization were confirmed by EDX spectra. The SEM image revealed cell deformation while the confocal microscopy showed maximum dead cells indicating Cr(VI) toxicity to membrane integrity. While comparing live and dead biomass, live biomass demonstrated maximum biosorbing ability at lower chromium concentration while at higher concentration the dead biomass performed comparatively better. The chemical functional groups identified by FTIR spectroscopy included carboxyl, hydroxyl, amino and carbonyl groups in adsorption of Cr(VI). The biosorption model fit the Freundlich model better than Langmuir model with coefficient of determination for both the models close to 1. **Conclusion:** The present findings strongly suggests that the variable plant growth promotory activities of strain RZ2 could be exploited for bioremediation of sites contaminated with Cr(VI) and as an efficient bio fertilizer for enhancing the legume production.

Keywords: Cr(VI) resistance, Biosorption, Bioremediation, PGPR, *Mesorhizobium ciceri*

HARVESTING WEED (*LANTANA CAMARA*) FOR UTILIZATION IN SILVER NANOPARTICLES SYNTHESIS WITH ANTIBACTERIAL ACTIVITY AGAINST ANTIBIOTIC RESISTANT *ESCHERICHIA COLI* AND *STAPHYLOCOCCUS AUREUS* ISOLATED FROM HOSPITAL SEWAGE.

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The term weed is used commonly for the plants that grow out of place and are competitive, never ending and destructive. They may include plant species that are non-native or exotic but invasive. These species cause loss of biodiversity including species extinctions, and changes in hydrology and ecosystem function. Although the term "weed" generally has a negative implication, yet many weeds have beneficial properties. The ecological and sustainable solutions to these unwanted species may not only be by eliminating them in fields yet they may be possibly used in the production of therapeutic agents that requires exploitation of medicinal flora in large amount. The present study involves the use of a weed namely *Lantana camara* for its utilization for the synthesis of silver nanoparticles having potential application as antimicrobials. For this aqueous plant leaf extract was used to reduce silver ions by adding 5ml plant leaf extract to 95ml of 10⁻³M silver nitrate solution. The bioreduction was monitored spectrophotometrically. These silver nanoparticles were then characterized using XRD analysis, FTIR analysis and TEM analysis. The XRD study confirms that the resulting particles are Face-centered cubic (FCC) silver nanoparticles. FTIR measurements were carried out to identify the possible biomolecules responsible for capping and efficient stabilization of silver nanoparticles synthesized using aqueous leaf extracts. The observed intense bands were compared with standard values to identify the functional groups. Lots of absorption bands in the spectrum indicate the presence of active functional group in the synthesized silver nanoparticles. The size and shape of the silver nanoparticles was determined using TEM analysis. The TEM images showed the presence of spherical silver nanoparticles with a mean diameter of 17.61 nm. The antimicrobial activity of the aqueous plant extract and the synthesized nanoparticles was determined by agar well diffusion method and growth curve analysis, against *Escherichia coli* and *Staphylococcus aureus* isolated from hospital sewage. From the study it may be concluded that weeds may be an option of choice for the fabrication of silver nanoparticles with potential use as antimicrobials, thereby utilizing the eliminated flora for a beneficial cause that may be a step towards saving our fields from the invasive weeds.

Keywords: Silver nanoparticles, weeds, antimicrobials.

DESIGNING AND OPTIMIZATION OF CIRCULATORY HYDROPONICS SYSTEM FOR THE EVALUATION OF NUTRITIONAL STATUS AND PLANT'S GROWTH IN FINGER MILLET

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Hydroponics is a suitable method to study the nutrient's responsiveness at molecular level and its advantages include easy approachability to all plant tissues since the roots directly gets nutrients from water when compared to soil. Finger millet (*Eleusine coracana* L. Gaertn) one of the nutritionally important crop contains exceptionally high amount of calcium. However, very little is still understood about the accumulation of calcium present in plants including finger millet. In this context a hydroponic system was established and optimized for evaluation of nutrient status in two contrasting genotypes of finger millet under different treatment of exogenous calcium. The developed hydroponic system had five different units: two trays for plant growth and a 100 liter tank with a water pump and an air pump. Two trays are connect with a pump which lies in 100 L tank and trays are reconnect with the tank on the other side separately so the media can circulate easily. In this investigation the significant genotypic difference was clearly visualized in the physiological growth parameter of both the genotype of finger millet. Results suggested that hydroponic system is more suitable for analysis of effect of nutrient in finger millet and accumulation of calcium depends on genetic as well as environmental factor. A optimized and economical hydroponic circulatory system developed was not only used to assess the effect of exogenous calcium on different physiological parameter of plant but it can be also used for interaction study of nutrient and anti-nutrient factor in finger millet.

OPTION FOR HIGH – TECH NURSERY RAISING FOR ENHANCED PRODUCTIVITY AND PROFITABILITY IN THE DISTRICT, BULANDSHAHR REGION OF U.P.

S.D. Singh, Reshu Singh & Manoj Kumar

S.V.P.U. A & T; Meerut, Krishi Vigyan Kendra Bulandshahr (U.P.)

Nursery raising is the mainstay of Hi-tech horticulture and protected cultivation is one of the main components of high tech production technology for horticulture crops. The Planks of the technology are enhancing productivity and reduce stresses (Biotic & abiotic) through controlled conditions such as microclimate, migration & fertigation systems inside the protected structures. In the protected structures, this technology can help in great way to enhance the quality Nursery plants can be grown successful all the year round, which have controlled microclimate, irrigation and fertigation systems. The optimal weather conditions like temperature, relative humidity and solar radiation (Intensity and duration), aeration could be maintained as per crop requirement. The vegetable growers are not growing their own nursery, but they procure seedlings from a established nursery. Quality seedlings ensure not only virus-free vigorous and even off season seedlings but also eradicate the need for weeding out and provides very good opportunities for cultivation under protected conditions. Therefore, it becomes indispensable to know the protected make up which can be proficiently used for raising of crops seedlings, appropriate containers, system of seeding in containers and growing media, soil less media, growing conditions and water and fertilizer requirement of seedlings along with hardening and transplanting to the field. Protected nursery raising technology is highly suitable and can be established as a small scale industry in major vegetable growing areas of our country by progressive farmers especially in semi urban and peri - urban areas.

EVALUATION OF AGRONOMIC PERFORMANCE OF PRUNUS CLONAL ROOTSTOCKS UNDER MID HILL CONDITION OF HIMACHAL PRADESH

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Performance studies of different clonal rootstocks of *Prunus* species were undertaken in the Departmental field of Fruit Breeding at Dr YSP UHF, Nauni-Solan (Himachal Pradesh). The experimental plant material was comprised of three clonal rootstocks viz. Myrocal (*P. cerasifera*), Julior (St. Julien x Pershore) and Jaspi (Methley x *P. spinosa*) introduced from France and planted in the experimental farms. Observations were recorded on one year old plants on the various growth characters (growth habit, plant height (m), plant spread (m), trunk girth (mm), number of branches per plant), foliage characters (leaf bud burst time, leaf area (cm²), leaf shape, time of leaf fall), physiological characters (stomatal density and size (µm), chlorophyll content (mg/g) and cold hardiness. With respect to growth characters plant height (2.35 m), trunk girth (27.15 mm), plant spread-NS (1.23 m), plant spread-EW (1.19 m) and number of branches per plant (8.67) in Myrocal was significantly higher from those of Julior and Jaspi, however, all the three rootstocks exhibited erect growth habit. Early leaf bud burst and leaf fall was noticed in Julior rootstock i.e. 1st - 2nd week of March and 2nd - 3rd week of November. Maximum stomatal density per microscopic field was recorded in Myrocal (34.29) alongwith maximum stomata length (27.86 µm), breadth (17.09 µm) and chlorophyll content (2.91 mg/g). Leaf shape in all the three clonal rootstocks studied was observed as ovate, obovate and obovate in Myrocal, Julior and Jaspi, respectively. Mean per cent electrolyte leached out was maximum (35.93) in Myrocal followed by 33.89 per cent in Julior and 32.23 per cent in Jaspi which was statistically significant. On the whole, all the three rootstocks survived well and shown optimum growth.

CLUSTER ANALYSIS AND PRINCIPLE COMPONENT ANALYSIS IN GRAPE, VITIS VINIFERA L. GERMPLASM OF LEH DISTRICT OF JAMMU AND KASHMIR

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Evaluation of wild germplasm of grape was carried out from different villages of Leh district on the basis of several morphological characters during 2014-2015. After intense survey ten elite grape accessions were selected having superior yield and quality traits. Observations were recorded on the basis of growth, foliage and yield of vine using cluster analysis and Principle Component Analysis. Cluster II (27) comprised of maximum number of genotypes followed by Cluster-III and Cluster-V have 8, Cluster-I have 4 and Cluster-VI have 3 genotypes. The clustering pattern revealed that genotypes from the same location did not fall in the same cluster depicting that genetic diversity was not



necessarily associated with graphical location. Cluster means for different growth and yield characters revealed that cluster-III possessed maximum vine girth (69.37 cm). Cane length was observed maximum (201.77 cm) in cluster-V. Cane diameter was observed maximum (2.03 cm) in cluster-I. Internodal length was observed maximum (29.17 cm) in cluster-I. Leaf area was observed maximum (170.75 cm²) in cluster-I. Cluster-I showed maximum yield (20.99 kg per vine). The yield efficiency was found maximum (0.09 kg/cm²) in cluster-II. Cluster means for physical attributes of grape genotypes revealed that bunch length and bunch breadth was maximum in cluster-I (21.36 and 11.12 cm respectively). Highest bunch weight (150.42 g) was observed in cluster-I. Number of bunches per vine was recorded maximum (148.75) in cluster-I. Berry length was recorded maximum (1.53 cm) in cluster-I. Berry breadth was recorded maximum (1.33 cm). These genotypes can be further evaluated and used in breeding programme for further improvement of grape.

IMPACT OF PESTICIDES USE IN KASHMIR HORTICULTURE: BENEFITS AND HAZARDS?

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Kashmir valley Paradise on earth has also been rightly described as the 'Fruit Bowl' of India. Its land environment and climate is most favourable and provides greater facilities to horticulture industry to grow more rapidly. The flourishing horticulture sector of Kashmir valley has changed the Socio-Economy status of people and helped them in reshaping their economy to some extent. One way of flourishing horticulture sectors in Kashmir valley is use of standard pesticides by orchardists. As primary use of pesticides is as a soil fumigant to control soil-borne diseases, nematodes, soil insects, pathogens and weeds, These are also used in post-harvest storage and transportation of mainly fruits and vegetables and for quarantine and pre-shipment purposes. In Kashmir horticulture sector the rampant use of these chemicals under the adage "if little is good, a lot more will be better" has played havoc with human and other life forms. By the use of excessive pesticides soil biodiversity gets affected and the water bodies of Kashmir are also getting contaminated. Orchardist of Kashmir valley use pesticides without any consultation of scientist, never follow the spray schedule provided by SKUAST-K and without sign of such diseases for which spray schedule is meant. The high risk groups exposed to pesticides include production workers, formulators, sprayers, mixers, loaders in Kashmir as they ignore the use of personal protective equipment. *To overcome these problems Integrated Pest Management should be adopted and most importantly the horticulture graduate should be provided licenses to prohibit non-recommended pesticides.*

FUNGICIDES INDUCE RESISTANCE *TOUROMYCES APPENDICULATUS* IN FRENCH BEAN

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The induction of systemic resistance was studied to elucidate the role of azoxystrobin and tebuconazole in the disease management of French bean against *Uromyces appendiculatus*. The application of fungicides triggered the activity of three defense related enzymes viz., peroxidase (PO), polyphenol oxidase (PPO) and phenylalanine ammonia lyase (PAL) in bean plants upon challenge inoculation with *U. appendiculatus*. The activities of defence enzymes reached a peak at five days after inoculation (DAI) with the pathogen. The activity of defence enzymes was more in bean plants treated with azoxystrobin (0.1 %) followed by tebuconazole (0.1 %) as compared to control.

EVALUATION AND COMMERCIALIZATION OF AFRICAN MARIGOLD (*TAGETUS ERECTA* L.) GENOTYPES UNDER UKP COMMAND AREA OF KARNATAKA

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The study on evaluation of sixteen African marigold genotypes for their growth, yield and xanthophyll content was carried out RCB design with three replications in the experimental block of COA, B. gudi, Yadgir district of Karnataka, during the period of (Kharif, 2015 and Summer 2016). The pooled mean of both two season, the maximum plant height was found in maxima yellow (92.24 cm), Number of primary branches and Secondary branches was found in A Bangara-2 (21.63 and 36.92 cm), Plant spread was highest in maxima yellow (3471.50 cm²), diameter of flower in A Bangara-2 (6.17 cm) and least number of days to first flower bud initiation, 50 percent of flowering was found in A Bangara-2 (39.54 and 52.22 days). Maximum diameter of flower was found in A Bangara-2 (6.17 cm), fresh weight and dry weight of individual of flower in Maxima yellow (7.55 g) and yellow gold (0.90 g), petal meal yield per/ha was found in A Bangara-2 (12.52 t/ha). Maximum flower yield was recorded in A Bangara-2 (21.76 t/ha), followed by Arka Agni (17.13 t/ha), Xanthophyll content highest A Agni (22.88 mg/g, per petal meal). Duration of flowering A Agni (115 days), B:C ratio was recorded in the A Bangara-2 (1:2.4) followed by A Agni (1:2.32), were as, highest number of days taken for first flower bud initiation and 50 percent of flowering found in Dharwad local (45.57 days) and Maxima yellow (62.67 days). Minimum flower diameter Shahapur local (3.42 cm), fresh weight and dry weight of individual of flower recorded in Dharwad local (2.65 g) and yellow gold (0.90 g), petal meal yield per/ha Indam yellow (2.67 t/ha), yield Raichur local (7.38 t/ha), shelf life Indam yellow (3.26 days), xanthophyll content was found in the Raichur local (1.73 mg/g petal meal), duration of flowering yellow gold (63.58 days), lowest B:C ratios in Indam yellow (1:1.08). Among the marigold genotypes for their growth, yield and xanthophyll content parameters, the genotypes A Bangara-2 and Maxima Yellow and A Agni were found promising under UKP command area of Karnataka.



BIODIVERSITY AND CONSERVATION OF TROPICAL FRUITS

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Tropical Asia is the center of diversity of most of tropical fruits. Although fruits have always been important agricultural species, it is only in recent years that there is an increasing awareness of the potential of native tropical fruit species as good sources of dietary vitamins, minerals and energy. The tropical fruit trees are valuable resources for the well being of the people through enhancing household income, employment generation particularly for women, and environmental protection. At the same time, their genetic diversity and even the species diversity is threatened due to various human interventions and concerted efforts are required to take corrective measures. Farmers are the key actors in maintaining and using this diversity. Over the years they have developed a range of production and management practices along with formal research and private institutions to conserve and use tropical fruit diversity sustainably. Biodiversity International, in collaboration with national partners, implemented in recent past several programmes for effective conservation and sustainable use of genetic resources of tropical fruits in the region and is continuing to do so. Various methods employed for conservation of genetic resources of tropical fruits included exploration, collection, characterization, evaluation, identification of promising/elite lines, documentation, conservation, training and capacity building, socio-economic analysis, information dissemination, collaboration and networking, impacts and sustainability of efforts.

DRYING OF JACKFRUIT BULB AND ITS IMPORTANCE FOR LIVELIHOOD MINAM TABING* AND A.K. CHAURASIYA**

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Jackfruit contains 28.7% pulp, 11.5% seeds and 59.8% rind, sheath and core. The pulp contains 23.20% TSS, 15.15% total sugars, 0.27% acid and 0.93% ash. Jackfruit bulbs are a rich source of vitamin A, B and C and minerals constituents especially Ca and Fe. The bulb is a source of energy and is also reported to have laxative effects as a result of its dietary fiber content. Much of the raw jackfruit is consumed locally for curry preparation and after ripening, the bulbs are relished as such in India as it is considered to be a good appetizer. Products such as jackfruit leather, chips, fruit bars, candy, jam, wine, can also be made from dried jackfruit pulp. The osmo-air dried products prepared from jackfruit bulbs may be consumed as snack. It can also find use in military rations in suitable packing. The amount of jackfruits spoiled during the harvesting season can be minimized by drying the jackfruit bulb into different products to increase its shelf life and to ensure year-round availability of jackfruits. The jackfruit bulb was dried by two methods i.e. solar drying on the quality and consumer acceptability of jackfruit bulb was compared to cabinet and convention oven drying methods. Results show that the moisture content of solar dried pulp was not significantly different from that of cabinet dried pulp. However the moisture content of the pulp dried using these methods was significantly higher than the oven dried pulp. The color loss in oven dried pulp was not significantly different from solar dried pulp.

MINE SPOIL REHABILITATION AND REVEGETATION FOR SUSTAINABLE DEVELOPMENT

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Sustainable Development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations. Brundtland Commission coined what has become the most often-quoted definition of sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development contains within it two key concepts: The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. The field of sustainable development can be conceptually broken into three constituent parts: Environmental, economic, sociopolitical sustainability. World Business Council on Sustainable Development working with the International Institute for Environment and Development created the Mining, Minerals and Sustainable Development (MMSD) project in 1999. The report includes an agenda for change and outlines 9 sustainable development challenges facing mining: Ensuring long-term viability of the minerals industry, control use and management of land, using minerals to assist with economic development making a positive impact on local communities managing the environmental impact of mines, Integrating the approach to using minerals so as to reduce waste and inefficiency giving stakeholders access to information to build trust and cooperation, managing the relationship between large companies and smallscale mining operation, sector governance: clearly defining the roles, responsibilities, and instruments for change expected of all stakeholders.

Keywords: Sustainability, mining and economy.

STUDY ON EVALUATION OF BLENDED MANGO BAR

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Mango (*Mango indica*. Linn) is the most important fruit of India and is known as "King of fruits". The fruit is cultivated in the largest area i.e. 2,312 thousand ha and the production is around 15.03 million tons, contributing 49.48% of the world production of mango. India occupies top position among mango producing countries. Mango are juicy with a sweet and unique taste. It is used to make juices, squash, fruit bars, RTS, pickle, candy, nectar, powder etc. In the present investigation mango bar var. Lakhanbhog was prepared from mango-cassava blended fruit pulp with sugar. The six treatments were experimented viz. T₁- M (mango pulp), T₂- M+S (mango pulp + sugar in proportion of 90+10%), T₃-



M+S (80+20%), T₄- M+S (70+30%), T₅- M+S (60+40%), T₆- M+S (50+50%) and KMS @350ppm and cassava flour 20% were added in each treatment, and acid content was maintained @ 0.5% for each treatment. The processed bar was packed air tightly in polythene bag and stored at ambient condition. The physico-chemical characteristics like TSS, total sugar, reducing sugar, non-reducing sugar, acidity, ascorbic acid, protein, carbohydrate, starch, β -carotene, moisture content and organoleptic quality with respect to colour, flavor/aroma, texture and overall acceptability were evaluated and standardized the recipe of mango bar. The treatment of T2 and T3 were standardized by the panelists with the help of 5 Point Hedonic Scale.

Keywords: Mango bar, cassava flour, KMS, physico-chemical.

EFFICACY OF DIFFERENT STRATEGIES OF ZINC APPLICATION FOR CORRECTION OF ZINC DEFICIENCY AND ITS BIOFORTIFICATION IN HYBRID RICE (ORYZA SATIVA)

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Zinc (Zn) is one of the most essential micronutrients required for the growth and development of plant and human beings. More than one billion population, particular infant and pregnant women suffer from Zn deficiency related health and dietary Zn shortage is a global wide nutritional problem in world. Micronutrient deficiencies or “hidden hunger” affect about 38% of pregnant women and 43% of preschool children worldwide and are most prevalent in developing countries. A experiment was conducted to appraise the Zn content of rice grain and straw with and without Zn by the different method of application Zn fertilizer To evolution the performance of different strategies of Zn application on hybrid rice growth, yield and nutrient concentration in plant. This experiment included nine treatments: no Zn, RDF (NPK), soil application, ZnO root dipping, foliar application, soil + root dipping, soil+ foliar, root dipping+ foliar, soil + root dipping +foliar. The results as found that Zn application by different methods, significant increase of different growth stage, in general, plant height, number of tiller, chlorophyll content, number of panicle, length of panicle, grain panicle⁻¹, straw yield, grain yield and 1000 grains Weight. Among the different methods Zn application, 5 kg ha⁻¹ of ZnSO₄·7H₂O (soil application) + foliar application of 0.5% ZnSO₄·7H₂O +lime in tillering and milking stage caused Highest increase in Zn concentration in rice grain of hybrid rice cultivars, followed by soil+root dipping + foliar+lime and root dipping +foliar in hybrid rice.

Keywords: Hybrid rice, Zn deficiency, Zn content, root dipping, foliar spray, Bio-fortification.

ANTAGONISTIC EFFECT OF DIFFERENT *TRICHODERMA* SPECIES AGAINST DIFFERENT SOIL BORNE PATHOGEN IN VITRO CONDITIONS

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The recent challenge in agriculture is to achieve higher yield in an environment friendly manner. Thus there is an immediate need to find eco-friendly solution such as wider opportunities of bio-control agents, like Trichoderma. Trichoderma produces different kind of enzyme which play major role antagonistic activity like cell degradation of cell wall, tolerance to biotic and abiotic stresses, hyphal growth etc. So, we have tested the antagonistic effect of different *Trichoderma* species i.e. *Trichoderma Viridae*, *Trichoderma koningii*, *Trichoderma harzianum* was used against different soil borne pathogens like *Fusarium oxysporum* f. sp. *ciceri*, *Fusarium oxysporum* f.sp. *lycopersici*, *Pyricularia oryzae* in- vitro condition. Among the three species we have found that *Trichoderma harzianum* inhibit maximum percentage about 75.3% the growth of the pathogens.

Keywords : Trichoderma, pathogens

STUDIES ON EFFECT OF ABIOTIC FACTORS ON PRODUCTION OF MILKY MUSHROOM (*CALOCYBE INDICA*)

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Mushroom is now considered crucial component for food safety and security. The phytonutrients in mushroom are now sought after food items. Micro-economy and community engagement in mushroom cultivation is helping rural economy. Urban and semi urban cultivation is also gaining popularity for various edible plants including mushroom and *Calocybe indica* an edible mushroom. Mushroom has been defined as a macro-fungus with a distinctive fruiting body which can be either epigeous or hypogeous and large enough to be seen with naked eye and picked by hand. Mushrooms contain relatively higher amount of good quality protein (27.00%), polyunsaturated fatty acids (1.6-2%), carbohydrates (58.00%), fibers, water (11.50%) soluble vitamins (1-2%) as well as minerals (1-2%) and very low amount of total fat. Mushrooms also have anti-cancerous (carcinostatic), hypolipidemic, hypocholesterolemic, hypoglycemic, hypotensive, immunomodulatory, haematoprotective properties including properties of lowering blood sugars and blood pressure, antibacterial, antiviral and antifungal activities. They are also useful in bioremediation. It grows well at a temperature range of 25-35°C and relative humidity more than 80%, cylindrical polythene bag beds of 15 x 30 cm size and clay loam soil (pH 8.4) were found useful for commercial cultivation. It is a tropical edible fungus and can be cultivated indoor in high temperature and high humidity areas. The experiments were conducted session April 2017 in Mushroom Laboratory of Department of Plant Pathology, Sardar Vallabh Bhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh in completely randomized design. Therefore, these experiments were conducted to explore the role of abiotic factors like temperature, storage of spawn and different organic additive as casing materials in the production and productivity of milky mushroom. Substrates like wheat straw, chickpea straw, cowpea straw and pea straw were also found to be suitable for growing *Calocybe indica*. However, paddy straw the commonly employed material



showed relatively less yield. Substrate pre-treatment, chemical substrate treatment (with Carbendazim 75 ppm + formalin 500 ppm for 16 h) was effective in viability and preservation. Mushroom grows competing and utilizing resources around it in special environment and their commercial conditions creation is importantly for science and society.

Keywords: Abiotic factors Milky Mushroom (*Calocybe indica*), macro fungus, Science and Society

MOLECULAR TOOLS IN PLANT DISEASE MANAGEMENT

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Plant pathogens infect a wide range of plant species and cause great loss in terms of yield and quality. In order to achieve potential yield, disease management is one of the important aspect in the current era. Detection of *plant* pathogens is very essential to improve the strategies for managing *plant diseases* which also provide basis for understanding their biology and appropriate strategies. Molecular tools can play a crucial role for detection. These are classified into Serology or immunoassay based techniques such as flow cytometry, enzyme linked immunosorbent assay (ELISA) and nucleic acid based techniques such as FISH, nucleic acid hybridization, PCR, microarray, isothermal loop mediated amplification (LAMP) and CRISPR. Hence, Molecular tools such as marker assisted selection, genetic engineering and wide hybridization to develop resistant crop cultivars will have a great bearing on future disease management strategies.

Keywords: Detection, Molecular tools, Disease management

EFFECT OF SEED PRIMING WITH PROLINE ON GERMINATION OF RICE (*ORYZA SATIVA* L.) UNDER SALT STRESS CONDITION

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The present investigation was carried to study the effect of seed priming with 1mM, 5mM and 10mM proline on germination of rice (*Oryza sativa* L.) exposed to five level of salinity i.e.0, 50, 100,150 and 200mM NaCl and water. Seeds of ten rice genotypes (IR11, IR12, IR28, USAR2, USAR3, Swarna *sub1*, IR11T172, IR11T220, IRR1147and IRR1154) were procured from diverse origin and primed with proline and studied under various salinity levels. The experimental design based on completely randomized design with three replicates and performs at the laboratory of crop physiology, NDU&T, Kumarganj, Faizabad from July 2015 to Dec. 2015. The exposure of rice seeds to increasing concentration of NaCl had drastically reduced germination (%), seed vigour index and α -amylase activity. It is evident from the result that seed treatment with various concentration of proline significantly increased the germination (%), seed vigour index and α -amylase activity of ten rice genotypes under normal as well as salinity condition. Beneficial effect of seed priming with proline on various traits was more pronounced under salinity than normal condition. Further study has demonstrated that rice seeds pre-treated with proline (1mM, 5mM and 10mM) and grown at different NaCl concentrations counteracted the adverse effect of salt. Pre-treatment of proline at a concentration of 1mM was found to be effective and stimulated cellular activities, whereas 10mM proline was found ineffective to improve germination and biochemical activity under high level of salt (150 and 200mM NaCl).

Keywords: Salinity, rice, proline, germination percent, and α -amylase.

MORPHOLOGICAL BEHAVIOUR OF BARLEY CULTIVARS UNDER DIFFERENT DATE OF SOWING

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Barley is photo and thermosensitive long day plant so it is prerequisite to determine the duration of development phase in a particular environment to achieve higher productivity. Hence, a field experiment was conducted at Wheat and Barley Research Area, CCS Haryana Agricultural University, Hisar during *rabi* 2013-14 to study the effect of different date of sowing on growth and yield of barley cultivars. The experiment was laid out in a split plot design with five dates of sowing (30th October, 10th, 20th, 30th November and 10th December) in main plots and four cultivars (BH 902, RD 2552, RD 2668 and DWRUB 52) kept in sub plots replicated thrice. Growth parameters viz., plant height, dry matter and leaf area index (LAI) decreased significantly with the delay in sowing. Barley cultivar was sown on 10th December resulted in 56.0% and 37.9% reduction in LAI as compared to 30th October sown barley at 30 and 60 days after sowing, respectively. Dry matter accumulation (DMA) in barley was decreased by 28.4% with the delay in sowing from 30th October to 10th December at maturity. Crop sown on 30th October produced significantly higher values of growth parameters but it was statistically at par with 10th November. Grain yield was decreased as barley was sown on 20th November (7.6%), 30th November (13.2%) and 10th December (18.7%) as compared to 30th October. Maximum plant height, DMA and LAI were recorded in cultivar BH 902 than other cultivars at all the crop growth stages. Cultivar DWRUB 52 produced significantly higher grain yield and at par with BH 902. Conclusively, optimum date of sowing (30th October to 20th November) and cultivar DWRUB52 should be preferred for the higher productivity of barley.

Keywords: Barley, Cultivars, Date of sowing, Grain yield

MUSHROOM PRODUCTION TECHNOLOGY: ISSUES AND CHALLENGES IN INDIA

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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. Mushrooms are one such component that not only uses vertical space but also help in addressing the issues of quality food, nutrition, health, and environmental sustainability. Mushroom farming today is being practiced in more than 100 countries, China alone produced more than twenty types of mushrooms at commercial scale. But in India growth of mushroom production industries are very poor. China produces more than 60 percent of world mushroom whereas India contribute only 3-5 percent. In India mostly commercially grown mushrooms are- White button (*Agaricus bisporus*), Oyster mushroom (*Pleurotus spp.*), Paddy straw mushroom (*Volvariella volvacea*), Milky mushroom (*Calocybe indica*) etc. Button mushroom contribute about 70 percent of total mushroom production in India. There are several reasons behind poor growth of mushroom production industries in India like awareness, poor knowledge of advanced production technologies, fear in consumption due to poisonousness or allergies effects etc. Increase in price of raw material, less availability, and poor supply of good quality mushroom spawn. Short of govt. policies and promotion for mushroom cultivation in country. Training programmes and farmer fairs to increase awareness related to mushroom cultivation and their problems like pest and diseases (Die back, wet bubble, Green mold, Bacterial blotch, mite, mushroom flies, mushroom nematodes etc.) incidences, maintenance of environmental conditions during crop period etc. Increase in shelf life of mushroom through different preservative techniques and value added products of mushroom help in promotion of mushroom production and supply for long term.

Keywords: Mushroom production technology, spawn, Button, Oyster, Milky mushrooms

MANAGEMENT OF MUNGBEAN YELLOW MOSAIC VIRUS USING NEWER GROUP OF INSECTICIDAL TREATMENTS

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Mungbean is one of the major pulse crops in India. The Yellow Mosaic Virus disease (MYMV) caused by mungbean yellow mosaic virus (MYMV) is one of the most destructive diseases of mungbean growing areas of northern India. Efficacy of some newer insecticides was recorded on mungbean (*Vigna radiata* L.) during Kharif season 2013-14 and 2014-15 for the management of Mungbean Yellow Mosaic Virus (MYMV) on variety HUM-12, at Agriculture Research Farm, Banaras Hindu University Varanasi. Among the insecticides, Imidacloprid (Hilmida @ 100 g a.i./ha) reduced the disease to a maximum extent having reduction in disease of 63.84 per cent on 60th day after sowing the next effective treatments i.e. thiamethoxam (Tagxone @ 25 g a.i./ha) followed by clothianidin (Dantop @ 20 g a.i./ha), profenophos (Celcron @ 500 g a.i./ha), buprofezin (Applaud @ 200 g a.i./ha), lambda cyhalothrin (Karate @ 40 g a.i./ha) and emamectin benzoate (Missile @ 12 g a.i./ha) per cent reduction in disease of 62.10 followed by 59.32, 56.93, 54.85, 52.30 and 47.52 per cent at 60 day after sowing. While lowest reduction in MYMV was recorded in indoxacarb (Isocarb @ 65 g a.i./ha) and spinosad (Tracer @ 60 g a.i./ha) treated plot with 36.10 and 43.90 per cent during 2013-14 and 2014-15 experimental year. Those insecticide identified in the present study could be used for the control of MYMV disease in mungbean.

Keyword: Mungbean yellow mosaic virus, disease, mung bean, insecticide.

INTEGRATED FERTILIZER PRESCRIPTION EQUATIONS FOR RECOMMENDATIONS OF FERTILIZERS IN HYBRID RICE ON ALLUVIAL SOILS OF ASSAM

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A field experiment was conducted at the Instructional – cum – Research (ICR) Farm, Assam Agricultural University, Jorhat during the year 2016-17 to study Integrated fertilizer prescription equations for recommendations of fertilizers in hybrid rice on Alluvial soils of Assam. In order to develop fertilizer prescription equation, fertility gradient experiment was conducted taking kharif rice (cv. Ranjit) as exhaust crop by creating three fertility gradient strips. After harvest of gradient crop, test crop experiment was conducted in the same field with hybrid rice (cv. US – 382) by superimposing 24 treatment combination consisting of five levels of N (0, 30, 60, 90 and 120 kg ha⁻¹), four levels of P₂O₅ (0, 20, 40 and 80 kg ha⁻¹), three levels of K₂O (0, 40 and 80 kg ha⁻¹) and three levels of vermicompost (0, 2 and 3 t ha⁻¹) in each of these fertility gradient strips. Integrated nutrient management approach brought about a positive influence on organic carbon, soil available nutrient status, crop yield and uptake of nutrients by hybrid rice. Combined application of 120 kg N, 80 kg P₂O₅ and 80 kg K₂O per hectare along with 3 tonnes of vermicompost per hectare resulted the highest available N, P and K as compared to other treatments. The highest crop yield and uptake of nitrogen, phosphorus and potassium by rice was obtained with combined application of 120 kg N, 80 kg P₂O₅ and 80 kg K₂O along with 3 tonnes of vermicompost per hectare. Fertilizer prescription equations were formulated for hybrid rice by following Ramamoorthy's Inductive – cum – targeted yield model. Based on experiment, the nutrient requirement (NR) for producing one quintal of hybrid rice was found to be 2.00 kg, 0.31 kg and 2.35 kg of N, P₂O₅ and K₂O, respectively. The percent contribution of nutrients from soil (CS), fertilizer (CF) and vermicompost (CO) were found to be 35.15, 48.65, 26.50 for N, 47.17, 23.06, 12.08 for P and 60.32, 55.68, 28.69 for K, respectively. Based on NR, CS, CF and CO, the fertilizer prescription equations were developed for hybrid rice (cv. US – 382) and an estimate of fertilizer doses were formulated for a range of soil test values and desired yield targets under NPK alone and NPK plus organics.

IMPACT OF CHITOSAN ON MULTIPLICATION AND ROOTING OF JACKFRUIT UNDER IN VITRO SYSTEM

Divyangana, Ratna Rai, Ranjan Srivastava, K K Misra & Pradyot Nalini

Jackfruit (*Artocarpus heterophyllus* L.) is an evergreen fruit tree. With least attention paid, the crop never fails and the tree gives regular yield with low inputs. An investigation to study the effect of chitosan on the micropropagation of jackfruit was carried out. The effects of seasons, sterilisation procedure, PGRs with and without chitosan on explant establishment, proliferation, elongation, rooting and primary hardening was evaluated. The experimental findings revealed that successful micropropagation of jackfruit cv. Pant Garima can



be achieved with nodal segments collected during winter season. The explants were successfully sterilized with 25% ethanol for 1 min + HgCl_2 @ 0.2% for 5 min and inoculated in medium. Maximum explant establishment (80.00%), number of shoots (10.7), buds (4.6) and shoot length (4.07cm) was obtained with BAP (4mg/l). Additional supplementation of GA_3 (1mg/l) along with BAP (4mg/l) enhanced number of shoots, buds and length of shoots considerably. Chitosan (15mg/l) substituted in media with BAP (4mg/l) reduced the number of shoots, buds and shoot length. However, positive impact of chitosan (10mg/l) with IBA (2mg/l) on rooting percentage, number and length of roots was observed. Cocopeat and vermiculite (1:1, v/v) gave 80 % of plantlet survival after 15 days of primary hardening. Based on overall performance, it was concluded that chitosan can be successfully utilise as a bio-stimulator to improve the horticultural crops under tissue culture studies. However, thorough investigation is necessary.

MYCORRHIZAE; IMPORTANTS AND ITS APPLICATIONS IN PLANT DISEASE MANAGEMENT

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The symbiotic association between fungi and root systems of higher plants are called mycorrhizae, which literally means 'fungus roots'. It was first discovered by a German Forest Pathologist, A.B. Frank (1885) in pine trees. More than 95% of the plant species are infected by the symbiotic fungi. The most preferred plant species for the symbiotic fungi are Acaacia, citrus, legume, sorghum, maize, onion and other grasses. Based on anatomical and morphological features mycorrhizae can be classified in to seven types (arbuscular, ecto, ectendo, arbutoid, monotropoid, ericoid and orchidaceous mycorrhizae). Of these, ectomycorrhizae are the most common among forest and ornamentals trees. Most endomycorrhizal fungi belong to zygomycetes. The endomycorrhizal fungus is also known as VAM (Vesicular Arbuscular Mycorrhizae). Arbuscular mycorrhizal fungi (AMF) are the major components of the rhizosphere of the most plants and play an important role in decreasing the plant disease caused by *Phytophthora*, *Rhizoctonia*, *Pythium*, *Aphanomyces*, *Verticillium*, *Fusarium*, *Macrophomina*. Disease severity could be reduced by root colonization of AMF via several mechanisms including competing plant pathogens for nutrients; production of antibiotics; induction of hydrolytic enzymes; enhancing the PR-protein; induction of phytoalexins and by stimulating defense related enzymes. It is now proved that mycorrhizal fungi greatly enhance nutrient uptake especially phosphorus and improve plant growth and crop productivity. It helps to maximize ecological benefits and minimize environmental hazards. In future, the integrated management by combining biofertilizers, organic manure and bio-control agents may work better for sustainable agriculture.

USE OF SLOW RELEASE CHEMICAL FERTILIZERS IN CROP PRODUCTION

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The necessity of increasing food production to meet the demand of the ever-increasing population in India hardly requires any over-emphasis. With the current level of production (263 million tonne), an additional 5 Mt food grain has to be added each year to the national food basket for the next decade or so to feed the increasing population. The total area under cultivation remained more or less constant (at 140-142 Mha) over the past several decades, and there are indications that the agricultural lands are gradually being diverted to accommodate increased urbanization and industrialization. It is unlikely that sizable additional area will be brought in under cultivation in the foreseeable future. Therefore, the only option left is to increase the crop productivity per unit area. Maintenance of native soil fertility in the intensively cultivated regions of the country is the only option left for maintaining and improving the current crop yield levels. Nitrogen use efficiency is generally <50% and phosphorus use efficiency 10-30% with application of urea, single super phosphate etc. The conventional fertilizer losses dependents most of the processes that nutrients undergo in soil include transformations induced by microbes (N fixation, nitrification, denitrification, immobilization etc.), chemical processes (exchange, fixation, precipitation, hydrolysis, etc.) and physical processes (leaching, runoff, volatilization etc.). The basic concept of slow release chemical fertilizers is that they release their nutrient contents at more gradual rates that permit maximum uptake and utilization of the nutrient while minimizing losses due to leaching, volatilization or excessive growth. Nutrient management through slow release fertilizer is viable tool in improving FUE of applied fertilizers through regulated supply/release of nutrients and synchronizes crop demand.

Keywords: Production, Population, Soil Fertility, Nutrient Management

SEED BIOPRIMING WITH MICROBIAL AGENTS MITIGATING STRESS IN PULSES FOR SUSTAINABLE AGRICULTURAL PRODUCTION

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Pulses are indispensable part of Indian agricultural economy and primary source of proteins and energy for indian population especially for those below poverty line. In the world, the largest producer and consumer of pulses is India with 25% of the global production, 27% of consumption and 34% of culinary purposes. In India, pulses cover 87% of area as rainfed and confined to marginal and sub-marginal lands. For sustainable pulse production in the present deteriorating climate and man-made identical agroecology, integrated package of practices are required for different agro-climatic regions of the country. Biopriming has evolved as a potential agent for stimulating plant growth and managing soil and plant health in a sustainable manner. Biopriming includes treatment with *Trichoderma* and *Bacillus* species to maximize plant growth and disease control has widely been reported. Application of arbuscular mycorrhizal (AM) fungi has been reported to



enhance water tolerance properties in crops. It also increases phosphorus solubilization and uptake in legumes and beans. Plant growth promoting rhizobacteria (PGPR) and fungi (PGPF) are useful soil microorganisms that colonize plant roots improving plant growth parameters by colonizing the developing root system and biocontrol of plant pathogens. Biopriming is an effective alternative which reduces the use of chemicals and the incurring costs entirely or a fraction of it in agriculture. The widely recognized mechanisms of biocontrol mediated by PGPR and others are growth promoting mechanisms such as production of plant hormones, increase in nutrient uptake, control of pathogens, release of soil nutrients and minerals and biotic and abiotic stress has been successfully facilitated by microbial agents after biopriming through competition for an ecological niche or a substrate, production of inhibitory allelochemicals and induction of systemic resistance (ISR) in host plants to biotic and abiotic stresses.

Keywords: biopriming, agroecology, PGPR, biotic and abiotic stress

STUDIES ON POLLINATION AND FRUIT SET IN STRAWBERRY (*FRAGARIA* × *ANANASA*) AND RASPBERRY FRUIT (*RUBUS ELLIPTICUS*) UNDER HILLY CONDITIONS OF UTTARAKHAND

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The study was entitled “Studies on pollination and fruit set in strawberry (*Fragaria* × *ananas*) and raspberry fruit (*Rubus ellipticus*) under hilly conditions of Uttarakhand” was carried out at College of Horticulture, Uttarakhand University of Horticulture and Forestry, Bharsar, during 2015-2016. The different parameter for pollination and fruit set was recorded on the basis of time period. The experiment laid in CRD with 13 treatments and 3 replication of each treatment only in laboratory condition. Amongst different media tested, the average size of pollens (length × width) was maximum $155.52 \times 88.86\mu$ in strawberry while in raspberry $177.73 \times 124.43\mu$ in glycerol conditions, followed by $173.29 \times 173.29\mu$ in water suspension. The highest pollen germination percentage 94.34% and maximum pollen tube length 59.54μ was recorded with T₁₂ (20% sucrose solution + 0.4 % boric acid solution) in strawberry and in raspberrypollen germination percentage (36.66 %) and maximum pollen tube length (284.37μ) was recorded with T₁₂ (25 % sucrose solution + 0.4 % boric acid solution). Best receptivity of stigma in strawberry (100%) had witnessed on the day of anthesis by the fruit set method and the stigma receptivity continued upto one week while in raspberry receptivity of stigma (86.66 %) has been found on the day of anthesis by the fruit set method. The maximum fruit set (88.00%) has been recorded in strawberry under natural pollination, followed by self pollination (64.00%) and in raspberry (96.66 %) fruit set has been recorded under self pollination, followed by natural pollination (76.66 %). The fruit retention in strawberry and raspberry fruit upto maturity in case of natural pollination was 72% and 64.66% respectively.

NEMATODE MANAGEMENT BY USING THE BIOPESTICIDES

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Phytonematodes are tiny, microscopic, worldwide distributed and found in soil. They were having many of the enemies to human being. They causes globally crop loss which is estimated as 100 billion annually crop loss out of which 12.3% by nematodes and 50% by other pests. In a early period of time lot of synthetic chemicals were used by farmers but they are not safer for environment and human being. They causing different type of pollution, soil, water, air etc. so the uses of harmful chemicals have created, Interest for developing the alternative strategies for control of plant nematodes. Recently researchers try to develops variety of Biopesticides for managing the nematode by using Biopesticides. Because it is a emerging one of the primary protection of the crops. Because they are environmentally safe, cheaper, easy handling, fulfill the all requirement of farmers and will also sustainability to agriculture.

NEONICOTINOIDS IN HONEY

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Honey bees are the prominent and economically important group of pollinators with a worldwide distribution. A healthy, diverse floral environment is the recipe for a healthy and copious honey production. Bees rely on nectar and pollen sources for their survival. These nectar will be transformed into honey and stored in hive. A mature colony can have upto 60,000 adults and therefore needs vast amount of food. Individuals harvest nectar and pollen within 4 km of hive, hence the level of pesticide residue in honey clearly indicate the contamination of surroundings. The extensive use of chemical pesticides especially neonicotinoids against insect pest is showing an adverse effect on these pollinators. Neonicotinoids are the most widely used class of insecticides and are systemic in nature. Concerns about the impact of these systemic insecticides on the non-target organisms, such as honey bees has aroused interest. A global view on the worldwide distribution of neonicotinoid contamination in the environment was taken up for evaluating its risk on bees. To build such a map, neonicotinoid concentrations in 198 honey samples from different regions of the world was measured. The survey was conducted on concentrations of five commonly used neonicotinoids - acetamiprid, clothianidin, imidacloprid, thiacloprid, and thiamethoxam showed that 75% of samples contained at least one out of the five tested compounds, 45% of samples contained two or more of these compounds, and 10% contained four or five. Thus it got confirmed that there is exposure of bees to neonicotinoids in their food throughout the world. However, the concentrations detected were below the maximum residue limit for human consumption. The coexistence of neonicotinoids and other pesticides may increase harm to pollinators.



STUDIES ON POPULATION DYNAMICS OF *HELICOVERPA ARMIGERA* (HUBNER) ON CHICKPEA**M.P.Gautam, Dr. Umesh Chandra, Ramveer, S.K.Giri and S.K.Yadav**

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The present investigations entitled “Studies on population dynamics of *Helicoverpa armigera* (Hubner) on chickpea was carried out at Students’ Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad and at farmers’ fields during Rabi, 2016. It is evident from the data that the *Helicoverpa armigera* population was started since the vegetative stage and continued up to maturity stage of the crop. Larvae were found on whole plant. Due to its attack, the leaflets become cup shaped and yellow at the edges. Heavy infestation whole plant become dried and finally defoliate at last. *Helicoverpa armigera* population were noticed for the first time during 46th SW of 2016 and respective mean population were 0.33 larvae/plant. The lowest mean population *H. armigera* is 0.33 larvae/plant was recorded during 46nd and 47th SW at the minimum temperature of 11.8 °C, maximum temperature of 29 °C, relative humidity 67.4 and there were no rainfall. Whereas maximum mean population of *Helicoverpa armigera* population of 5.67 larvae/plant was recorded during 08 SW of 2017 at the minimum temperature of 11.1 °C, maximum temperature of 27.9 °C, relative humidity 63.9 and there were no rainfall.

Keywords: Cold plasma, seed treatment, okra, plant growth, increased yield.**MANAGEMENT OF RICE ROOT KNOT THROUGH PLANT EXTRACTS****MUKESH, SUNIL KUMAR ARSIA, SATISH CHAND, SACHIN KUMAR JAIN**

Rice (*Oryza sativa* L.) is the world’s most important food crop of Asian origin. It is an indispensable source of calorie for almost half of the world population with in Asia. Nematodes are small unsegmented worms live in water, soil, plants and animals. Plant parasitic nematodes are mostly microscopic. It causes significant damage for almost all crops. Nematicidal activity of extracts from plants was assayed against *Meloidogyne graminicola*. In pot experiment extracts from Neem (*Azadirachta indica*), Bael (*Aegle marmelos*), Jatrofa (*Jatropha curcas*), Eucalyptus (*Eucalyptus globus*), Sahjan (*Moringa oleifera*), Ber (*Ziziphus mauritiana*), Sarifa (*Annona reticulata*), Congress grass (*Parthenium argentatum*) were most effective in killing the nematode. The extracts Neem, Bael, Jatropha, Eucalyptus and Congress grass leaf extracts were found significantly increased Shoot length, Root length (cm.) and Root weight (gm.) and reduced root gall in different concentration 100% and 50%. The 100% plant leaf extracts of Neem and Bael showed highest significantly increased plant growth parameters of shoot length 30.23 and 29.50 (cm.), root length 54.00 and 51.33 (cm.), root weight 0.66 and 0.43 (gm.) and highest significantly reduction of root gall 22.66 and 35.33 as compared to treatment (T₁ - Nematode alone). The use of organic amendment will act as an asset to control environmental pollution.

DIVERSITY AND DEVELOPMENTAL BIOLOGY OF RHABDITID NEMATODES FROM SAPHROBIC HABITAT**Hiba Fatima*, Sabia Mumtaz and Irfan Ahmad**

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Nematodes commonly known as roundworms are the most numerous organisms on earth. They fill critical roles in aquatic and terrestrial ecosystems and have significant impacts on agriculture, veterinary medicine and human health. Nowadays, nematodes are increasingly used as biological models for various studies like ecology, developmental biology, cell biology, molecular biology and evolutionary biology. This work deals with the study of diversity and developmental biology of rhabditid nematodes. For light microscopy, the extracted nematodes were heat-killed and fixed in FG fixative, dehydrated and mounted in anhydrous glycerine. For SEM studies, specimens were dehydrated in acetone series, critical point dried using CO₂, mounted on stub, coated with gold and viewed on a JOEL JSM-6510 SEM. For developmental studies, nematodes were cultured on agar medium. Some rhabditid nematodes i.e., *Metarhabditis*, *Cephaloboides*, *Oscheius*, *Rhabditella*, *Teratorhabditis*, *Acrostichus*, *Mononchoides*, *Diplogastrellus*, *Fictor*, *Oigolaimella*, were identified. Comparison of Pre- embryonic and post- embryonic development of three genera was studied in detail. Different embryonic stage starting from single-cell to pretzel stage was observed. The first cleavage was unequal, after the pronuclear fusion, was perpendicular to the longitudinal axis of the egg, and gave rise to a different size of anterior and posterior blastomere. The aim of this study is to better understand these species which have the potential to be used as biological models.

Keywords: Taxonomy, development, Rhabditid, SEM.**META-TOPOLIN INDUCED RAPID IN VITRO AXILLARY SHOOT BUD PROLIFERATION IN *WEDELIA CHINENSIS* L. : A POTENTIAL MEDICINAL PLANT****Mehrun Nisha Khanam* and Mohammad Anis**Plant Biotechnology Laboratory, Department of Botany
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Wedelia chinensis (Asteraceae) is an important medicinal plant used by traditional medicinal practitioners of Bangladesh. This plant is used in treating hepatic disorders, coughs, cephalgia, skin diseases, dyeing and promoting hair growth, cancer and also during uterine hemorrhages and menorrhagia. An efficient regeneration protocol has been set for its multiplication using nodal segment. The nodal explants (1.5 cm) were cultured on MS (Murashige & Skoog, 1962) medium containing meta-Topolin (mT), a new aromatic cytokinin. About 40-45 direct shoot bud appeared per explants when incubated on MS+mT (5.0 µM) which were further enhanced when transferred to shoot growth medium comprised of MS+mT (5.0 µM)+NAA (0.5 µM). In this medium satisfactory growth was achieved in 4 weeks of incubation time. Well developed shoots were



excised from the raised culture and successfully rooted on ½ MS with IBA (0.5µM). The rooted plantlets were hardened initially in the culture room condition, then transferred to net house to acclimatize the plantlets with 90% survival rate.

PRE-BREEDING INTERSPECIFIC HYBRIDIZATION WITH BIOTECHNOLOGICAL APPROACHES FOR CROP IMPROVEMENT.

Sachin kumar, chandan yadav

(Choudhary Charan Singh University Meerut).

Legumes play a energetic role to make certain nutritional food availability to world population and improving soil quality by nitrification. Intensify higher genetic gains is required to meet the want of ever increasing world population. The narrow genetic base of cultivars associated with low utilization of genetic resources is the major factors limiting grain legume production and universal yield. Over use of new and diverse sources of variation is needed for the pre-breeding in legumes grain. Pre-breeding gratify a unique possibility, through the introgression of desirable genes from wild germplasm into genetic inheritance promptly used by the breeders with minimum linkage pull, to overcome this. Genetic enhancement activities likely landraces, wild relatives, Breeding line and cultivated variety have been initiated at International Crops Research Institute for the Semi-Arid Tropics to develop new gene pools in legume with a high frequency of useful genes, increase adaptability, and a wide genetic base. The accessibility of molecular markers will greatly facilitate in reducing linkage pull and increasing the efficiency of introgression in genetic enhancement programs. The use of marker assisted selection can complement conventional breeding by quick selection of desirable traits and increasing selection efficiency. Now a days, molecular markers linked to a gene controlling qualitative and quantitative characters of higher yield, nutritional value of seeds disease resistance, Biotic and abiotic stress. Several *in-vitro* techniques would be very useful for pre breeding. New techniques such as embryo-rescue regeneration, and protoplast fusion assisted interspecific hybridization may be introduced to legume for improving yield and quality.

Key word: legume, wild, germplasm, linkage molecular marker, embryo rescue.

ECR (EFFECTIVE CONSUMER RESPONSE): AN EFFECTIVE TOOL OF AGRICULTURAL MARKETING

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Department of Business Management Dr YSPUHF, NAUNI, SOLAN

In today's competitive era we can't produce the things in general way, we have to analysis about market place and basis on need of consumers we can produce the goods. if we talk about agriculture of developing countries where most of farm population having very small size land holding as comparatively. for maximization of profit in farm business they have to analysis about consumers. Here producers have to think about various aspects like what kind of composition, which variety of specific crop, changes in agricultural practices needed, describe the kind of chemicals as pesticides and fertilizers used at what quantitative level, effects of production practices on environment, producers have to think about health issue of consumers. Producers have to connect with demand. they have to connect those processors and manufacturers which having specific production conditions, by adopting these strategies they can earn more. through adoption of ECR technology farmers will maintain required standards and produce specific commodity in accepted form. through it they will save excess use of input, maintain quality, increase professionalism toward their farm. they can increase value of product. They can market their produce to those processor and end consumer. here farmers can practice ECR in production process by adopting direct contract to processors or higher functionaries of supply chain. they can sell their produce to niche markets where they can describe all specifications and they can earn more. By agreement or contract farming they can reduce post-harvest losses.

Keywords: Effective consumer response, contract farming and niche marketing.

RELEVANCE OF VA MYCORRHIZA IN ENVIRONMENT FRIENDLY AND SUSTAINABLE AGRICULTURAL PRACTICES

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VA mycorrhiza are symbiotically associated with over 90% of the plants including those of agricultural importance and extend several benefits to the host plants. The relevance of AM fungi in resistance against a number of pathogenic micro-organisms, stresses caused by abiotic environmental variables and feasibility of phyto-remediation of heavy metals through mycorrhization of accumulator plants have been emphasized in this review and possible mechanisms of disease resistance in mycorrhizal plants so far reported have been reviewed. The symbiotic bonds between AM fungi and host plants grew stronger during past several millions of years of co-evolution and the host plants have deriving several benefits from this natural association. AM fungi can be safely used for bio-control of plant pathogens. Future studies need more attention and focused researches involving control of pathogenic micro- organisms and pollutants of anthropogenic origins as in some cases increased heavy metals uptake in mycorrhizal plants is reported.

DROUGHT IMPACTS IN AGRICULTURE: WATER CONSERVATION AND WATER SAVING PRACTICES

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Droughts have a wide range of effects on the masses in a developing country like India. The impact of droughts is specifically conspicuous in view of the tropical monsoon character of the country. Rainfall by the south-west monsoon is notorious for its vagaries. The terms water conservation and water saving are generally associated with the management of water resources under scarcity. Very often, both terms are used as synonyms. Water conservation refers to every policy, managerial measure, or user practice that aim at conserving or preserving water resources, as well as combating the degradation of water resource quality. Water saving aims at limiting or controlling water demand and use for any specific purpose, including the avoidance of water waste and the misuse of water. In areas with poor rainfall, there may not be enough water to grow crops reliably. But even in dry years in these areas, more than half the precious rainwater may be lost through evaporation or because it runs off. Conservation agriculture helps conserve water and use it efficiently in at least five ways: more water in the soil, less evaporation, better use of season's rainfall, roots can reach more water and water concentrates in planting lines or pits and the techniques to manage water include: broad beds and furrows, planting basins or pitting, permanent strips, contour bunds and catchment strips, bunds and runoff strips, road catchments and half-moon micro catchments. One word of caution: cover crops also use water. In dry areas, you should consider using other types of mulch, such as crop residues or plant remains brought in from outside the field. That will help conserve moisture in the soil where it can be used by the crop

Keywords: Drought, Water conservation, Conservation agriculture, monsoon, cover crops, mulch broad beds and furrows

RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON TURNIP (*BRASSICA RAPAL.*) CV. PURPLE TOP WHITE GLOBE.

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The Turnip (*Brassica rapa*) belongs to the family *Cruciferae* 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. Turnip 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 P.T.W.G. 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 inance in plant height (7.8 cm), total no. of leaf per plant(17), the number of fully opened leaves per plant(14.5), length of the largest leaves (20.4cm), width of the largest leaf(38.2cm) at harvest. Besides, the fresh weight of root(2.043gm), length of the whole root(25.5cm), diameter of storage root the shoulder point(2.55cm) and total root yield 250 Q/ha. Were recorded under T2(80%RDF+FYM+Vermicompost) followed by T4(60%RDF+FYM+Vermicompost).

EFFECT OF SODICITY ON BIOCHEMICALS OF DIFFERENT RICE VARIETIES

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A pot experiment was conducted at the Net House of Department of Crop Physiology at Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during Kharif season in year 2015 and 2016 to investigate physiological characterization of rice under sodic soil. Six rice variety viz. Narendra Usar Dhan 3, CSR 36, CSR 43, Swarna Sub 1, IR 28 and IR 29 were grown in various sodicity levels i.e. 8.5, 9.0 and 9.5 pH. 21 days old seedlings were transplanted in the pots. Results indicated that biochemical parameters such as chlorophyll, total soluble sugar, starch and protein were decreased with gradual increasing of sodicity levels. Among the varieties, the yield loss due to sodicity was less in CSR 36, CSR 43 and Narendra Usar Dhan 3 than in Swarna Sub 1, IR 28 and IR 29. CSR 36, CSR 43 and Narendra Usar Dhan 3 had a greater tolerance to sodicity than Swarna Sub 1, IR 28 and IR 29.

Keywords: Sodidity, chlorophyll, total soluble sugar, starch, protein and rice

SEED GERMINATION OF COWPEA (*VIGNA UNGUICULATA* L.) VARIETY HIMACHAL LOBIA-1 AS AFFECTED BY RHIZOBIUM PELLEETING DURING ONE YEAR STORAGE

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A lab experiment was conducted during April 2015- April 2016, to study the effects of seed pelleting on seed quality parameters of cowpea variety Himachal Lobia - 1 during a storage period of one year. Seeds were checked for quality parameters at a monthly interval. Two formulations of *Rhizobium* viz a vis powder and liquid along with control (unpelleted) were used for experiment. The analysis of variance revealed that there were significant effects of seed pelleting and storage periods on germination percent, seedling length, seedling dry weight, seed vigour index-I and seed vigour index-II. Seeds pelleted with liquid formulation of *Rhizobium* gave maximum germination (93.55



%) whereas unpelleted seeds gave minimum germination (91.45 %) when seeds were germinated using between the paper method. However, the germination decreased as the storage period increased. It ranged from 94.42 percent germination at 0 month to 89.52 per cent at 12 months of storage. The interaction effects on germination per cent due to seed pelleting and storage periods were found to be non-significant at 5% level of significance. Seed vigour index I was found to be maximum (2980.48) when fresh seeds were pelleted with liquid *Rhizobium* and minimum (2315.58) in unpelleted seeds stored for 12 months. Seed vigour index II also followed the same trend. It was found to be maximum (7451.34) in fresh seeds pelleted with liquid *Rhizobium* and minimum (6310.23) in unpelleted seeds stored for 12 months.

Keywords: seed pelleting, cowpea, *Rhizobium*, Himachal Lobia - 1

MINIMIZING YIELD LOSSES WITH THE FOLIAR SPRAY OF GLYCINE BETAINE AND KNO_3 UNDER DROUGHT STRESS IN RICE (*ORYZA SATIVA L.*)

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The investigation entitled “Minimizing yield losses with the foliar spray of Glycine betaine and KNO_3 under drought stress in rice (*Oryza sativa L.*)” was conducted during the *kharif* season 2015 and 2016 in the Rainout shelter of Student Instructional Farm at 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 9 treatments. The treatments comprised of T₁- Control (Drought exposed at 60 DAT), T₂ Foliar spray of KNO_3 @ 2% at 30 DAT, T₃- Foliar spray of KNO_3 @ 3% at 30 DAT, T₄ Foliar spray of KNO_3 @ 2% at 60 DAT, T₅- Foliar spray of KNO_3 @ 3% at 60 DAT, T₆ Foliar spray of Glycine betaine @ 100 ppm at 60 DAT, T₇- Foliar spray of Glycine betaines @ 200 ppm at 60 DAT, T₈ Foliar spray of KNO_3 @ 2% at 30 DAT and Glycine betaine @ 100 ppm at 60 DAT, T₉- Foliar spray of KNO_3 @ 3% at 30 DAT and Glycine betaines @ 200 ppm at 60 DAT. Results of the experiments indicated that yield characters like Ear bearing tillers plant⁻¹, Panicle length, fertile grains, grain yield and biological yield decreased due to drought but foliar spray of osmoprotectants helps to minimize the losses occurs due to drought stress however the effect of foliar spray of KNO_3 @ 3% at 30 DAT and Glycine betaines @ 200 ppm at 60 DAT was more prominent and found most effective in minimizing the yield losses due to drought by enhancing the antioxidant enzymatic activities like SOD, Catalase, Peroxidase and Proline content in leaves that may act as a scavenging system in drought stress.

So, foliar spray of osmoprotectants like glycine betaines and KNO_3 can be used as a tool to minimize the growth and yield losses occurs due to drought stress.

Keywords: Rice, drought, yield, glycine betaine and KNO_3

INTEGRATED FARMING SYSTEM: A BETTER TOOL FOR SOIL HEALTH AND SUSTAINABLE AGRICULTURE.

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Integrated Farming systems (IFS) and ways of thinking about them, evolved in space and time. Rapid evolution took place in the last two decades when crop and livestock yields increased, together with concerns about their socio-economic and biophysical tradeoffs. Integrated farming system is the system invariably having combination of crop and animal components. Where, the product and byproduct of one component can be used for other component. The demand for food is increasing day by day due to decreased food production; there is continuous conversion of agricultural lands to residential lands and also the number of farmers working in the field is drastically reduced. The primary objective of the IFS is to maintain production of food and other goods and services that contribute to food security and income generation to the rural poor. Other functions that are just as important are achieving environmental sustainability and contributing to agriculture sustainability and ecosystem services. Continuous production of crops without external inputs reduce the ability of the soil resource base to both provide and retain nutrients which often results in a decline in productivity. Integrated farming systems are often viewed as a sustainable alternative to commercial farming systems particularly on marginal lands with the objective of reversing resource degradation and stabilizing farm incomes. Addition of organic residues in the form of animal and plant wastes could also help in improving the soil health and thereby productivity over a longer period of time with lesser environmental hazards. It improves soil fertility and soil physical structure from appropriate crop rotation and using cover crop and organic compost. It reduce weeds, insect pests and diseases from appropriate crop rotation. It improves space utilization and increase productivity per unit area. It provides diversified products.

Keywords: Integrated farming system, organic residues, crop rotation and soil health.

MANAGEMENT OF TOMATO LEAF CURL VIRUS AND ITS VECTOR WHITE FLY (*BEMISSIA TABACI*) IN FIELD CONDITION

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Tomato (*Lycopersicon esculentum* Lin.) is one of the most widely grown vegetables. The notoriety of *B. tabaci* as a pest obscured by its role as an efficient vector of a large number of viral diseases of tomato in the tropical and subtropical parts of the world. Among all, tomato leaf curl virus is shown to be transmitted by the vector, whitefly (*Bemisia tabaci* Genn.) have seriously hampered the cultivation and production of tomato. A pot experiment were conducted during 2015-16 to evaluate the different plant leaf extracts 10% (*Bougainvillea*, Marigold, and Bael),



seed kernel extract 5% (Neem and Jatrofa), plant oils 2% (lemon grass and Eucalyptus) and chemicals (Acetamiprid 0.1%) for management of virus vector white flies (*Bemisia tabaci*). The effect of plant leaf extracts, seed kernel extract, plant oils, bio agent and chemicals were found to be effective for reducing whiteflies population. The maximum decrease number of whitefly was recorded 3.00, 3.67, 1.67, 2.33 in Acetamiprid followed by Neem seed kernel extract 4.00, 4.33, 2.67, 3.00 after 7 and 14 days of first and second spray. Whereas, untreated control was recorded with 13.00, 14.67, 15.00, 16.00 respectively and also reduced the disease severity 62 to 65 % of tomato leaf curl virus, pots treated with Acetamiprid.

STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF TOMATO CV. PUNJAB CHHUHARA UNDER COLD ARID CONDITIONS OF KARGIL.

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Field experiments were carried out to study the effect of integrated nutrient management on growth, yield and economics of tomato variety Punjab Chhuhara at Regional Agricultural Research Sub-Station Kargil, SKUAST Kashmir during 2007 and 2008. The experiment was laid out in randomized block design with nine treatments replicated thrice. The results revealed that application of NPK @ 120:60:60 kg/ha + FYM@20t/ha + two sprays of Copper Sulphate(100ppm) at 40 and 55 days after transplanting significantly influenced the growth and yield of tomato and also gave maximum benefit cost ratio with highest net return.

Keywords: INM, Tomato, growth, yield, Kargil.

STANDARDIZATION OF ORGANIC MEDIA FOR PRODUCTION OF TOMATO (*Lycopersicon esculentum*) CV. INDAM-13

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Keeping in view the importance of cultivation and storage of tomato under the study entitled “ Standardization of organic media for production of tomato (*Lycopersicon esculentum*) CV. Indam -13” was carried out at the Department of Horticulture, North-Eastern Hill University, Tura campus, Chandmari, Meghalaya during 2014-15. The experiment was conducted to study the organic cultivation with different treatments in Randomized Block Design (RBD) with three replications and seven treatments, viz; T1(soil), T2(50%tea dust+50% soil), T3(50% coco peat+50%soil), T4(50% compost+50% soil), T5(25% tea dust+25% coco peat+25% vermicompost+25% soil), T6(25% tea dust+25% vermicompost+50% soil), T7(25% tea dust+25% coco peat+ 50% soil), and T8(control).The results showed that the treatment T2(50% Vermicompost+50% soil was best and found suitable in production of tomato compared to other treatments of organic media. Growth characters like plant height, number of branches, number of leaves were found best in treatment T2. The fruits maintained all the quality attributes like minimum reduction in total soluble solids, total sugar, reducing sugar, acidity and ascorbic acid during the entire storage period.

NUTRIENTS MANAGEMENT IN DRY LAND AGRICULTURE IN INDIA

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Dry lands are characterized by the scarcity of water due to low precipitation and high evaporation from the soil surfaces and transpiration by plants. Extreme variability in rainfall events, nutrient losses due to soil erosion, leaching, nutrient mining, runoff, and lack of integrated nutrient management approaches trigger the full crop production potential of dry land soils, which accounts for 65 (91mha) per cent of net cultivated area and 40 per cent production in India. Chemical fertilizer use by farmers in dry land area is less than that use in irrigated farming. Indeed, cultivated crops in dryland areas deplete the soil nutrients more than the amount of nutrients back to soil causes negative balance of nutrients thus making the soil deficient in major and micronutrients. Therefore, nutrient management in dryland regions is of prime concern. Type, time and method of fertilizer application are most important in dry land area. Application of chemical fertilizers including micronutrient on the basis of soil analysis, combine use of organic manures, compost and crop residues, use of bio fertilizers (e.g. Rhizobium, Azotobacter etc), phosphorus solubilizing microorganisms (e.g. VAM). Inclusion of legumes in crop rotation, and cultivating the legume crops during fallow periods in dryland regions may enhance the soil nutrient supply to upcoming crops. The strategy of conservation agriculture which involves reduced tillage, planned crop rotation and use of crop residue mulch also help enhance the nutrient deposition, cycling and retention within the dryland soils with substantial improvement in soil moisture. Water conservation techniques such as mulching, land levelling, contouring, and terracing should be encouraged and subsidized to reduce the losses of nutrients through erosion and runoff. Use of slow and control release fertilizers, and biological nitrification inhibitors can also improve the fertilizer use efficiency and reduce the losses of nutrients from dryland soils.

Keywords: Bio-fertilizer, Chemical fertilizer, Dry land, Nutrient Management, Organic manure.

NUTRITION EDUCATION AND IT'S IMPACT - A STUDY

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Lack of awareness about the dietary requirements and nutritive value of different food stuffs is the main contributory cause for the widespread occurrence of malnutrition among school going children, pregnant women, lactating mothers and other vulnerable section of the community. Undernutrition amongst women is one of the prime causes of low birth weight babies, and is significant contributor of infant mortality, moreover, low birth weight babies, who survive, are likely to suffer from growth retardation and illness throughout their childhood. So, it is necessary to equip the individual with the ability to make judicious food choices for health and well-being through Nutrition education. Good nutrition is vital for the achievement of the maximum genetic potential of the population. Taking this fact into consideration, this study was conducted in 20 villages, 05 each in district Baghpat, Muzaffarnagar, Gautam Budh Nagar and Bulandshahar of Uttar Pradesh, with an aim to persuade farm women to adopt and sustain improved nutrition and health practices and to take their own decisions, both individually and collectively, to improve their nutritional and health status and environment. From each village, 20 farm women were randomly selected. The data were collected from 400 farm women, with the help of "Questionnaire cum Interview Technique" about their background information, dietary awareness and dietary practices, knowledge regarding personal hygiene and sanitation, agents of contamination, diarrhoea: its causes and prevention. After imparting the nutrition and health education by using educational material such as posters, charts, pamphlets, the same questionnaire was again administered to test nutritional and health knowledge level. A significant difference was observed in the score of pre and post-test of Nutrition Education Intervention. Hence, nutrition education programme should become a part of the community.

NUTRITION GARDEN – AN INNOVATIVE APPROACH FOR SUSTAINABLE AGRICULTURE AND LIVELIHOOD SECURITY

Nidhi Sinha¹ Maya Kumari², Ashok Kumar³,

India is a rich heritage to indigenous fruits and vegetables. Cultivation of these crops by gardening in a systematic manner in small piece of land available in household is known as "Nutrition Garden". Study was conducted in the five villages of Bodhgaya block of Gaya district. Diagnostic survey was conducted for determining effect of nutrition garden. One hundred respondents (50 have nutrition garden and 50 have no nutrition garden) were randomly selected from the beneficiaries of KVK front line demonstration programme on nutrition security. Data collected with the help of interview schedule. The 250 m² area was found appropriate for the family of 4-6 members. The total vegetable production, consumption and calorie intake of respondents were increased by 100 per cent and 53 per cent respectively after implementation of demonstration. Majority of the respondents (40%) earned handsome annual income through nutrition garden. Inadequate access to water supply, limited access to input supply and high input cost were identified as the major problem faced by the farmer's/farm women in management of nutrition garden.

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EFFECT OF DIFFERENT DOSES OF SULPHUR AND BORON ON YIELD, QUALITY AND NUTRIENT UPTAKE OF MOONG BEAN

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Sulphur (S) is an essential plant nutrient. It is required by plants in amount similar to phosphorus (P), thus it is grouped with nitrogen (N), potassium (K) and P as the fourth major plant nutrient. Sulphur is an important component of several essential amino acids and so is important for both protein quality and quantity. Boron (B), a micronutrient also required for normal growth of most of the plants. Boron deficiency severely inhibits pollen germination and pollen tube growth as well as the viability of pollen grains.

A pot experiment was carried out to study the effect of different doses of sulphur and boron at Department of Soil Science and Agricultural Chemistry, Institute of Agriculture Sciences, BHU on Inceptisol deficient in S and B with Moong bean as a test crop. The treatment consisted of four levels of S (0, 10, 20 and 30 kg/ha) and three levels of B (0, 1 and 2 kg/ha) applied from gypsum and borax respectively. 12 treatments were replicated thrice. The data revealed that 30 kg/ha S and 2 kg/ha B significantly increased growth parameters such as plant height, number of branches and chlorophyll content. The same treatment combination proved most effective in improving the yield and yield attributing characters viz., number of pods, number of seeds per pod, seed wt. per plant, test weight,. Application of 30 kg/ha S and 2 kg/ha B produced highest seed along with nutrient content and uptake of nitrogen, phosphorus, potassium, sulphur and boron over rest of the treatments.

Keywords: Essential amino acids, Inceptisol, Test crop, Test weight.

STUDIES ON THE PERFORMANCE OF ONION (*ALLIUM CEPA L*) VARIETY IN WESTERN PLAIN ZONE CONDITION OF U.P.

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K.V.K Saharanpur U.P. (SVPUA&T, Meerut)

Onion is a popular vegetable cum spice crop all over the India. It is grown in 475 hectre area in Saharanpur District, with a productivity of 155 qt/ha . The predominant variety cultivated by the farmers is N-53 & the productivity is low and poor storage quality. Keeping the above point in view and experiment entitled "Studies on the performance of onion (*Allium Cepa L*) variety in Western Plain Zone climatic condition of U.P. was conducted by K.V.K Scientist during the year 2015-16 & 2016-17 at the farmer's field. The experiment compared of two treatment having two varieties Agri found light Red and N-53 and was replicated 5 times. The result on analysis displayed significant variation in character like bulb diameter and yield. The large bulb diameter (5.8 cm.) and higher yield (325 qt/ha was obtained in T2 variety (Agri found light red) followed by T1(Variety N-53) having bulb diameter (4.8 cm.) and yield (266 qt/ha). The yield increased 21.94%. From the basis of above experiment it can be concluded that variety Agri found light red performance better and can be recommended for cultivation by the farmers in place of variety N-53.



STUDIES ON DIFFERENT VARIETAL GERBERA CULTIVATION IN POLY HOUSE FOR BETTER PRODUCTIVITY & INCOME IN SAHARANPUR CONDITION

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Gerbera is a popular cut flower among the floriculture crop all over the India. Gerbera plant produce the flowers whole year under polyhouse condition resulting farmers get income whole year. But farmer are not getting good in due to availability of good varieties. Keeping point in view an experiment entitled "Studies on different varieties Gerbera cultivation in polyhouse for better productivity and income was conducted by KVK, Saharanpur during 2015-16&2016-17 at farmer's field. The experiment comprised of 5 Varieties (Natasha, Ameli, Hawana, Rain grow & Balance) and replicated 3 times. The results and analysis displayed significant variation in characters like flower diameters and flower yield. The larger flowers diameters (7.3cm) and higher yield (32 flower / plant/ year) was obtained varieties Nantasha Rain grow & Hawana followed by varieties cultivated by farmers, Having flowers diameter (4.8cm) and yield (23 flower / plant / years) and self life was much in comparisons to the varieties grown by farmers resulting farmer are getting 10-12 lakh /per year net profit with introduction of new varieties 4000SqM Polyhouse. On the basis of experiment result varieties Amali , Raingrow, Natash, Hawana & Balance are suitable for growing polyhouse condition for better productivity & Income in Saharanpur Conditions.

STUDIES ON DIFFERENT VARIETAL GERBERA CULTIVATION IN POLY HOUSE FOR BETTER PRODUCTIVITY & INCOME IN SAHARANPUR CONDITION

Dr. B.P.Shahi SMS(Horti) , Dr. Satya Prakash Professor (Horti)cum Head& Ashok Kumar
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A field experiment conducted for two consecutive year(2015-2016& 2016-2017) with a view to assess the response of early cauliflower variety (Sabour Agrim) based on different locational trails in Saharanpur district during the Kharif season. The trails were conducted in Multiplication trials in entire district and compared with the farmers practice varieties Dector. The results revealed that transplanting of early Cauliflower Variety (Sabour Agrim) had significant effect on growth and yield of Cauliflower followed by maximum plant height (66.4cm), the best marketable size of curd (452.9gm), maximum curd length(14.9cm), diameter of curd (16.5cm) and the maximum yield (204qt/ha.) over local cultivar(145.6qt/ha.). Farmers can gain a handsome profit by growing "Sabour Agrim" adopting the transplantation and agronomic practices. The potentials of the improved Cauliflower variety for higher yield and income were communicated to the farmers through demonstrations.

"INTEGRATED EFFECT OF DIFFERENT ORGANIC MANURES ON YIELD SUSTAINABILITY AND QUALITY OF WHEAT VARIETIES."

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Wheat (*Triticum aestivum* L.) is number one cereal crop of the world and is grown on the largest area. It is an unique crop among cereals and the staple food of the world's poor. Wheat grain is mostly used for food purpose (55%) followed by feed grain (33%). It contains about 10-12% protein, 3% fat and 70% carbohydrate. The chemical driven farming target only higher yield is proved to degrade the natural resources, therefore now a days concept of higher yield is change towards sustainable agriculture. Organic farming is one that conserved the natural resources and produce good quality crop. The area under organic farming in 2005 was around 42000 ha in India which is increased more than 30 times in present day. Treatments are:- Variable-I: Varieties V1: Wheat (var. UP-368), V2: Wheat (var. UP-2003). These are timely sown, irrigated and N-E Plain Zone Varieties. Variable-II: Solid organic manures- M0: Control, M1: 100% RDN through NADEP + Jivamrut 900 litres, three split, M2: 50% RDN through NADEP + Jivamrut 900 litres, three split. Variable-III: Liquid organic manures - L0: Control, L1: Seaweed 4%, three split, L2: Enriched banana pseudostem sap 2%, three spray. Total number of treatments are twelve. The design used is randomised block design (RBD) and the number of replications are three. The plot size: 10m x 8m = 80m². Total no. of plots = 36. Spacing: 22.5 cm x 10 cm (irrigated wheat). Seed rate: 100-125 kg/ha. RDF: N -120 kg/ha, P₂O₅ - 60 kg/ha, K₂O-40 kg/ha (Eastern UP). The recommended dose of N in the form of NADEP as per the treatments will be given at the time of sowing. Jivamrut will be given in three split, each of 300 litres at 20-25 days interval, starting from sowing. Spraying of liquid organic manures as per the treatments will be applied at 30, 60 and 90 days after sowing. Soil and plant samples will be collected after harvest of the crop and analysed by adopting standard methods. The observations to be recorded are growth and yield, quality, nutrient content and uptake of N, P, K, Fe, Mn, Cu and Zn and soil analysis for BD, O.C., available N, P, K, Fe, Mn, Cu and Zn. The grain yield of wheat varieties increased on application of organic manures with N and P fertilizers. The amounts of both organic C and total N will be observed higher in soils receiving organic manures with fertilizers and lower in fertilized and control. The application of organic manures alone or in combination with NP fertilizer decreased the soil pH and increased the EC due to accumulation of soluble salts. N, P and micronutrient uptake will increased due to application of different organic manures with N, P as compared to fertilized and control. The protein and starch content will show significant increase in organic manures treated soils as compared to control. The sustainability in wheat production can be achieved through application of different organic manures with N and P fertilizers.

Keywords: solid organic manures, liquid organic manures, wheat varieties, yield sustainability

ORGANIC FARMING AND ITS IMPACT ON CROP PRODUCTIVITY, FOOD QUALITY AND ENVIRONMENT

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Green revolution has increased the food grain production of our country 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. So to protect the environment and to get sustainable yield, organic farming is an alternative to this intensive cultivation (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. Organic farming methods rely on organic inputs and recycling of farm waste for nutrient supply, emphasize cropping system design and soil biological processes for pest management and ban applications of synthetic fertilizers and pesticides and hence may reduce negative effects attributed to conventional farming. In general, during the initial years of transition from conventional to organic farming, a decline in yield is seen which can be attributed to requirement of time for the adaptation of soil biological activity to a new situation. Food quality is a very complex term and several past investigations suggest that production system can affect crop quality. Reduced availability of nitrogen and no use of pesticides create stress on plants that enhance the synthesis of active phyto-chemicals such as phenols, flavonoids and anti-oxidants which enhance the quality of food. The potential environmental benefits of organic farming are in the areas of better soil health, carbon sequestration, maintenance of bio-diversity, reduced energy requirement per unit area, reduced nitrate leaching and emission of nitrous oxide. Thus, adoption of organic farming would promote agricultural diversification and sustainable crop production, augment family income as well as can solve environmental issues.

Organic farming: a way towards environmentally friendly farming

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Organic farming provide better alternative option for high input farming that use synthetic fertilizers, fungicides and pesticides. It protects environment, offers higher resilience to environmental changes, increases farmers' income, reduces external input cost, enhance social capacity and increases employment opportunities. As well as enhancing food security primarily by increasing the food purchasing power of local people. It is based on holistic concept, living soil concept and healthy plant concept. It is mostly excluded the use of synthetic fertilizer, pesticide, growth regulators, livestock feed additives and genetic modified organism. Organic agriculture relies on crop rotation, animal manures, crop residues, green manures and the biological control of pests and diseases to maintain soil health and productivity. Basic principles of organic farming are health, ecology, fairness and care for humans as well as whole ecosystems. Thus organic farming is a holistic production system that considers long-term environmental sustainability and primarily aims to produce food in an environmentally friendly manner. Environmental benefits of organic farming include biodiversity conservation, better quality of soil, reducing evaporation and water harvesting, strengthening adaptation strategies and reducing greenhouse gas emissions as well as energy efficiency. In spite of this benefits organic farming faces many challenges *ie.*, low yield, nutrient management, certification and market, education and research.

Study of behaviour and orientation modifying cues of *Coccinella transversalis* Fab. on cowpea aphid *Aphis craccivora* Koch

Rakshith H. S., Sachin S. Suroshe., Suresh M. Nebapure., Subhash Chander and Sweetee Kumari

Cowpea, *Vigna unguiculata*, is an important vegetable legume crop in many tropical regions of the world. The cowpea aphid, *Aphis craccivora*, Koch is a key pest of the crop, nymphs and adults feed gregariously on tender plant parts causing malformations, stunting and drying up of the parts and act as vector for several mosaic viruses. Coccinellid predator, *Coccinella transversalis* provide important ecosystem services as bio-control agent and contributes in the regulation of cowpea aphid. The behaviour of natural enemies is greatly influenced by the diverse chemical cues present in the ecosystem especially in host plant and pest. The behaviour and orientation modifying cues from host plant and pest play key role in the process of host selection and acceptance by predators. Thus, for the first time we conducted an experiment to understanding the orientation behaviour of *C. transversalis* on cowpea aphid. Y-tube olfactometer studies of both male and females *C. transversalis* were tested against both Hexane and DCM extracts *viz.* Uninfested Leaves (UL), With Out Aphid (WOA), With Aphid (WA) and Aphid Only (AO). Highest numbers of beetles were moved towards WA extracts followed by WOA, AO and UL extract for both Hexane and DCM solvents. Among the different concentrations, 10% proved very effective concentration than others. The least time was recorded for 10 % concentration followed by 15, 5 and 20% in both hexane and DCM by male and female *C. transversalis*. GCMS analysis of WA extracts in hexane shown the presence compounds *Viz.*, Octane, 5-ethyl-2-methyl-Nonane, 5-butyl-Tetracosyl acetate *etc.*, Similarly, in DCM, we obtained compounds Octacosanal, Nonadecanol, 2,6,11-trimethyl-dodecane *etc.*, and these compounds could be responsible for eliciting attraction in predator towards WA extracts of both Hexane and DCM. Synomones (cowpea plant) and kairomones (aphid body) played a vital role in orientation behaviour of *C. transversalis* to locate Cowpea aphid.

STUDY OF BEHAVIOUR AND ORIENTATION MODIFYING CUES OF COCCINELLA TRANSVERSALIS FAB. ON COWPEA APHID APHISCRACCIVORA KOCH

Rakshith H. S., Sachin S. Suroshe., Suresh M. Nebapure., SubhashChander and SweeteeKumari

Cowpea, *Vigna unguiculata* is an important vegetable legume crop in many tropical regions of the world. The cowpea aphid, *Aphis craccivora* Koch is a key pest of this crop, Nymphs and adults of aphid feed gregariously on tender plant parts causing malformations, stunting and drying up of the parts and act as vector for several mosaic viruses. Coccinellid predator, *Coccinella transversalis* provide important ecosystem services as bio-control agent and contributes in the regulation of cowpea aphid. The behaviour of natural enemies is greatly influenced by the diverse chemical cues present in the ecosystem especially in host plant and it's prey. The behaviour and orientation modifying cues from host plant and prey insect play key role in the process of host selection and acceptance by predators. Thus, for the first time we conducted an experiment to understand the orientation behaviour of *C. transversalis* on cowpea aphid. Y-tube olfactometer studies of *C. transversalis*



male and females were studied against both Hexane and DCM extracts from healthy cowpea leaves, cowpea leaves infested with aphid, only aphid injured leaves and body extracts of aphids. The least time was recorded for 10 % concentration followed by 15, 5 and 20% in both hexane and DCM by male and female *C. transversalis*. GCMS analysis of Hexane and DCM extracts shown the presence compounds Viz., Octane, 5-butyl-Tetracosyl-acetate and Octacosanal, Nonadecanol, 2, 6, 11-trimethyl-dodecane etc., respectively and these compounds could be responsible for eliciting attraction in predator towards the extracts. Our study suggested that synomones (volatiles from cowpea plant) and kairomones (volatiles from aphid body) played a vital role in orientation behaviour of *C. transversalis* to locate Cowpea aphid.

Keywords: *A. craccivora*, *C. transversalis*, GC-MS, Volatiles, Orientation, Olfactometer.

IMPROVING GROWTH, BIOCHEMICAL CHARACTERISTICS AND ESSENTIAL OIL PRODUCTION OF *VETIVERIA ZIZANIOIDES* L. NASH BY THE FOLIAR APPLICATION OF RADIATION PROCESSED CHITOSAN AND METHYL JASMONATE

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Vetiveria zizanioides L. Nash (family-Poaceae), also known as vetiver or khus, is currently one of the most economically important medicinal and aromatic plants. Some of the important components of the oil include khusimol, α -vetivone, β -vetivone, iso-valencenol etc. PGRs play a crucial role in regulation of plant growth and secondary metabolite production in plants. Methyl Jasmonate (MeJA) is a [volatile organic compound](#) used in plant defense and many diverse developmental pathways such as seed germination, root growth, flowering, fruit ripening and [senescence](#). Chitosan is derived from chitin, a polysaccharide found in exoskeleton of shellfish such as shrimp, lobster or crabs and cell wall of fungi. It is a polysaccharide called 2-Amino-2-deoxy-beta-D-glucosamine. Recently, a new agro-technique has been evolved in which it has been proved that if natural polysaccharides (e.g. alginate, carrageenan and chitosan) are exposed to gamma radiation, they are depolymerized into various oligomers. When aqueous solution of these oligomers is applied to the plants, it proves as potent plant promoter. A pot experiment was conducted to study whether MeJA and the chitosan oligomers can boost the essential oil (EO) production or change the essential oil quality of vetiver? The treatments were: a water sprayed control, 25 ppm MeJA, 80 ppm irradiated chitosan (IC) and MeJA (25 ppm)+IC (80 ppm). Of these treatments MeJA was found to reduce the chlorophyll and carotenoid contents. However the EO content and yield per plant was found to increase. On the contrary, IC was found to enhance all the growth, biochemical as well as yield parameters. The combined treatment was found to be equally significant with IC though the yield was more in the combination treatment. Thus the technique proves helpful in enhancing the EO content and yield of the plant.

IMPORTANCE OF PREDATORY NEMATODES IN ORGANIC FARMING

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Nematodes are important components of soil ecosystems, but have so far received little attention in organic farming. Many free-living nematodes are important for decomposition and mineralization processes, and it is estimated that the nematode grazing of bacteria would mobilise up to 124 kg N/ha/yr. When farmers are adding organic matters to the soil, organic residues must be decomposed to release nutrients for plant to uptake. Decomposition of organic matter in a soil can be divided into two channels, a faster bacterial channel and a slower fungal-based channel. Soil ecosystem types and nutrient forms (e.g., Carbon to Nitrogen ratios or C:N ratios) determine the predominant decomposition channels. Although bacteria and fungi are the primary decomposers in the soil food web, these microbes also can immobilize inorganic nutrients in the soil, making nutrients unavailable for plants to uptake. As an extension of these decomposition channels, when the bacterivorous and fungivorous nematodes graze on these microbes, they give off CO₂ and NH₄⁺ and other nitrogenous compounds, affecting C and N mineralization directly. Indirectly, nematodes can disseminate microbial propagules throughout the soil, which advances the colonization of substrates and mineralization of nutrients. Furthermore, their feeding activities on the rhizoplane may reduce microbiological immobilisation of nitrogen. Predatory nematodes contribute to nitrogen mineralization by feeding on other nematodes. Under field conditions these nematodes are estimated to contribute to 8% and 19% of the nitrogen mineralization in conventional and integrated farming systems. In organic farming, nematode monitoring is a prerequisite for management. Effective control measures of plant parasitic nematodes and good management systems for beneficial nematodes would allow for increasing yields and improved quality. Organic farming puts new challenges to the science of nematology, and would profit from a close interaction between nematology and soil science.

Keywords: Organic farming, Predatory nematodes, Ecosystem, Mineralization processes, Beneficial nematodes

EVALUATION OF SOME INSECTICIDES AGAINST CITRUS PSYLLA, *DIAPHORINA CITRI* KUWAYAMA ON SWEET ORANGE

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A field experiment on evaluation of some insecticides for the control of citrus psylla, *Diaphorina citri* Kuwayama conducted at the experimental orchard, Department of Horticulture, CCSHAU, Hisar during 2015-16 revealed that among the different insecticidal treatments, imidacloprid (200 SL) @ 20 g a.i. /ha, clothianidin 50 WDG @ 25 g a.i. /ha, dimethoate 30 EC @ 468.7 g a.i. /ha proved to be most effective



treatments followed by the monocrotophos 36 WSC @ 450 g a.i./ha, quinalphos 25 EC @ 250 g a.i./ha, spinosad 45 SC @ 0.17 g a.i./ha, novaluron 10 EC @ 0.14 g a.i./ha whereas NSKE 5% @ 5ml/l were found to be least effective against the pest.

Keywords: Evaluation, insecticides, *Diaphorina citri*, sweet orange

PLUS TREE SELECTION AND PROGENY TESTING OF MAHANEEM (*AILANTHUS EXCELSA* ROXB)

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The vital importance of mahaneem in present day context in terms of its multiple uses in general and lack of information on its genetic aspects especially plus tree selection and progeny testing promoted the present study. The study was conducted by collecting seeds from plus trees representing different eco-geographical regions of Haryana, Rajasthan and Gujarat on the basis of economically desirable traits. A total of 21 morphologically superior trees (plus trees) were selected and sufficient amount of good quality ripened fruits were collected from these trees. Then the collected seeds were grown in nursery of Department of Forestry, Chaudhary Charan Singh Haryana Agricultural University, Hisar. A considerable amount of variation for different morphological characters such as height (9.4 m to 22 m), clear bole height (2.1 m to 4.2 m), girth at breast height (58.4 cm to 114.1 cm) etc. was found among twenty one diverse plus trees for morphological traits. The height exhibited a positive and highly significant correlation with clear bole height, girth at breast height (gbh), height of crown and positive significant association with height: gbh ratio. However, height displayed a negative and highly significant correlation with clear bole: total height ratio. Ample genetic variation was also observed for field emergence, seedling height, basal diameter, root length and number of branches among the progenies of the selected plus trees. Considering several desirable traits simultaneously, the progenies of plus trees from Palsana (Rajasthan), Jhunjhunu (Rajasthan), SK Nagar (Gujarat) and Ajitpura (Haryana) appeared promising than others under study. High heritability coupled with genetic advance was found in field emergence and seedling dry weight.

Keywords: Plus tree, Progeny testing, Heritability and Genetic advance

EVALUATING DIFFERENT PRE AND POST HERBICIDES FOR CONTROLLING BARNYARD GRASS (*ECHINOCHLOA GLABRESCENS*) IN DIRECT SEEDED RICE

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A field experiment was conducted during *kharif* 2012 at Students' Farm Kaul campus (Kaithal) CCS Haryana Agricultural University, Hisar to evaluate different pre and post emergence herbicides for controlling Barnyard grass (*Echinochloa glabrescens*) in direct seeded rice. As barnyard grass is problematic weed in direct seeded rice, its effective control is necessary to get higher yield in direct seeded rice. Use of single herbicide did not provide effective control during the critical period of crop growth, so it becomes imperative to use herbicides in sequence to get effective control during early crop growth period. Two pre-emergence herbicides (pendimethalin 1000 g/ha and oxadiargyl 100 g/ha) alone or in combination with four post-emergence herbicides (bispyribac-Na 25 g/ha, fenoxaprop 67 g/ha, ethoxysulfuron 18.75 g/ha and chlorimuron-ethyl + metsulfuron-methyl 4 g/ha RM) were used along with weed free and weedy check. Among different herbicidal treatments, pre-emergence application of pendimethalin 1000 g/ha *fb* bispyribac-Na 25 g/ha and chlorimuron-ethyl + metsulfuron-methyl 4 g/ha RM gave minimum weed density (8.5), minimum weed dry weight (84.1) and highest weed control efficiency (80.9 %) at 75 DAS along with higher yield attributes (effective tillers 209.3, no. of filled grains/panicle 83.7, 1000-grain weight 27.3 g), B:C (2.37) and yield (3967 kg/ha)

Keywords: B:C, herbicides, weed control efficiency, weed density, weed dry weight, yield, yield attributes

SEASONAL INCIDENCE OF *HELICOVERPA ARMIGERA* (HUB.) IN RELATION TO ABIOTIC FACTORS IN CHICKPEA

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The field experiment was conducted on *Helicoverpa armigera* (Hubner) in chickpea during *Rabi*, 2016-17 at B.E.D.F and laboratory experiment in Bio control laboratory, Department of Entomology, S.V.P.U.A & T, Meerut, U.P. *Helicoverpa armigera* is a major pest of chickpea and weather factors are the major regulating causes for the insect pest population under field conditions and laboratory reared larvae used for the study of insect pathogens, plant resistance factors, effects of insecticides and radiations on fecundity and growth and its own biology. Adult population of *H. armigera* was found maximum during 9th standard week and larval population of *H. armigera* found active throughout the crop season and peak larval population of *H. armigera* was recorded during 11th standard week.

EFFECT OF SOME INSECTICIDES AND BIO-PRODUCTS ON COCCINELLIDS AND SPIDER POPULATION IN MAIZE

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An investigation to study the effect of some insecticides and bio-products on coccinellids and spider population in maize was carried out for two consecutive seasons *i.e.* 2013 and 2014, at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. Nine treatments with insecticides and bio-products were tested in a randomized block design with three replications. Effect of different



insecticides and bio-products viz. Imidacloprid 70WS@5 g/kg seed treatment, Thiamethoxam 70WS@2 g/kg seed treatment, Carbofuran 3G@12 kg/ha soil application, Phorate 10G@10 kg/ha soil application, NKSE@5%, Cow urine@5%-NSKE@5%, Imidacloprid 70WS@5 g/kg seed treatment -NSKE@5% and Thiamethoxam 70WS@2 g/kg seed treatment -NSKE@5% were tested on coccinellids and spider population. Two soil application and sprays by knapsack sprayer were done at 7 and 21 DAE (Days after emergence), to compare the effect of some insecticides and bio-products on coccinellids and spider population. The incidence of coccinellids and spiders was recorded at 20, 40 and 60 DAE till the maturity of crop from five randomly selected plants per plot from six inner rows. Result revealed that the bio-products was found to be safer to spiders and coccinellids. Among all the treatments NSKE@5% prove the more safer insecticides to the spider and coccinellids than other treatments. The second safer treatment to the spider and coccinellids was Cow urine@5%-NSKE@5% while treatment Carbofuran 3G@12 kg/ha soil application proved highly toxic to coccinellids and spiders population.

MECHANISM OF *TRICHODERMA HARZIANUM* AS A BIOCONTROL AGENT IN DISEASE MANAGEMENT

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Fungal species belonging to the genus *Trichoderma* are worldwide in occurrence and easily isolated from soil, one of the most interesting aspects of the science of biological control is the study of the mechanisms employed by biocontrol agents to effect disease control, this biocontrol agent have the potential of nonchemical property. Mycoparasitism and Antibiotic (Toxin) Production, *Trichoderma* know that one of the most salient characteristics of the group is their ability to parasitize other fungi i.e. *R. solani* and *P. ultimum* Competition and Rhizosphere Competence, Rhizosphere competence is important because a biocontrol agent cannot compete for space and nutrients if it is unable to grow in the rhizosphere. *Trichoderma* species, either added to the soil or applied as seed treatments, grow readily along with the developing root system of the treated plant. Enzymes, such as chitinases, amylase and glucanases produced by the *T. harzianum* and these are responsible for suppression of the plant pathogens. *T. harzianum* also effective against *Botrytis cinerea* on bean leaves. It is also concluded that hyphae of the biocontrol fungus penetrated the epidermis and upper cortex of the plant root. Metabolism of Germination Stimulants, pathogen propagules were induced to germinate by artificial means.

Keywords: Mycoparasitism, Antibiotic, Competition, Enzymes, Germination Stimulants.

INTEGRATED WEED MANAGEMENT IN DIRECT SEEDED RICE

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The area under direct-seeded rice systems is expected to increase in the future because of labor and water shortages. Weeds, however, are the major biological constraints to direct-seeded rice production. Weed management is the major challenge in direct seeded rice and failure to control weeds result in yield losses ranging from 50-90 %. Moreover, seedling of some grassy weeds such as *Echinochloa crusgalli* look similar to rice seedling, making hand weeding more tedious, difficult and less effective. Weeds compete with crops for solar radiation, nutrient and soil moisture when they are limiting and the early season competition is the most critical. When improved agricultural technologies are adopted, efficient management becomes even more important for obtaining the maximum productivity and benefits. To achieve effective, long-term and sustainable weed control in direct-seeded systems, there is a need to integrate different weed management strategies, such as the use of a stale seedbed practice, the rotation of different direct-seeded systems, the use of crop residue as mulches, the use of weed-competitive cultivars with high yield potential, appropriate flooding depth and duration, appropriate agronomic practices (row spacing, seeding rates, and manual or mechanical weeding), and appropriate herbicide mixtures, timing, and rotation. The long term approach to integrated weed management should reduce the extent of weeds and reduce the weed seed stock in the soil. A single weed control approach may not be able to keep weeds below the economic threshold level, and may result in weed flora, resistant development and environmental hazards. For example, if a herbicide is used over a long period of time, a weed species can build up a resistance to the chemical. Therefore, adoption of diverse technology is essential for weed management because weed communities are highly responsive to management practices.

KEYWORDS: Weed, direct seeded rice, long term approach, sustainability, productivity

DIVERSITY ANALYSIS IN A CORE COLLECTION OF INDIAN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Diversity analysis provides opportunity to assess genetically important distinct traits that will be contributing to improvement of genotypes. Genetic diversity assess in a core collection is key to find out ways to efficient utilization of genetic resource. Indian bread wheat cultivars spanning over a century is procured from the Indian Institute of Wheat & Barely Research (IIWBR), Karnal, used made up of a core collection. A characterization of DUS descriptors and analysis of core collection by traditional and multivariate methods. The present



investigation was carried out with a view to know the degree of genetic diversity, association among yield attributing characters in bread wheat (*Triticum aestivum* L.) at the agro-morphological level. The experimental material consisted of ~100 genotypes which were evaluated in an Augmented Randomized Block Design. DUS descriptors were used to discriminate genotypes during germplasm evaluation. Descriptors like waxiness on plant parts, foliage colour, flag leaf attitude and seed size considerable amount of variability. Quantitative characteristics were recorded to record variation in genotypes at agro-morphological level. The data were subjected to appropriate statistical analysis for estimation of mean, range, variance, heritability, genetic advance as percentage of mean and correlation. Quantitative characters like no. of grain per spike, no. of spikelet per spike and test weight have significantly contributing to yield. These characters have huge amount of genetic variation, high GCV and PCV value, highly heritable, GAM and positive significant correlation with yield. PCA and cluster analysis of eight characters and genotypes fall into three principal component and three cluster respectively. Based on analysis, first and third cluster genotypes have associate with yield component and great chances to enhance their characters. Second cluster genotypes have lower than average characters. Avoid use of second cluster genotypes to reduce the time, cost and labour.

Keyword: Diversity Analysis, bread wheat

NEMATODE AS BIOINDICATORS FROM ORGANIC-ENRICHED HABITATS

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Nematodes are the most abundant mesofauna on planet earth inhabiting every possible biotypic zone. Abundance of nematode taxa are specific to particular type of habitat having specific environmental conditions. Some taxa are highly tolerant to perturbation and some are specifically susceptible. Due to these attributes they can serve as potential bioindicators for monitoring various ecosystem. Samples were randomly collected from different organic- enriched habitats viz., organic manure, dead and decaying plant material, humus, dung, compost and organically fertilized fields. Order Rhabditida had the maximum representation followed by Monhysterida, Plectida, Chromodorida, Araeolaimida and Enoplida. The high presence of bacterivore nematodes particularly from families Rhabditidae, Diplogastridae and Panagrolaimidae is an indicative of high enrichment and bacterial decomposition pathway. These r-selective opportunists indicate towards disturbance and utilize abundant resources as colonizers to build up their populations. *Teratorhabditis* sp., *Panagrolaimus* sp., *Acrobeloides* sp., *Monhystera* sp., *Plectus* sp. and *Achromodora* sp. were observed in large numbers and can be recognised as indicators of disturbed habitat. The disturbances may be due to anthropogenic activity, waste organic enrichment and eutrophication. While k-selective nematode groups like Dorylaims, Mononchs and Enoplids viz., *Eudorylaimus* sp., *Discolaimus* sp., *Mylonchulus* sp., *Tobrilus* sp. and *Ironus* sp. were also observed in most of the samples. The co-existence of lower cp value bacteriovores with higher cp value omnivores and predators may be due to absence of edaphic physical disturbances. These predator species may serve as indicators of less disturbance in soil food web providing ecosystem services by regulating population of opportunistic species. Thus, composition of the nematode communities may be used as indicators of soil health and offers an instrument for soil health management.

Keywords: nematode, bioindicators, organic enriched, ecosystem.

INTEGRATED WEED MANAGEMENT IN DIRECT SEEDED RICE

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The area under direct-seeded rice systems is expected to increase in the future because of labor and water shortages. Weeds, however, are the major biological constraints to direct-seeded rice production. Weed management is the major challenge in direct seeded rice and failure to control weeds result in yield losses ranging from 50-90 %. Moreover, seedling of some grassy weeds such as *Echinochloa crusgalli* look similar to rice seedling, making hand weeding more tedious, difficult and less effective. Weeds compete with crops for solar radiation, nutrient and soil moisture when they are limiting and the early season competition is the most critical. When improved agricultural technologies are adopted, efficient management becomes even more important for obtaining the maximum productivity and benefits. To achieve effective, long-term and sustainable weed control in direct-seeded systems, there is a need to integrate different weed management strategies, such as the use of a stale seedbed practice, the rotation of different direct-seeded systems, the use of crop residue as mulches, the use of weed-competitive cultivars with high yield potential, appropriate flooding depth and duration, appropriate agronomic practices (row spacing, seeding rates, and manual or mechanical weeding), and appropriate herbicide mixtures, timing, and rotation. The long term approach to integrated weed management should reduce the extent of weeds and reduce the weed seed stock in the soil. A single weed control approach may not be able to keep weeds below the economic threshold level, and may result in weed flora, resistant development and environmental hazards. For example, if a herbicide is used over a long period of time, a weed species can build up a resistance to the chemical. Therefore, adoption of diverse technology is essential for weed management because weed communities are highly responsive to management practices.

KEYWORDS: Weed, direct seeded rice, long term approach, sustainability, productivity

GENETIC VARIABILITY AND ITS IMPLICATION IN SELECTION OF ELITE LINES OF CHICKPEA (*CICER ARIETINUM* L.)

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The present investigation was undertaken to assess the genetic variability which provides strong and broad genetic base to the genotype and helps the breeders by bringing improvement in quantitatively inherited traits, which will directly affects the yield. The field experiment was



conducted in randomized completely block design with three replications during rabi 2016-17 at Seed Breeding Farm, College of Agriculture, Jabalpur (M.P.) with seventy elite lines of chickpea from different sources during rabi 2016-17 in randomized completely block design. High phenotypic coefficient of variation and genotypic coefficient of variation recorded for seed yield per plant, followed by number of effective pods per plant, total number of pods per plant, biological yield per plant, height of the first fruiting node and 100 seed weight. High heritability estimates coupled with high genetic advance as percentage of mean were recorded for seed yield per plant, total number of pods per plant, biological yield per plant, height of first fruiting node, number of effective pods per plant and high heritability coupled with low genetic advance as percentage of mean was recorded for days to 50% flowering and days to pod initiation. Selection of these traits may be effective for the improvement of chickpea. Such results indicated, predominantly the presence of additive gene action in the expression of these traits which will enable the breeder to select plants on the basis of phenotypic expression of these characters for the development of promising genotypes in future.

Keywords- Genetic Variability, Phenotypic coefficient of variation, Genotypic coefficient of variation, Heritability, Genetic Advance

ASSESSMENT OF BIO- MANAGEMENT POTENTIAL OF SOME CARNIVOROUS FUNGI AGAINST ROOT- KNOT DISEASE OF BRINJAL (*SOLANUM MELONGENA L.*)

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Root-knot nematode *Meloidogyne incognita* is famous for its highly destructive pathogenic effect that can result in extensive damage of brinjal crop. Chemical nematicides are widely used for the control of plant- parasitic nematodes. However, chemical nematicides are associated with environmental hazard, high costs, and limited availability in many developing countries. Since many nematicides have recently been withdrawn due to their harmful effects on humans and the environment, alternative management strategies are required. Biological management of soil borne plant pathogens have shown to be a potential alternative. In search of the fungal natural enemies of *M. incognita* for the management of the root- knot disease in brinjal, seven species of carnivorous fungi were isolated from agricultural and horticultural soil. Three species of carnivorous fungi namely *Arthrobotrys conoides*, *Dactylellina geophyropaga* and *Drechslerella brochopaga* were studied in detail with special reference to their adoptability in soil and bio management potential at different doses. *A. conoides* was found fast growing followed by *D. brochopaga* and *D. geophyropaga* on corn meal agar medium. Conidia of all the three carnivorous fungi applied into agricultural soil had good germination ranged from 88.8-96.46%. *D. brochopaga* formed conidial traps whereas *D. geophyropaga* formed adhesive branches on growing hyphae. No trap formation observed in the growing hyphae of *A. conoides*. Three species of carnivorous fungi were studied for their nematophagous ability against second stage juveniles of *M. incognita* under *in vitro* condition. *D. brochopaga* was found more carnivorous by formation of higher number of traps and trapping of *M. incognita* (J₂). Maximum trapping was observed during the nematode interface of *D. brochopaga* and *M. incognita* followed by *D. geophyropaga* and *A. conoides*. Application of 5000 colony forming units per g. of soil in *M. incognita* infested soil caused reduction 69.58 % in number of root- knot by *D. brochopaga* followed by *D. geophyropaga* (58.86%) and *A. conoides* (50.48%). Lowest reduction in number of root knots and number of J₂ was observed by application of 50 CFU of *A. conoides* per g. of soil.

Key word: Nematode, Root-knot, Carnivorous, Brinjal, Soil born plant pathogens.

RESPONSE OF BIO-ENHANCERS ON THE PLANT GROWTH AND YIELD OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS*)

IFTM University, Moradabad (U.P.)

Department of Agricultural Sciences & Engineering

Rahul Sah*, Sharvan Kumar*, Dheeraj Yadav and Satish Yadav*

The present investigation entitled. "Response of bio-enhancers on the plant growth and yield of cauliflower (*Brassica oleracea* var. *botrytis*)" was carried out during winter season of 2016-17 at Agricultural farm, Department of Agricultural Sciences & Engineering, IFTM University, Lodhipur Rajput, Moradabad (U.P.) in Randomized Block Design with three replications. Different combinations of *Panchgavya* (4%) *Jivamrita* (20%) and vermiwash (1:5 times dilution) with RDF (N: P: K: 120:30:30) and control were used as treatment. Observations were recorded on vegetative and yield parameters. On the basis of observations recorded, it is found that the performance of the RDF (N:P:K::120:30:30) was better in all vegetative and yield parameters such as plant height (26.73cm), number of leaves (14.67), leaf length (21.53cm), width of leaf (12.10cm) at 15, 30 and 45 DAT and yield attributes viz. whole plant weight (1341g), curd weight (544g), curd length (9.49cm), curd diameter (14.19cm), stem length (8.95cm), stem weight (48.87g), stem diameter (6.69cm), and yield (29.04t/ha.). the values for the characters. plant height (26.30cm), number of leaves (14.53cm), leaf length (21.53cm), width of leaf (11.91cm) at 15, 30 and 45 DAT and yield attributes viz. whole plant weight (1290g), curd weight (488g), curd length (8.70cm), curd diameter (13.75cm), stem length (8.83cm), stem weight (47.30g), stem diameter (6.21cm), and yield (27.06t/ha.). Were recorded nearly similar in a treatment combination of bio-enhancers T₅ *Panchagavya* (4%) + Vermiwash (1:5 times dilution) to the RDF. The treatment T₅ (4% *Panchagavya* + 1:5 times dilution of Vermiwash) came out as the best combination for growth and yield characters of cauliflower for commercial production because Organically produced vegetables fetch higher price in the market therefore, even if the yield is low with organic inputs, it can be recommended for the commercial production of cauliflower in account of human health, soil health, environmental health and quality product instead of quantity.



EVALUATION OF SELECTED CARROT CULTIVARS FOR THEIR RESISTANCE/SUSCEPTIBILITY AGAINST ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA***Faryad Khan*, Mohd. Asif, Amir Khan, Moh. Tariq, Taruba Ansari and Mansoor A. Siddiqui**

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Root-knot nematodes (*Meloidogyne* spp.) are considered as the most damaging nematode pest in the world as they induce high yield losses to most cultivated crops in tropical and subtropical regions. A greenhouse study was conducted to evaluate the response of 13 carrot cultivars to *Meloidogyne incognita* inoculated with 2000 second stage juveniles (J2) per pot. All the tested cultivars behaved differently in relation to plant growth parameters and nematode infestation over their controls. Cultivar Kamini was found highly susceptible as it showed maximum root-knot index (5.0) and egg masses per root system (131) thereby resulted in maximum reduction in shoot and root length (47.6 % and 50.2 %), shoot and root fresh weight (44.7 % and 49.1 %); whereas cultivar Golden Rosy was observed resistant with least RKI (1.2) and egg masses per root system (6) thereby resulted in minimum reduction in shoot and root length (11.6 % and 13.8 %), shoot and root fresh weight (16.5 % and 13.2 %). The order of susceptibility was Kamini > Selection 80 > Sindhuri > Lali > Noorie > Rose Red > Kamboj > Surbhi > Super Red > Pearl Red > Desi Red > Red King > Golden Rosy. Similarly the cultivars Selection 80, Sindhuri, Lali and Noorie were found susceptible while the cultivars Rose Red, Kamboj, Surbhi, Super Red and Pearl Red were found moderately susceptible as evident from RKI and egg masses and reductions in growth parameters. Two cultivars Desi Red and Red King were found moderately resistant as they showed less damage by the nematodes. The screenings of carrot cultivars are recommended to resource-limited producers as better options for enhanced and sustainable crop yields.

Keywords: *Meloidogyne incognita*, Resistance, Root-knot index (RKI), Screening, Susceptibility**ENHANCING GROWTH, YIELD AND QUALITY OF CHICK PEA (*CICER ARIETINUM* L.) THROUGH APPLICATION OF MICRONUTRIENT UNDER IRRIGATED CONDITION****C.B.Verma, Shashank Srivastav and Mohd. Aslam**

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An experiment was conducted during rabi 2015-16 and 2016-17, in micro plot at Department of Crop Physiology C.S.Azad University of Agril. & Tech. Kanpur-2, Uttar Pradesh, (India). To study the effect of micronutrients (Iron, Mo and B) significantly increased growth yield and quality of chick pea varieties (Uday KPG59), Awarodhi and KWR-108. Result revealed that application of RDF(20:40:40NPK) + Iron @ 8kg/ha. (ferrous sulfate), + Mo @ Sodium molybdate 0.5kg/ha. Significantly increased seed yield (qu/ha.), Chlorophyll content (mg/g of fresh weight), protein (%), NR Activity, Plant height (cm), Branches/plant was significantly have in comparison to control (RDF).

EVALUATION OF POTATO PROCESSING QUALITY AND BEHAVIOUR OF INDIGENOUS AND EXOTIC CULTIVARS DURING STORAGE WITH CIPC**Bandana¹, Vineet Sharma¹ and Manoj Kumar¹**¹ICAR-Central Potato Research Institute Regional Station, Modipuram, Meerut-250110 (U.P.)-India

In the Indian diet potato is one of the most popular food item and India is one of the largest producer of potato. Besides being used as a daily food item in various vegetable preparations and today it increasingly finds use in the form various processed products. This experiment was conducted for determination of processing quality and storage behaviour of four indigenous varieties viz., Kufri Chipsona-1, Kufri Chipsona-2, Kufri Chipsona-3, Kufri Himsona and two exotic processing varieties namely Atlantic and Lady Rosetta. The experimental design was completely randomized with three replications. The crop was harvested at their respective days of maturity, skin cured and stored at 10-12°C with two CIPC treatments. Samples were analyzed for their processing quality parameters at monthly intervals till 180 days of storage. Among the six varieties, Kufri Himsona remained in acceptable colour range (<4.0) up to 60 days of storage. Kufri Chipsona-3 also maintained chip colour up to 120 days except at 30 and 90 days of storage. The mean values of sucrose content, an indicator of chemical maturity of all the selected samples was at par at zero day of storage and came down to almost 50% at '90' days stage and then increased at '150' days of storage. Immediately after harvest, maximum free amino acid was observed in Kufri Chipsona-3 (654.3 mg/100g FW) followed by Atlantic (611.2 mg/100 g FW). The increase in total free amino acids at later stages of storage can be ascertained to the initiation of break in dormancy of tubers.

STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN OAT**Charupriya Chauhan and S.K. Singh**

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The present investigation was comprised of eight promising diverse parents and their all possible 28 F₁'s, developed through crossing eight parental lines in diallel mating design (excluding reciprocals). All genotypes were evaluated in a complete randomized block design with three replications at Crop Research Center (Chirodi) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during rabi season 2015-16 and 2016-2017. Analysis of variance for the experiment and for parents and F₁s showed highly significant differences among the treatments for all the ten characters viz., days to 50 % flowering, plant height, number of leaves per plant, leaf area, number of tillers per plant, stem girth, number of green pods per spike, length of spike, leaf stem ratio and green fodder yield per plant which indicates that wide genotypic difference among the parental lines and F₁'s cross combinations. Highest percentage of genotypic and phenotypic coefficient of variation (more than 25%) were recorded for number of leaves per plant, number of tillers per plant, leaf stem ratio and green fodder yield per plant. Estimates of phenotypic coefficient of variation were generally higher than their corresponding genotypic coefficient of variation for all the attributes.



The high values of genotypic and phenotypic coefficient of variation for these characters, suggested that there was a possibility of improvement of fodder yield through direct selection. High heritability (>60%) was observed for days to 50 % flowering, number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per spike, length of spike, leaf stem ratio and green fodder yield per plant. The high degree of heritability estimates for these characters suggested that the attributes were under genotypic control. High (>20%) genetic advance expressed as per cent of mean estimated for number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per spike, length of spike and green fodder yield per plant, suggesting good response for selection based on *per se* performance. High heritability coupled with high genetic advance as percent of mean was noted for number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per spike, length of spike and green fodder yield per plant, which indicated that these characters are controlled by additive gene action. Direct selection of these attributes will be effective and profitably for yield improvement.

COMBINING ABILITY IN OAT (*AVENA SATIVA* L.)

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The present investigation entitled “Studies on combining ability and heterosis in oat (*Avena sativa* L.)” was undertaken to assess the information on genetic parameters for green fodder yield and its components from a eight diverse parents i.e. Kent, OS6, JHO-99-2, JHO851, OS403, OL125, UPO212 and NDO612 using diallel mating design. The experimental material for the present investigation was comprised of eight promising diverse parents and their all possible 28 F_1 's, developed through crossing eight parental lines in diallel mating design (excluding reciprocals). All genotypes were evaluated in a complete randomized block design with three replications at Crop Research Center (Chirodi) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during *rabi* season 2015-16 and 2016-2017. The observations were recorded on ten characters viz., days to 50% flowering, number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per plant, length of spike, leaf stem ratio and green fodder yield per plant. The study revealed that parents JHO851 was found good general combiner for maximum eight characters including green yield per plant, OL125 for eight character and NDO612 for eight characters, may be used in the hybridization programme aimed at development of superior genotypes. Out of 28 F_1 's hybrids twelve best cross combinations, viz., Kent x OS6, Kent x JHO-99-2, Kent x JHO851, OS6 x UPO212, JHO-99-2 x JHO851, JHO-99-2 x OS403, JHO 851 x OS403, JHO851 x OL125, JHO851 x NDO612, OS403 x OL125, OL125 x NDO612 and UPO212 x NDO612 exhibited significant and positive specific combining ability effects along with good *per se* performance for green fodder yield per plant and also showed significant positive specific combining ability effects for some other important yield components characters. These cross combinations may be exploited in suitable breeding device for the some attributes. On the basis of overall results and *per se* performance the four F_1 's hybrids i.e. Kent x OS6, Kent x JHO-99-2, OL125 x NDO612 and UPO212 x NDO612 were emerged to be as best specific combiners for maximum attributes including green fodder yield per plant for 8-9 other contributing traits, which may be utilized for obtaining transgressive segment in the next generation.

HETEROSIS FOR YIELD AND YIELD COMPONENTS IN OAT (*AVENA SATIVA* L.)

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Study of heterosis in twenty eight different hybrids of oat resulting from 8x8 diallel, excluding reciprocals indicated pronounced hybrid vigour for yield and most of the yield components. All genotypes were evaluated in a complete randomized block design with three replications at Crop Research Center (Chirodi) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during *rabi* season 2015-16 and 2016-2017. The observations were recorded on ten characters viz., days to 50% flowering, number of leaves per plant, leaf area, plant height, number of tillers per plant, stem girth, number of green pods per plant, length of spike, leaf stem ratio and green fodder yield per plant. Out of 28 F_1 's, 15 cross combination expressed high heterotic response with significant and positive heterosis and among these four crosses viz., Kent x JHO851, Kent x UPO212, JHO-99-2 x JHO851 and UPO 212 x NDO612 showed heterosis per cent more than 27% over better and mid parents for 8-9 attributes. These crosses which showed very high level of heterosis can be exploited further in future breeding programme to develop high yielding genotypes in forage oat. As above cross combinations may be exploited for heterosis breeding programme. Since these hybrids involve high x high or high x average or average x average or average x low or low x low gca value of parent and significant sca effect for involved of non additive gene action and response of dominance and dominance x dominance type of gene effect. A high heterosis result for yield might be obtained by exploiting these individual cross for developing hybrids through heterosis breeding programme.

REDUCTION IN POLLUTION LOAD DURING BLEACHING STUDIES OF *L. LEUCOCEPHALA* BY XYLANASE ENZYME PRODUCED BY *C. CINEREA* RM-1 NFCCI-3086

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The present study was done to analyze the effect of crude xylanase extracted from *C. cinerea* RM-1 employed in different bleaching sequences and its effect on optical properties, and pollution load generated during bleaching of kraft pulp of *L. leucocephala*. The reaction conditions i.e. enzyme dose, reaction time and pulp consistency were optimized during enzymatic prebleaching. The effect of xylanase treatment on pulp of *L. leucocephala* was studied under multistage conventional, ECF and TCF bleaching sequences. The filtrates were analyzed for release of



reducing sugars and chromophores. The pulp was analyzed for kappa number, viscosity and brightness (%), ISO. A xylanase dose of 5 IU/g, reaction time of 120 min and pulp consistency of 8% were found to be optimum conditions of enzyme for prebleaching. Xylanase also causes the release of reducing sugars along with chromophores from the kraft pulps of *L. leucocephala* and depicts the bio-bleaching potential of xylanase obtained from *C. cinerea* RM-1. The pulp showed reduction in kappa number and improvement in brightness during all bleaching sequences as compared to untreated pulps, after pretreatment of xylanase. The total chlorine demand was reduced by 15.3% for kraft pulp of *L. leucocephala* bleached by XECEHH and XECEHHP sequence as compared to CEHH and CEHHP. Similarly, the total chlorine demand of XODED and XODEP bleaching sequences is reduced by 24.64% as compared to controls (ODED and ODEP). The AOX in combined bleach effluents of pulps bleached by different conventional and ECF bleaching sequences was also reduced as a result of xylanase pretreatment as compared to their controls.

EFFICACY OF ORGANIC AMENDMENTS AGAINST DRY ROOT ROT PATHOGEN *RHIZOCTONIA BATATICOLOA* OF CLUSTERBEAN [*CYAMOPSIS TETRAGONOLOBA* (L.) TAUB.]

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Cluster bean (*Cyamopsis tetragonoloba*) has been grown in India since ancient time for vegetables and fodder purposes. Guar, a versatile crop with industrial uses and export potential, has transformed economic status of large number of farmers. In recent years, it suffers severely from the vagary of diseases caused by fungi and bacteria. Dry root rot caused by *Rhizoctonia bataticola* is the major disease responsible for its low productivity in Haryana and Rajasthan. An experiment was carried out in the Department of Plant Pathology, CCS Haryana Agricultural University, Hisar during 2015-16 to study the efficacy of organic amendments against dry root rot pathogen *Rhizoctonia bataticola* of Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.]. Six organic amendments viz., neem cake, mustard cake, cotton cake, vermicompost at a dose of 2g/kg soil, poultry manure and mushroom spent compost (SMS) at a dose of 5g/kg soil were tested against *R. bataticola* under screen house conditions. The results revealed that minimum disease incidence of 36.9 per cent and 39.9 per cent was recorded when the soils were incorporated with mustard cake followed by cotton cake as compared to the highest disease incidence of 66.7 per cent in control pots of clusterbean cv. HG-365. Soil application of four organic amendments viz., mustard cake, neem cake, cotton cake and vermicompost reduced pre-emergence plant mortality as compared to control (no soil application), whereas, all the six organic amendments reduced the post-emergence plant mortality as compared to control. Poultry manure and mushroom spent compost could protect only 15 per cent and 19.9 per cent plant mortality respectively, as compared to control.

RATE OF DECOMPOSITION OF PLANT LITTER

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It is well established fact that litters of different plants do not decompose at the same rate under similar environmental conditions. The difference may be due to anatomy nutrient status and the possible production of substances toxic to microorganisms. In the present study the rate of decomposition of wheat crop residues was investigated, expressed in terms of percentage loss in the dry weight of material initially placed in the litter bags. The different components of wheat crop residues viz., internode, leaves, chaffs and straw were separated and filled in nylon bags and placed in soil for 90 days. The amount of different components decomposed during the time intervals, absolute decomposition rate per day (ADR) and relative decomposition rate per day (RDR) was recorded. Out of four components leaves took least time for decomposition followed by chaff, straw and internode.

Keywords: Decomposition, wheat, chaff, straw, leaves and internode, ADR, RDR.

EFFECT OF BIO-CONTROL AGENT TRICHODERMA ON WILT

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Organic matter input such as household waste composts and composted cow manure reduce disease severity because the enrichment of compost with *trichoderma* spp. has been also proposed to enhance their suppressive capacity of Fusarium (causing wilt) and other soil borne diseases we have therefore investigated the potential of different composts to suppress Fusarium and also seek new potential antagonists (*trichoderma* spp) and screened in in-vitro and in-vivo assays for their bio-control capabilities. The temperature effects growth of fungus at different temperature. In *Trichoderma* unique medium at specific optimum pH and orbital shaker is used at 150 rpm for 10 days. The suitable [temperature](#) that stimulate the growth of biomass production was favourable the growth of *Trichoderma*. In the last few years, commercially available *Trichoderma* products biopesticides, biofertilizers and soil amendments have been used as part of environmental friendly protocols to defend crops against plant pathogenic organisms and to increase yields. Despite the commercial successes of these microbial-based fungicides, the major limitations remain their restricted efficacy and inconsistency under field conditions. Consequently, more efficient *Trichoderma* strains with high capabilities are needed for successful biological control systems. However, understanding the genetic variability within *Trichoderma* strains and their biological and biochemical activities are necessary to improve the selection of the different isolates



as biocontrol agents. Information could be valuable for development of new bio-fungicides to control tomato Fusarium wilt disease without using synthetic fungicides. Vegetables and spices have a vital importance in a balanced diet and are the cheapest source of carbohydrates, vitamins, minerals and proteins. Amongst spices, chilli an interspecies hybrid chilli cultivated. Explore the techniques for mass culture and enhance survivability of these antagonists in different organic substrates and develop effective biological formulations are becoming priority research for most of the agricultural scientists associated with biological management of crop diseases.

Keyword: Bio-control, Fusarium, Compost, Biomass, crop diseases, environmentally-friendly practices.

ANTIFUNGAL ACTIVITY OF ANGIOSPERMIC PLANTS AGAINST *PHYTOPHTHORA INFESTANS* (L)

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Emerging losses caused by late blight of potatoes need new approaches to control *Phytophthora infestans*. Potato is an important vegetable crop which is cultivated all over the world and is highly affected by *Phytophthora infestans* at low temperature and high humidity. In severe case whole field converted into burnt blacken field. Many chemical fungicides are used to control this pathogen but these fungicides also affect soil and water microflora and environment become affected. Present study focused to avoid these adversely affects on environments and used green materials like plant extracts to control phytopathogenic fungi *Phytophthora infestans* that cause late blight of potato. Some plant extracts showed highly effective activity while some of them were not effective at all.

Objectives: Application of plant extracts (toxin free method to control late blight pathogen).

Materials and methods: Some plants are collected from the field of Meerut and Hardwar region and powdered after drying at 60°C overnight in the oven and powdered green materials were subjected to convenient process: soxhlet extraction unit (Viro et al., 2007). Solvent prepared at different concentrations and discs applied on potato leaves after inoculating pathogen on leaves (Heatley, 1944).

Result: *Terminalia* sp and *Psoralea* sp showed encouraging result while some plant extracts were not effective.

Conclusion: Plant extracts are fully safe to the environment and not toxic to anyone.

Keywords: Ecofriendly, *Phytophthora infestans*, Botanicals, phytopathogenic fungi.

EVALUATION OF TOMATO GENOTYPES FOR GROWTH, YIELD AND QUALITY ATTRIBUTES

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Field experiments were conducted in (2015-16) at Department of Vegetable Science, College of Horticulture, Bengaluru, Karnataka. The main objective was to assess growth, earliness, yield and quality attributes of 238 genotypes of tomato. These 238 genotypes collected from AVRDC, Taiwan, IIVR, Varanasi, NBPGR, New Delhi and SAU of India and other institutes, Karnataka. The experiments were carried out in augmented design with ten plants in each treatment. The experimental field was fairly leveled land with red sandy loam soil of uniform fertility status. The seeds of tomato genotypes were sown in January-15, in the pro trays of 98 cells at nursery, Department of Vegetable Science, COH, Bengaluru. Four week old seedlings were transplanted in the main field at the spacing of (60x 60 cm). All the package of practices recommended by UHS, Bagalkot were followed. Among the early ness parameters like days to first flowering (13 days) and days to 50 per cent flowering (19 days) the genotype- 5404 reported superior hence, this genotype useful in heterosis breeding program. In case of growth parameters like plant height at harvesting, maximum height (202.33cm) was reported in genotype-29P4, number of branches per plant at harvest (12.67) maximum was reported in genotype-49. Fruit characters like, fruit width (8.15cm) and average fruit weight (131.95 g) was found maximum in genotype-H-86, in case fruit length (7.45cm) maximum was found in genotypes-EC-321426, for number of locules per fruit (13) was highest in genotype- EC-501580 and pericarp thickness (7.42 mm) highest at genotype- AOTD-10, yield per plant (6.47 kg) was highest was found genotype-4P1, for quality parameters like total soluble solids (7°B) was highest in genotype- AR-56 and maximum firmness (6.25mm) was found in genotype- AOTD-18. Among the tomato genotypes for their growth (Genotype-5404), yield (Genotype- AOTD-10) and quality parameters (AOTD-18) were found promising under Bengaluru condition of Karnataka.

STUDY ON DETECTION OF ADULTERANTS OF MILK

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Since very old days, adulteration of water in milk was common practice. But nowadays, greed of the milk seller is increased to that extent; they started adulterating milk by very harmful commodities like urea, detergent powder, etc. Even it, synthetic milk is also became common at present. A number of adulterants are presently being used for milk adulteration viz Starch, Cane Sugar, Saccharin, Gelatin, Detergent, Pulverized Soap, Frozen Fat, Ammonium Sulphates, Salicylic Acid, Benzoic Acid, Hydrogen Peroxide, Glucose/Mono Saccharides, Formalin, Urea, Sodium Chloride, Neutralizer and Water. Methods of detection were studied then standardized for these adulterants. Most suitable, easy, fast, and low cost based methodology were reviewed for better results and most easy, cheap, and less time taking methods of detection is recommended to minimize adulteration hazards.

Keywords: Neutralizers, Saccharin, Urea, Pulverized Soap, Adulteration, Detection.



MODULATION OF SENESCENCE AND POSTHARVEST PERICARP BROWNING IN LITCHI**Kalyan Barman^{1*}, Md. Wasim Siddiqui² and Muneshwar Prasad³**¹Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi – 221 005, Uttar Pradesh, India²Department of Food Science and Post-Harvest Technology, Bihar Agricultural University, Sabour, Bhagalpur – 813 210, Bihar³Department of Horticulture (Fruit & Fruit Technology), Bihar Agricultural University, Sabour, Bhagalpur – 813 210, Bihar, India*Corresponding author E-mail: barman.kalyan@gmail.com

Litchi (*Litchi chinensis* Sonn.) is one of the most important subtropical fruit of high commercial value due to its pleasing flavoured juicy aril and refreshing taste. However, its bright red attractive pericarp colour turns brown rapidly within a couple of days after harvest, which negatively affect its external appearance and consumer acceptability. Postharvest sulphur dioxide fumigation is commercially practiced to prevent pericarp browning in litchi. But, this treatment is now in question due to undesirable chemical residues that alter the fruit taste and also causes health hazards for consumers and pack-house workers. In this study, the efficacy of some biologically safe treatments was evaluated to delay senescence, thereby reduce pericarp browning and extending its shelf life. Litchi fruits were treated with ascorbic acid (1%) or chitosan (1%) by immersion method, packed in low density polyethylene (LDPE) film and stored at low temperature (2°C). Control fruits were treated with distilled water and stored at 2°C without packaging. Results revealed that litchis packed in LDPE following ascorbic acid (1%) treatment was highly effective in reducing pericarp browning by delaying moisture loss and destruction of anthocyanin pigments up to 30 days of storage while, fruits under control become completely brown just after 3 days of storage. Ascorbic acid treatment also delayed senescence of the fruit as evidenced by higher membrane integrity and lower malondialdehyde content. This treatment was also proved its effectiveness in preserving nutritional quality attributes of litchi fruit up to 30 days of storage.

PREDICTION OF WHEAT YIELD USING CROP SIMULATION MODEL (CERES-WHEAT) FOR DEHRADUN DISTRICT OF UTTARAKHAND**Pawan Mall*, A.S. Nain, R.K. Singh and Neha Sharma**

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Wheat is the staple food crop of Uttarakhand and is grown in *rabi* (winter) season in plains and higher hills. However, due to inter annual variability in weather conditions, the large amount of year-to-year variability in productivity and production of wheat is observed. Therefore, there is a need to develop a system for timely and accurate estimation/prediction of productivity and production of wheat for major wheat growing area of Uttarakhand.

Wheat yields were evaluated during the period (2000-01 to 2013-14) using CERES-Wheat model to simulate seasonal yield variability and forecast wheat yield prediction (2014-15 and 2015-16) of Dehradun district in Uttarakhand. Yield deviations (Ydobs) from single linear technology trends (Yobs) (Period 2000-01 to 2013) were used along with year-wise deviations in simulated yields (Ydsim) from its simulated yields (Ysim) of fourteen-year period (2000-01 to 2013-14) used for yield prediction. The deviations of simulated to the deviation of trend wheat yields during 2000-01 to 2013-14 and its relationship signified the importance in predicting the trend yield with RMSE = 143.13, absolute per cent error 7.19 and further explain the direction and magnitude of predicted yield for the period (2014-15 and 2015-16).

Keywords: CERES- Wheat, yield deviations and trend yields.

ATTITUDE OF FARMERS TOWARDS MAIZE FARMING**Nandita Kumari (Subject Matter Specialist, Home Science)**

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Study undertaken in three village of Dankhora block of Katihar District (Bihar) revealed that majority of the respondents had shown their positive attitude towards usefulness of maize crop. The respondents had the view that cultivation of the crop is of expensive enterprise and not profitable for small farmers. They also realized that recent maize production technologies are lacking.

Bihar is one of the largest maize growing State and other crop was grown primarily as a subsistence crop to meet food needs for a long time till recently. But now like in nontraditional Area (Karnataka and Andhra Pradesh) is also grown for commercial purpose (i.e. mainly to meet the raw material requirement of the animal feed sector). It is third largest maize producing state contributing around 10 percent to national production. Maize can be utilized in much different form by converting it into a variety of products through grinding, alkali processing, boiling, cooking and fermenting such as corn, starch, corn flakes and cereal etc. It also has much industrial application, which can make it a profitable crop in the state. Maize processing and utilization pattern shows that in India. Around 60 percent of the total produce is for animal feed, 28 percent for human consumption and 12 percent is used by the industry (starch, brewery etc). In Bihar only 8-10 percent of maize (5% directly by the processor and another 3-5% is being used by road side snacks, joints etc) is processed within the state despite the fact that the state has huge and rising marketable surplus.

Hence the socio economic and Psychological attributes of farmers involved in maize farming has been recognized as an important segment of human resource management.

In order to formulate a suitable strategy for increasing production potential capacities of maize crop through effective farmers involvement in maize farming. It has been decided to assess the attitude of farmers engaged in maize cultivation.



DEVELOPMENT OF TRICHODERMA BASED NOVEL BIO-FORMULATIONS WITH INCREASED SHELF LIFE FOR THE MANAGEMENT OF SOIL BORNE PATHOGENS

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Insect, pest and diseases are the major constraints for achieving higher production in agriculture. The use of microorganisms to control plant pathogens, known as biological control is now in practice. It is accepted as a suitable and environmentally friendly alternative or a supplemental way of reducing the use of chemicals in agriculture against plant disease management. Therefore, the present studies have been proposed with the main focus on the identification of *Trichoderma* based novel bio-formulations to replace chemicals in fertilizing soils and improving plant resistance against phytopathogens. A total of 8 *Trichoderma* species viz; *T. harzianum*, *T. asperellum*, *T. koningiopsis*, *T. virens*, *T. reesei*, *T. koningii*, *T. atroviride* and *T. longibrachiatum* were isolated from soil samples collected from 12 districts of Uttar Pradesh and sent to Indian Type Culture Collection (ITCC), New Delhi for confirmation. The isolated and identified strains of the *Trichoderma* sp. were characterized based on cultural, morphological, physiological, biochemical and molecular analysis to study the growth pattern, characteristics of the mycelium / spores, nutritional behavior, physiological and phylogenetic analysis and were evaluated for their antagonistic potential against *Fusarium oxysporum* f.sp. *ciceri*, *Fusarium udum*, *Rhizoctonia bataticola*, *Rhizoctonia solani*, *Sclerotinia sclerotiorum*, and *Sclerotium rolfsii* using dual inoculation method. Effect of volatile and non-volatile compounds of *Trichoderma* sp. on the growth and sporulation of the phytopathogens was also studied. Based on these studies *T. harzianum* (ITCC 9864) was found best in reducing growth & sporulation of the test pathogen. Pure *Trichoderma* spores (PTS) were harvested from *T. harzianum* (ITCC 9864) and compared with commercially available talc based formulations. Different dosage of pure spore mass of *T. harzianum* @ 0.004g/kg, 0.04g/kg, 0.4g/kg and 0.2g/kg and commercially available talc based formulation (*Trichoderma harzianum*) @ 4g/Kg were mixed in FYM with 2×10^8 cfu/g for substrate colonization and mass multiplication and studied periodically upto 18 months. Pure *Trichoderma* spore in FYM @ 0.04g/kg maintained 1×10^8 cfu/ml even upto 18 months while commercially available talc formulation showed no cfu after 10 months of storage. Shelf life of pure *Trichoderma* spores (PTS) alone and in combination with Chitin and Carboxymethyl Cellulose (CMC @ 5%) was studied to find out the efficacy of these adjuvants to increase shelf life. Shelf life of pure *Trichoderma* spores mixed with chitin proved to be more effective as compared with pure *Trichoderma* spores (PTS) alone and with Carboxymethyl Cellulose, thereby indicating that chitin helps in maintaining cfu for long duration (even up to 18 months). Therefore, it may conclude that formulation prepared by these two methods has given better shelf life as 2×10^{12} cfu/ml even after 18 months of storage and is cost-effective, which is a new finding.

These observations clearly indicated that pure *Trichoderma* spores (PTS) even in a very small quantity are very potent and effective for longer survival as compared to commercially available talc based formulations and can effectively be used for the management of soil borne pathogens.

KISAN CALL CENTRE IN INDIA

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In order to harness the potential of ICT in Agriculture, Ministry of Agriculture launched the scheme "Kisan Call Centres (KCCs)" on January 21, 2004. Main aim of the project is to answer farmers' queries on a telephone call in their own dialect. These call Centres are working in 14 different locations covering all the States and UTs. A countrywide common eleven digit Toll Free number 1800-180-1551 has been allotted for Kisan Call Centre. This number is accessible through mobile phones and landlines of all telecom networks including private service providers. Replies to the farmers' queries are given in 22 local languages. Call centre services are available from 6.00 am to 10.00 pm on all seven days of the week at each KCC location. Kisan Call Centre agents known as Farm Tele Advisor (FTAs), are graduates or above (i.e. PG or Doctorate) in Agriculture or allied (Horticulture, Animal Husbandry, Fisheries, Poultry, Bee-keeping, Sericulture, Aquaculture, Agricultural Engineering, Agricultural Marketing, Bio-technology, Home Science etc. and possess excellent communication skills in respective local language. Queries which cannot be answered by Farm Tele Advisor (FTAs) are transferred to higher level experts in a call conferencing mode. These experts are subject matter specialists of State Agriculture Departments, ICAR and State Agricultural Universities. A Kisan Knowledge Management System (KKMS) to facilitate correct, consistent and quick replies to the queries of farmers and capture all the details of their calls, has been developed. Kisan Knowledge Management System (KKMS) has its independent web site <http://dackkms.gov.in>. The Kisan Call Centre (KCC) Agents working at various KCC locations throughout the country have access to this web site through their specific ID's & Pass-Word provided to them.

EXTRACTION AND EVALUATION OF INSECTICIDAL ACTIVITY FROM RESISTANT AND WILD ACCESSIONS OF *CICER ARIENTINUM* AGAINST *APHIS CRACCIVORA*

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The wild and resistant gene pools are the potential source of beneficial genes that offer considerable resistance to the insect pests. Insecticidal protein present in the seeds of pulses, especially in wild and resistant germplasms has been suggested to play a major role in insect resistance. In this study we have tested insecticidal activity of protein isolated from *Cicer arietinum* against *A. craccivora*. It is a cosmopolitan species with a worldwide distribution. It is [polyphagous](#), but it seems to have a preference for members of the legume family. *A. craccivora* causes



direct damage to plants by stunting and distorting growth. In this study, insecticidal protein was isolated using HEPES buffer from resistant variety (ICC 86111), susceptible variety (ICC-3137) and wild genotypes (ILWC 51, ILWC 207, IG72952, IG 70006, IG 72933, IG69979, IG 69979, PI 599066) and compared the insecticidal activity of susceptible & resistant genotypes of *Cicer arietinum* and resistant & wild accessions of *Cicer arietinum*. Results indicated that the resistant variety is giving significant higher insecticidal activity against *A. craccivora* as compared to susceptible; further the wild accessions are giving better insecticidal activity as compared to resistant genotypes. This natural chemistry of plants shows a ray of hope for eco-friendly and sustainable pest management in field of agriculture in future. The potential insecticidal proteins from wild and insect resistant genotypes of *Cicer arietinum* can be used as component for bio-pesticidal formulation for the management of *A. craccivora*.

Keywords: Wild and resistant germplasms, insecticidal protein, *A. craccivora*, *Cicer arietinum*.

EFFECT OF *TRICHODERMA* SPP. ON TURMERIC LEAF SPOT DISEASE (*COLLETOTRICHUM GLEOSPORIODES* PENZ AND SACC.) AND RHIZOME YIELD.

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The experiment was conducted both *in-vivo* and *in-vitro* condition to exhibit the antagonistic activities of trichoderma against the *colletotrichum gleosporiodes*. Turmeric (*Curcuma longa* L.) leaf spot disease caused by *Colletotrichum gleosporiodes*. *In-vitro* condition the percent of highest inhibition of mycelial growth of the test pathogen's was recorded on seventh day with *T. harzianum* (58.15 %) followed by *T. viride* (52.37%), *T. koningi* (48.12%), *T. virens* (39.74%) and *T. hamatum* (31.55%) over the control. *In-vivo* condition field was prepared with 20 plots and each plot was 1.5m×1.5m size and rhizome seed sown on ridges with interplant space 45 cm. The each plot treat with different bio-agents as first mixed with soil+FYM @180g/plot seven days pre-sowing, treated rhizomes @5g/ kg at the time of sowing and three foliar sprays with liquid bio-formulation prepared in distilled water @3×10⁶ conidia/ml, first sprayed after emergence of leaves and others two at 45 days intervals. Amongst the five bio-agents, *Trichoderma harzianum* was found superior in reducing the disease and increasing the percent of fresh weight and dry weight of the rhizome. *Trichoderma harzianum* 52.23% and 68.37% followed by *T. viride* 35.20% and 51.26%, *T. koningi* 29.95% and 39.43%, *T. virens* 25.63% and *T. hamatum* 19.38% and 21.36% over the control.

ROLE OF CHEMICAL FERTILIZER AND CROP RESIDUE ON NUTRITIONAL CONTENT AND ECONOMICS OF BASMATI RICE (*Oryza sativa* L.)

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- A field experiment was carried out during *Kharif* season of July 2013 & 2014 at crop research farm SHUATS Allahabad to study the effect of chemical fertilizer and wheat residue on food grain content and economics in basmati rice. Treatments were arranged using factorial R.B.D with three replications. The result found that increasing level of NPK fertilizer and crop residue maximum in treatment T₁₁ (NPK 120: 60: 60 & 5 t ha⁻¹ wheat residue), which was nitrogen content in grain (1.22 & 1.27 %), phosphorus content in grain (0.26 & 0.29 %), potassium content in grain (0.18 & 0.23 %) and protein content in grain (7.6 & 7.9 %), while minimum in control treatment. Besides these, treatment also found more remunerative in terms of net return and benefit cost ratio (1.99 & 2.01).

RESPONSE OF INORGANIC FERTILIZER AND WHEAT RESIDUE ON CARBOHYDRATE AND OIL CONTENT IN PADDY (*ORYZA SATIVA* L.)

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A field experiment was conducted during *Kharif* season of July 2013 & 2014 at crop research farm SHUATS Allahabad to study the effect of inorganic fertilizer and wheat residue on carbohydrate and oil content in basmati rice. Treatments were arranged using (4x3) factorial R.B.D with three replications. Increasing level of NPK fertilizer significantly increases carbohydrate content in treatment I₃ 120:60:60 RDF ha⁻¹ over than rest of the treatment I. Among incorporation/ retention of wheat residue also increase the carbohydrate content in treatment W₂ from 0 to 5 tone ha⁻¹. It was lower in control and higher in highest level of wheat residue, which was at par with 2.5 t ha⁻¹ wheat residues in the year of experiment 2013-2014. In case oil content maximum increased in 120:60:60 RDF (NPK) over control. Among the oil content maximum increased in incorporation of 5 t ha⁻¹ wheat residue was found better than the rest of the treatment both the years of experiment 2013,14 respectively.

EFFECT OF FERTILIZER AND ORGANIC RESIDUE ON YIELD PARAMETER AND YIELD OF BASMATI RICE (*ORYZA SATIVA* L.)

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A field experiment was conducted during *Kharif* season of July 2013 and 2014 at crop research farm SHUATS Allahabad to study the effect of chemical fertilizer and crop residue on yield attributes and yield of rice. Treatments were arranged using (4x3) factorial R.B.D with three



replications. The crop was harvested at maturity data on plant ht. (cm.), no. of tillers, no. of effective tillers; panicle length (cm.), test wt. (g.), grain yield (q/ha.) and straw yield (q/ha.) were recorded. Plant ht., no. of tiller, no. of effective tiller, test wt., grain yield and straw yield was found significantly increased by different levels of doses. Maximum plant ht. was observed (86.15 cm and 87.80 cm.), no. of tillers (22.30 and 25.10), no. of effective tiller (12.29 and 13.33), panicle length (28.75 and 28.94 cm.), test wt. (23.30 and 23.69 g.), grain yield (39.53 and 41.88 q/ha.) and straw yield (87.40 and 91.25 q/ha.) by different levels of inorganic fertilizer and different levels of wheat residue retention in 2013-14 showed Plant ht. (83.19 and 84.17 cm.), no. of tillers (21.68 and 22.42), no. of effective tillers (10.70 and 10.75), panicle length (28.23 and 27.89 cm.), test wt. (23.15 and 23.74 g.), grain yield (34.75 and 36.41 q/ha.) and straw yield (84.48 and 79.20 q/ha.) in both the years of experiment 2013,14 respectively.

ENHANCING SOIL HEALTH AND PRODUCTIVITY OF BASMATI RICE THROUGH INORGANIC FERTILIZATION AND CROP RESIDUE INCORPORATION

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A field experiment was conducted during *Kharif* season of July 2013 and 2014 at crop research farm SHUATS Allahabad to study the Responce of chemical fertilizer and crop residue on soil properties, yield parameters and yield of rice. 12 treatments were arranged using (4x3) factorial R.B.D with three replications. The crop was harvested at maturity data on highest grain yield (43.50 and 45.39 q/ha.) in treatment T₁₁ (100 % RDF and 5 t ha⁻¹ wheat residue) and some physical properties viz bulk density (1.26 and 1.25 g cm⁻³/cm³), particle density (2.64 and 2.65 g cm⁻³/cm³), pore space (52.60 and 53.35 g cm⁻³%), were recorded in treatment T₁₁ (NPK 120: 60: 60 & 5 t ha⁻¹ wheat residue) in both the year of experiment 2013 & 2014 respectively.

ADOPTION OF DD KISAN AMONG FARMERS OF JABALPUR DISTRICT (M.P.)

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Television plays an important role in the field of agricultural development in agriculture. It helps to narrow the gap between research result and their application by farmers. Television contributes an important medium widely used to disseminate information to its viewers. DD Kisan is an Indian agricultural 24 hours television channel which is owned by Doordarshan. The channel has been dedicated to agriculture and related sectors, which disseminate real time input to farmers on new farming techniques. The present study was conducted purposively in Panagar Block of Jabalpur district (M.P.) because of having maximum viewers of DD Kisan Data were collected by personal interview method. The zero order correlation coefficient was determined between independent variables and dependent variable. Education, social participation, size of land holding, annual income, communicability, usefulness, innovativeness, extension participation, information seeking behavior, attitude towards farm broadcast were found significant relationship with farm telecast. It was found that majority of viewers having poor adoption of information given by DD Kisan and various constraints faced by farmers during telecast of channel. Majority of the respondents reported that scientific words/technical language used in agricultural programme/lack of simple language used in agricultural programme and found first rank among the other constraints. The study suggested that there is better scope for improving the knowledge and adoption of farmers by mean of addressing these constraints.

MANGO PROCESSING; PRESENT STATUS AND FUTURE OUTLOOK IN INDIA

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Mango (*Mangifera indica* L.) with many versatile properties has naturally found application for processing into various products application for processing into various products unparalleled by any other fruit. It is however estimated that 0.22% of mangoes produced in the world is only utilised for processing. Green mangoes are processed into traditional products like pickle, brine stock and chutney. Instant mango pickle, drum-dried green mango powder, production of raw mango beverage base are the new developments. Ripe mangoes are processed into canned slices, pulp, beverages like RTS beverage, nectar and juice, dehydrated products like mango fruit bar, mango cereal flakes, mango powder, strained baby foods, etc. Mango slices in nectar, mango concentrate, mango aroma concentrate, low viscosity and low pump containing mango beverage base, mango pulp concentrate by evaporative technique by split process and by partial drying and cut back technique, mango aroma concentrate and identification of aroma compounds, aseptic bulk packing of pulp and concentrate, mango beverage in tetrapack, etc., are the recent developments. Introduction of pulp pasteuriser, filler, and adaptation of double effect forced circulation evaporator scraped surface and thin film evaporator have improved the efficiency of mango pulp and concentrate processing and thus increased the capacity utilisation of pulp in India. This review covers the above developments including waste utilisation.

Keywords: Mango processing, RTS, Mango pulp etc.



BEHAVIOURAL DEFENCE ADAPTATIONS IN INSECTS AGAINST NATURAL ENEMIES

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Parasites pose major threats to the fitness of their hosts and natural selection should favour hosts that can effectively protect themselves against their parasites. Traditionally, most studies on anti-parasite defences have focused on physiological and genetic mechanisms that prevent or reduce infection. In insects, these mechanisms include phagocytosis, melanization, encapsulation, coagulation and production of antimicrobial peptides. However, hosts can employ alternative defence mechanisms, including morphological barriers, altered behaviours, changes in life-history traits, and symbiont mediated defences. One of the most appealing ways in which hosts can protect themselves against parasitism is through the use of altered behaviours with a series of mechanisms. Anti-parasitic behaviours can be divided into three major defence mechanisms: (a) Qualitative resistance (also known as anti-infection resistance or avoidance), which prevents the establishment of parasite infection or reduces the infective dose; (b) Quantitative resistance (also known as anti-growth resistance or clearance), which reduces parasite growth or parasite burdens in already infected hosts; and (c) Tolerance, which does not reduce parasite infection or growth, but instead alleviates the fitness reductions caused by infection. These defence strategies function to preserve host fitness, but their consequences on parasites are different. In particular, qualitative/quantitative resistance reduces parasite fitness, while tolerance does not. As a result, it is often expected that resistance and tolerance will differentially affect host-parasite co-evolutionary dynamics, with host populations maintaining genetic variation in resistance, but not in tolerance. We all know the phrase from the Darwinian evolutionary theory i.e. "Survival of the fittest" which states that the continued existence is only of the organisms which are best adapted to the changes and modify themselves and the extinction of the others which do not.

ECO-FRIENDLY ROLE OF ORGANICS AND BIO-ORGANICS ON THE GROWTH PARAMETERS OF TOMATO IN RELATION TO THE MANAGEMENT OF PLANT PATHOGENS

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Efficacy of some organics such as *Solanum xanthocarpum*, *Cosmos bipinnatus*, *Zinnia elegans* and *Calendula officinalis* along with the AM fungus *Glomus fasciculatum* and free nitrogen fixing bacteria, *Azotobacter chroococcum* in different combinations were evaluated against plant pathogens like plant-parasitic nematodes and soil-inhabiting fungi in field trials with respect to the growth and yield attributes of tomato (*Lycopersicon esculentum*). Significant improvement was observed in growth and yield parameters such as plant length, fresh as well as dry weights, percent pollen fertility, number of flowers and fruits/plant, ascorbic acid content and chlorophyll content in all individual and combined inoculants of these organics and bio-organics in various combinations as compared to untreated control. Soil application of these organic matters with *G. fasciculatum* and *A. chroococcum* was found most effective than individual applications in terms of different growth parameters. *Azotobacter* was found most beneficial than *G. fasciculatum*, while among the different organics, *Z. elegans* was found most efficacious in enhancing growth and yield attributes followed by *C. officinalis*, *C. bipinnatus* and *S. xanthocarpum*. Conjoint applications of these organics along with *G. fasciculatum* and *A. chroococcum* in the form of number of egg masses as well as root-galls caused by root-knot nematodes, *Meloidogyne incognita*. The population of plant-parasitic nematodes and frequency of occurrence of soil-inhabiting fungi infesting tomato was found greatly affected due to the combined applications of these organics with the two bio-organics as compared to individual ones. This type of study clearly explains that soil application of these organics and bio-organics were found to be more eco-friendly, cost effective and economical for sustainable management of pathogenic organisms and subsequently maintain the harmony of many organisms in soil ecosystem.

Keywords: organics, bio-organics, plant-parasitic nematodes, soil-infesting fungi

STUDIES ON BIOFILM DEVELOPMENT AND MULTIFARIOUS PLANT GROWTH PROMOTING ACTIVITIES OF SELECTED RHIZOBACTERIA AND WHEAT ROOT COLONIZATION BEHAVIOR OF BACILLUS SP.

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Several beneficial rhizobacteria are known to promote plant growth and protect plant health through their direct and indirect activities and production of metabolites. Use of such rhizobacteria is playing important role in crop production and protecting crop health. However, performance of such microbial inoculants under field conditions is not always consistent due to various biotic and abiotic factors. One of the factors is the poor rhizosphere colonization due to competition by native microflora. We hypothesize that the biofilm forming capacity by such rhizobacteria will be an added advantage in better survival in root zone. With this objective we have isolated 50 rhizobacteria from Aligarh soil which include species of *Pseudomonas*, *Bacillus* and *Azotobacter*. These isolates were first screened for their biofilm formation and its related traits (EPS, swarming, swimming motility and cell surface hydrophobicity) and PGP traits (IAA, phosphate solubilization, siderophore, hydrogen cyanide and ammonia). These isolates produced IAA up to 40 µg ml⁻¹ in the absence of tryptophan whereas in the presence of tryptophan the IAA production enhanced up to 230 µg ml⁻¹. *Azotobacter* and *Bacillus* isolates solubilized phosphate in the range of 461-660 µg ml⁻¹ whereas *Pseudomonas* isolates solubilized phosphate in the range of 661- 860 µg ml⁻¹. Varying level of siderophore production was observed in majority of the isolates. Similarly, 35.55 percent isolates produced hydrogen cyanide and ammonia respectively. Exopolysaccharides production was observed in the range of 70-130 µg ml⁻¹. The isolates exhibiting relevant multiple PGP traits were tested for biofilm formation *in vitro* and on root surface of wheat (*Triticum aestivum*). We found that, *in vitro*, these strains showed variations in biofilm formation. However,



selected isolate colonized root indiscriminately. Mature biofilm analysis by SEM revealed intense biofilm development by *Bacillus* sp. followed by *Pseudomonas* and *Azotobacter*. The *Bacillus* sp. was further evaluated for their effect on survival in the rhizosphere up to 60 days, which showed better survival compared to control strain. The data obtained revealed that *in vitro* biofilm formation has little correlation with root colonization. However, mature biofilm are formed by selected strains which also form strong biofilm *in vitro*. Further investigation will reveal the advantages of biofilm development in providing enhanced survival under environmental stress conditions.

Keywords: Biofilm, plant root, PGP activities, swarming motility, EPS production, SEM

EFFECT OF NANOCHITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION

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Nanoparticles are materials with a particle size of 1- 100 nm. Nanotechnology have led to the creation of various chitosan based nanoparticles. Chitosan have several advantage which are not properly expressed in its bulk size, so nanochitosan is preferable to be used instead of chitosan. Nanochitosan will have essential role in the controlled release of agrochemicals for protection against pests and pathogens, soil fortification, drought tolerance and plant growth. Nanochitosan can also efficiently enhances photosynthesis, promotes plant growth, increases nutrient uptake and seed germination rate. In this study, effect of Nanochitosan was evaluated on plant growth parameters and soil bacterial population. It was observed that Nanochitosan not only enhanced rate of seed germination upto 24 percent over control but all other parameters like root length, shoot length, fresh weight and dry weight, chlorophyll content and protein content of plants were also showing hike by two fold over control. For the soil health assessment Colony Forming Unit was done on Nutrient Agar and Aleksandrow Agar media which showed two fold increase, whereas soil protein was enhanced by 1.5 fold over the control. The above results suggests important applications of Nanochitosan in agriculture which was found to be not only beneficial for the crop productivity but also maintain soil health.

CYTOKININ REGIME FOR IN VITRO PROPAGATION AND ASSESSMENT OF ANTIOXIDANT ACTIVITIES DURING EX VITRO ESTABLISHMENT OF ANTI DIABETIC PLANT (*TECOMASTANS L.*)

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An efficient *in vitro* propagation system was developed for an antidiabetic plant (*Tecomastans*) using nodal explants. Effect of cytokinins (BA or Kin) either alone or in combination with different concentrations (0.1 – 2.0 μ M) of auxins, NAA or IAA on regeneration and multiplication was evaluated. All tested concentrations facilitated shoot bud induction and best organogenic potential (89%), maximum mean shoot number (6.40 ± 0.92) with average mean shoot length (3.70 ± 0.20 cm) per explant was achieved on (MS + 5 μ M BA + 0.5 μ M NAA) after 4 weeks of incubation. To stimulate the *in vitro* rhizogenesis healthy microshoots (≥ 4 cm) were excised and inoculated on root induction medium enriched with different (0.1- 2.0 μ M) concentration of IBA or NAA. Finally, 93% of the regenerated microshoots rooted with, mean root number (9.66 ± 0.88) and root length (2.66 ± 0.33 cm) was achieved on MS medium supplemented with (1.0 μ M) IBA after 4 weeks of incubation. About 75% of the regenerated plantlets were acclimatized in culture room and successfully established in earthen pots containing garden soil and manure (2:1) and maintained in greenhouse with 90% survival rate. An attempt was made to obtain basic information on different antioxidant enzymatic activities such as Superoxide dismutase (SOD), Ascorbate peroxidase (APX), Catalase (CAT) and protein estimation during acclimatization process. Results obtained from the studies would be beneficial in the mass multiplication, sustainable development and in assessing the physiological parameters in *Tecomastans*.

MICROBIAL PESTICIDES: AN ECOFRIENDLY APPROACH FOR PEST MANAGEMENT

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Microbial pesticides, one of three major classes of biopesticides, are composed of naturally occurring bacteria, viruses, fungi, or protozoans that cause variety of diseases in insects and are therefore exploited for biological control of insect pests. When using microbial pesticides, they usually only target a specific pest, unlike broad-spectrum pesticides that kill not only pests but also beneficial insects that are needed in the environment. Thus, these microbial pesticides are considered to be the best alternative to synthetic pesticides. Microbial pesticides control the pests by a non-toxic mechanism. One of the most widely used pathogen is the bacterium, *Bacillus thuringiensis* (Bt). A number of Bt strains such as *Btkurstaki*, *Bt var. galleriae* and *Bt var. israelensis* have been successfully utilized to manage the lepidopteran pests. High virulence and specificity attributes of Baculoviruses comprising nuclear polyhedrosis virus (NPV) and granulosis virus (GV) make them effective insect pathogens. In India, a number of NPV and GV formulations are used against lepidopteran pests like *Helicoverpa armigera* (HaNPV) and *Spodopteralitura* (SINPV). In recent years, Entomopathogenic fungi like *Beauveria bassiana*, *Lecanicillium* spp., *Metarhizium anisopliae* and *M. anisopliae* var. *acridum* are gaining importance in the crop pest management due to the simpler, easier and cheaper mass production techniques. The most notable Entomopathogenic protozoans commonly referred to as microsporidians belong to *Nosema* spp. and *Variomorphaneatrix*. The infection due to these microsporidians results in reduced feeding, vigour, fecundity and longevity of the insect host. Thus, there is an immense scope to utilize the biodiversity of these microbial pathogens having potential for the management of insect pests in an ecofriendly manner.

KEYWORDS: Microbial, Pesticides, ecofriendly, Pest, Management



PEST MANAGEMENT STRATEGIES IN KUMAON REGION ON AGRO- ECOSYSTEM: AN ECOFRIENDLY APPROACH**Neelam Yadav, Neerja Agrawal and *Renu Yadav**

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Kumaon region has rich traditional knowledge with biodiversity. The traditional knowledge has been acquired over ages and treasured by local farmers and communities. A survey of five villages of the Almora and Nainital region, Uttarakhand was made through personal interview schedules of farming community during 2017. This paper briefly presents the extent of the indigenous knowledge available in Kumaon district and methods of controlling the insect pest population of various species by exposing to its natural enemies have been enumerated. This paper also emphasizes the farming of Farmers as select well-adapted, stable crop varieties, and cropping systems. These diverse traditional systems enhance natural enemy abundance and generally keep pest numbers at low levels. Pest management practice in traditional agriculture is a built-in process in the overall crop production system rather than a separate well-defined activity.

Keywords: Pest management, Natural enemies, Ecofriendly, Sustainable agriculture, Community

ECO-FRIENDLY ROLE OF MICROBIAL PROTEASES IN LEATHER & TEXTILE INDUSTRIES**Deepak Kumar Koli¹ * and Ganesh Kumar Koli²**¹Division of Microbiology, ICAR- Indian Agricultural Research Institute (IARI), New Delhi-110012, India²Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, 2210005, India

Proteases, a group of enzymes hydrolyzing proteins into peptides and amino acids, are indispensable tools of all life forms including, viruses, bacteria, fungi, plants and animals and microbial proteases secure most important place due to their enormous industrial applications. Leather and textile industries are of most prominent interest. Leather industry contributes to one of the major in dustrial pollution problems facing the country, and the pollution causing chemicals, viz. Lime, sodium sulphide, salt, solvents, etc. arise mainly from the pre-tanning processes of leather processing. In fact, one third of the pollution caused by the leather industries results from the wastes generated during dehairing operations. Enzymatic methods are viable, eco-friendly and form alternative to the existing technologies. Using proteolytic enzymes at soaking stage degrade inter fibrillar protein significantly, facilitates water absorption and shortens the soaking operation. The enzymatic dehairing on industrial scale is generally accompanied by the use of small amount of lime to improve dehairing efficacy and to reduce cost of the dehairing process. Microbial proteases reduce the requirement of lime, reduces the dehairing time, lowers the waste treatment costs, increases the skin area and facilitates dyeing. Complete removal of hairs has been achieved through enzymes without chemical assistance. Today, the bacterial proteases are used as bating agent instead of chemicals. Various chemicals like washing soda, sodium sulphite, sodium silicate, sodium lauryl sulphate, hydrogen peroxide etc. are used during the silk industry. The use of proteases in the textile chemical processing is rapidly gaining globally recognition because of their non-toxic and eco-friendly characteristics with the increasingly important requirements for textile manufactures to reduce pollution in textile production. Novel use of proteolytic enzymes in silk industry can be divided into two stages viz. during cocoon cooking/reeling and the degumming process. Enzymatic degumming involves proteolytic degradation of sericin using specific protease which does not attack fibroin. Protease enzymatic treatment of wool make the fabric smooth and soft and improve other physical properties including hand, drapability, absorbency, dye ability and colour fastness properties while tensile strength decreased slightly.

EFFECT OF SEED TREATMENTS AND PACKAGING MATERIALS ON SEED GERMINATION IN COWPEA (VIGNA UNGUICULATA) DURING STORAGE**Pusarla Susmitha^{1*}, Prashant Kumar Rai²**^{1,2}Dept. of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh (211 007), India

The laboratory experiment was conducted at Post Graduate Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Uttar Pradesh during 2015 - 2016 with cowpea variety Kashiunnati to study the effects of seed germination and vigour during storage period of six months. The seed treatments used were viz., ferrous sulphate, *Trichoderma viridae*, mancozeb, neem oil along with control (untreated seeds). After treatment, seeds were stored in plastic container (P₁) and cloth bag (P₂) for evaluation of germination per cent, seedling length, seedling dry weight, seedling vigour index where data was analysed by factorial completely randomized design. The results revealed that by the end of storage, neem oil recorded highest per cent of seed germination (95.33%), seedling length (37.50 cm), seedling dry weight (0.60g) and seedling vigour index (SV-I 3573.95) over all other treatments. Also the seeds stored in plastic container was very effective for extending the seed longevity and maintaining the storability than the cloth bag.

Keywords: germination, packaging, seed treatment, storage, vigour index

SEED VIGOUR AND VIABILITY IN DIFFERENT VARIETIES OF INDIAN MUSTARD [BRASSICA JUNCEA (L.) CZERN.&COSS.]**Himanshu Rai*, O.S.Dahiya* And S.S.Jakhar***

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The experiment was conducted at the laboratories of the Department of Seed Science & Technology, CCS HAU, Hisar, during 2014-15 and 2015-16 to assess the seed vigour of twenty Indian mustard varieties/genotypes. The freshly harvested seed of all the varieties was assessed for seed vigour parameters viz, test weight (g), germination percentage, seedling length (cm), seedling dry weight (mg), vigour index-I,



vigour index-II, electrical conductivity test ($\mu\text{S cm}^{-1}\text{g}^{-1}$), tetrazolium test percentage, dehydrogenase activity test ($\text{OD g}^{-1}\text{ml}^{-1}$) Emergence index, Mean emergence time and Seedling establishment. The pooled data of both the years revealed that the highest test weight (6.01) was recorded in the variety RH0406, while the highest germination percentage (96.83), seedling length (14.98), seedling dry weight (2.54), vigour index-I (1450), vigour index-II (245), tetrazolium test percentage (97.91) and dehydrogenase activity (0.847), Emergence index (10.18), Mean emergence time (6.39) and Seedling establishment (81.50) was recorded in the variety RH30 followed by Kranti and Varuna. The lowest electrical conductivity was also recorded in the variety RH30 (12.567) followed by Kranti (13.500), Varuna (13.567) and NRCD601 (13.822). Among all the twenty Indian mustard varieties, the varieties RH30, Kranti, Varuna and NRCD601 showed superiority for almost all viability and vigour parameters. Keywords: Vigour, Germination (%), Vigour index, Tetrazolium, Dehydrogenase, Electrical conductivity Emergence Index, Mean emergence time and seedling establishment.

EFFECT OF DROUGHT STRESS ON PROLINE AND CHLOROPHYLL CONTENT IN DIFFERENT RICE GENOTYPES

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Rice (*Oryza sativa* L.) is an important cereal crop, and primary source of food accounting for 35-75% of calorie intake for more than 3 billion people. As the world population continues to increase, the demand for rice is also on the upsurge. Global climatic change is major constraint for sustainable food production increasing the frequency of abiotic & biotic stresses among which drought is most common abiotic factor which reduces the yield and productivity up to 70% worldwide. Plant responses to drought stress are complex and involve changes in their morphology, physiology and metabolism. The present investigation was carried out to understand the effect of drought on physiology of various rice genotypes. The experiment was performed with seven genotypes viz. IET 24672, IET 24677, PHY 6, IET 23337, PHY 2, PHY 7, IET 24683 laid out in randomized block design during kharif season 2015 at Norman E. Borlaug Crop Research Centre, Department of Plant Physiology, GBPUA&T, Pantnagar. The experiment was conducted in two blocks i.e. irrigated (control) and non irrigated (drought). Drought was imposed at the time of flowering. Proline content was found to increase in all genotypes during drought condition with respect to control. Proline was recorded to enhance minimally in PHY-6 with a mediocre decrease in yield whereas it increased significantly in IET24672 with a maximum decrease in yield. Chlorophyll content was found to be significantly lower in all genotypes under drought.

Keywords: Rice, Drought, Proline, Chlorophyll

APPLICATION OF SOLAR ENERGY BASED DEVICES IN FOOD PROCESSING SECTOR

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Solar food processing is an emerging technology that provides good quality foods at negligible fuel costs. A number of solar dryers, collectors and concentrators are currently being used for various steps in food processing and value addition. Solar vegetable-fruit dryers, operating below 55 degree centigrade, are used for the purpose. Different solar concentrators can provide excellent boiling, steaming, blanching and roasting capabilities while solar air dryers/heaters can effectively remove moisture. Solar energy based devices are an ideal choice for application of food processing in rural settings as well closer to where the harvest is produced. This not only eliminates the need for expensive transportation or storage of fresh produce but also creates employment opportunities among the rural population, especially women. Efforts are required to integrate knowledge of food processing with capabilities of available solar thermal gadgets. This paper thus provides information about the application of various solar based devices in food processing sector. Effort is also made in the form of suggestions for the better utilization of solar energy in food processing sector.

Keywords: Food processing, Solar energy, Value addition.

OPTIMIZING NITROGEN AND PHOSPHORUS LEVELS COMBINED WITH LOW MOLECULAR WEIGHT FRACTIONS OF Γ -IRRADIATED SODIUM ALGINATE FOR ENHANCED PHOTOSYNTHETIC ATTRIBUTES, ESSENTIAL OIL AND MENTHOL PRODUCTION IN *MENTHA PIPERITA* L.

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Alginate, an extraction product of the cell walls of some bacteria, marine molluscs and brown algae, exists as a linear polymer of (1-4)-linked β -D-mannuronate and α -L-guluronate units arranged as homo or hetero-polymeric sequences. Ionizing radiation-mediated oligoalginate production and its application to plants, has been attributed to the promotion of growth and yield in plants. Reduced molecular weight has been endorsed to this established growth promotion activity as is well documented. However, in order to better understand the reason of the growth promotion activity, it is desirable to separate and apply different fractions of varied molecular weights to plants in order to clarify which of the fractions has the strongest growth promoting activity and are there any structural changes which can be owed to the increased activity of that particular fraction? Furthermore, in view of the essential role of nitrogen (N) and phosphorus (P) in plants, a pot experiment was devised to investigate the cumulative effect of N and P fertilizers applied in the form of two splits and different fractions of sodium alginate, separated through column chromatography and characterized through IR spectroscopy, on different physiological and essential oil parameters of peppermint. Out of the different N and P doses, ($\text{N}_{30+30}\text{P}_{30+30}$) proved to be the best. This split dose was then applied along with the different fractions of the sodium alginate. Chlorophyll fluorescence was measured using Pulse-Amplitude Modulated Chlorophyll Fluorometer. The EO was extracted using Clevenger's apparatus and the active constituents of the oil were determined using Gas Chromatography. Significant increase was observed in the



content and yield of essential oil and menthol by the combined application of fraction 3 and $N_{30+30}P_{30+30}$, which ameliorated most of the physiological parameters as well, in comparison to the control.

Keywords: Sodium alginate, essential oil, menthol, peppermint, chlorophyll fluorescence.

EFFECT OF TERMINAL HEAT STRESS ON AGRO MORPHOLOGICAL TRAITS IN BREAD WHEAT

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High temperature during terminal growth stages has become a major determinant of wheat growth and development and causes yield loss to a great extent. The present investigation was undertaken to determine response to terminal heat stress of 35 lines of wheat, sown under timely, late and very late conditions. Analysis of variance revealed wider genetic variability as well as significant genotypic differences for all traits among the genotypes. Correlation study indicated significant association of EY with most of the traits under study. Path analysis of the traits revealed that BY had highest direct effect on EY (0.792) followed by HI (0.766). The traits viz., DF, GFP, MSI, CTD, CHL a, CHL b, TCC and SPSM had shown positive direct effect whereas DM, AEL, GNPS, TGW and HDI had shown negative direct effect on EY. Based on D^2 value all these 35 genotypes were grouped into six clusters with inter-cluster distance higher than intra-cluster distance revealing presence of considerable genetic diversity among the genotypes. PCA results reported that five principal components cumulatively contributed 77.8 % of the total variation among 35 genotypes of wheat. The GT biplot studies reported that some genotypes with long vectors that might have extreme values for one or more traits and might be useful as parents for some useful traits. The finding suggested that wheat genotypes differ in their response to terminal heat stress and the superior ones would be useful as genetic stock for developing tolerant lines in wheat improvement programme.

KEYWORDS: terminal heat, stress, bread wheat, genotypes

IN VITRO PROPAGATION AND CONSERVATION OF *HEMIDESMUSINDICUS* L. R. BR. THROUGH SOMATIC EMBRYOGENESIS AND SYNTHETIC SEED PRODUCTION

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Hemidesmus indicus L. R. Br. (family—Apocynaceae) commonly known as “Indian sarsaparilla” is a slender laticiferous semi erect ethnomedicinal shrub. The roots are woody and aromatic. In Indian traditional system of medicine it is widely used as a blood purifier. Root bark is used to cure nutritional disorders, high fever, ulcer, skin diseases, piles, bronchitis, epileptic fits in children, syphilis, loss of appetite and rheumatic fever. It significantly neutralizes the Viper venom induced lethality and haemorrhage and also effective against rat bite poisoning and scorpion sting. A protocol has been developed for achieving somatic embryogenesis from callus derived from nodal cuttings and production of synthetic seeds in *H. indicus*. Proembryogenic, friable, light yellowish callus was induced from the basal cut end of the nodal cuttings on Murashige and Skoog's Medium (MS) medium supplemented with 2.5 μ M 2,4-Dichlorophenoxyacetic acid (2,4-D). The highest rate of somatic embryogenesis (92%) was observed when the callus was subcultured on half strength MS medium supplemented with 5.0 μ M Kinetin (Kn). On induction medium somatic embryos were developed up to the torpedo stage. Further elongation and germination of somatic embryos were obtained in MS medium supplemented with 2.5 μ M Kn in combination with 1.0 μ M gibberellic acid (GA_3). About 80% of somatic embryoid derived plantlets were successfully acclimatized to ex vitro conditions and showed normal phenotypes.

Keywords : Ethnomedicinal plant, *Hemidesmus indicus*, In vitro propagation, Somatic embryos, Acclimatized

BIOLOGICAL CONTROL OF DAMPING OFF OF TOMATO CAUSED BY *PYTHIUM APHANIDERMATUM*

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Biological control is a harmless disease control method causing less environmental pollution and reducing hazardous pesticides use, biological control offers an environmental friendly approach to the management of plant disease. Seedling damping off disease is an important disease at nursery stage caused by *Pythium aphanidermatum*. It is the most important seedling disease in tomato production in India. The disease causes seed losses of upto 30%. Damping off is managed mainly by application of synthetic pesticides. Concerns about environmental hazards associated with the use of synthetic pesticides in tomato production have increased the need for alternative control methods. Biological control agents have been effectively used in controlling various diseases caused by *Pythium spp.* In addition to managing plant diseases bio control agents can also promote plant growth by enhancing uptake of micro and macro nutrients.

INFLUENCE OF CLIMATE PARAMETERS ON INCIDENCE OF LENTIL APHID (*APHIS CRACCIVORA* KOCH) IN EASTERN PLAIN OF UTTAR PRADESH

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The experiment was conducted on Influence of climate parameters on incidence of Lentil aphid (*Aphis craccivora* Koch) at research farm, Department of Entomology, SHIATS, Allahabad. The effect of abiotic factor viz., temperature, relative humidity and rainfall on the



incidence of lentil aphid in *rabi* season on Lentil variety 'Malika (K-75)' was studied during *rabi* season 2011-12. The observation on mustard aphid was recorded at weekly intervals just after initiation of infestation. The Seasonal incidence of aphids in the field commenced in the 2nd week of January (2nd SW) with an average population of 1.48 aphid / plant that remained up to last week of March (13 SW). The population of aphid reached at peak of 75.17 aphid / plant in 9th standard week. Correlation studies with climatic parameters showed that seasonal incidence of aphid population show non significant positive correlation with max. temp.(0.324) and min. temp.(0.357). While it showed significant negative correlation with max. relative humidity (-0.733) and significant negative min. relative humidity(-0.710). A non significant negative correlation was observed with rainfall (-0.211).

Keywords: Aphid population, Correlation, Rainfall, Relative humidity and Temperature.

SUITABILITY OF CRAMBE ABYSSINICA IN SUPPORTING OF GROWTH AND DEVELOPMENT OF MUSTARD APHID LIPAPHIS ERYSIMI (KALT.)

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The present investigation was undertaken to investigate the suitability of *Crambe abyssinica* in supporting of biology and growth & development of mustard aphid *Lipaphis erysimi* (Kalt.) which help to identify and development of resistance/tolerance cultivar of oilseeds *Brassica*. The results revealed that the nymphal period mustard aphid was observed 11 days (on leaf of *Crambe abyssinica* cv. CA3), alate forms 0% (*Crambe abyssinica* cv. CA1&2), nymphal survival was 0% (*Crambe abyssinica* cv. CA1&2), oviposition period was 0% (*Crambe abyssinica* cv. CA1&2), fecundity was 0% (*Crambe abyssinica* cv. CA1&2) and total life span was 12 days (*Crambe abyssinica* cv. CA1&2) whereas these biological parameters was observed in *B. nigra* cv. PBR-I 11 days, 33.3 %, 80%, 27 days, 0 days, 71.4 nymph per female and 37 days, respectively. Growth and development indices were calculated with observed data. Various parameters of growth indices were showed that the nymphal index and reproduction index was recorded 0.0 (*Crambe abyssinica* cv. CA1&2) while in *B. nigra* cv. PBR-I was 1.0. Low success index (0.42 to 0.68) and Howe index (0.092 to 0.095) was observed in different *Crambe abyssinica* cultivars shows less suitability to mustard aphid while in *B. nigra* cv. PBR-I success index (1.50) and Howe index (0.10).

Keywords: *Crambe abyssinica*, *Lipaphis erysimi*, *B. nigra*, Growth and development indices

ENHANCE THE ORGANIC MATTER IN SOIL THROUGH MODERN AGRICULTURAL PRACTICES

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Soil organic matter (SOM) is the organic matter component of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organisms. Plants produce organic compounds by using sunlight energy and combining carbon dioxide from the atmosphere with the help of water from the soil. Soil organic matter is created by the cycling of these organic compounds in plants, animals, and microorganisms into the soil. Well-decomposed organic matter forms humus, a dark brown, porous, spongy material that provides a carbon and energy source for soil microbes and plants. When soils are tilled, organic matter previously protected from microbial action is decomposed rapidly because of changes in water, air, and temperature conditions, and the breakdown of soil aggregates accelerates erosion. A soil with high organic matter is more productive than the same soil where much of the organic matter has been "burned" through tillage and poor management practices and transported by surface runoff and erosion. However, organic matter can be restored to about 60 to 70% of natural levels with best farming practices.

AVAILABILITY OF SOME MACRO AND MICRONUTRIENTS AND THEIR CORRELATION WITH SOME PHYSICO-CHEMICAL PARAMETERS IN MOLLISOLS SOIL OF UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND

Vineet Kumar and Shiv Singh Meena

An investigation was carried out to study the distribution of available macronutrients (N, P, K and S) and some micronutrient cations (Fe, Mn, Cu and Zn), their relationship with some physico-chemical properties of Mollisols soil of different blocks of district Udhm Singh Nagar (Uttarakhand). The soils of the district were found sufficient in Phosphorus, Potassium and Sulphur but low in available Nitrogen content. The values of the Alkaline KMnO₄ extractable N, Olsen's P, neutral normal Ammonium Acetate extractable K and available sulfur in the Udhm Singh Nagar district ranged between 125.44-338.68 kg N ha⁻¹, 7.34-76.70 kg P ha⁻¹, 66.08-271.04 kg K ha⁻¹ and 2.41-42.5 ppm, respectively. The average Nitrogen, Phosphorus, Potassium and Sulfur was 187.26 N ha⁻¹, 34.93 P ha⁻¹, 130.0 K ha⁻¹, and 17.42 ppm S, respectively. Values of DTPA-extractable Fe, Mn, Cu and Zn in soil samples of the district were ranged from 12.42-54.06, 0.96-22.06, 0.26-3.79 and 0.59-5.04 ppm with an average of 30.57, 6.84, 1.31 and 1.75, respectively. The available macro and micronutrients status was correlated with pH, electrical conductivity, organic carbon, sand, silt and clay content of the soil. In general the macronutrients were correlated significantly and negatively with pH and positively with organic carbon. The DTPA-extractable micronutrient cations were positively and significantly correlated with organic carbon and clay content but negatively with pH of the soil.

Findings from present study can successfully be utilized for the larger parts of *Tarai* region of Uttarakhand as effective guide for efficient and balanced fertilizer recommendations for the farmers.



ANTIOXIDANT POTENTIAL OF *MOMORDICA CHARANTIA* FRUIT IN FOUR DIFFERENT***In-vitro* assays.**

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Bitter gourd fruit has known to be a richer source of antioxidant compound than some common vegetables. It exhibited better radical scavenging effect and metal chelating ability than vitamin E. This study was aimed to verify the antioxidant potential of 12 diverse bitter gourd genotypes using different *in-vitro* assays, namely DPPH radical-scavenging activity, metal chelating activity and total antioxidant capacity by ferric reducing/antioxidant power (FRAP) assay and Total antioxidant CUPRAC assay. Total antioxidant activity was found highest in green coloured genotype Green star bold in both CUPRAC and FRAP assay whatever the solvent for extraction. Free radical scavenging activity was found maximum in L-214, while maximum metal chelating activity was found in L-314. The antioxidant capacity found in bitter gourd genotypes might be due to the presence of acidic compounds, flavonoids, phenols, saponins and tannins (phenolic compounds). Since genotype Green star bold was found best in antioxidant activity in both CUPRAC and FRAP assay, so Green star bold can be use as best genotype as source of antioxidant genotype. In conclusion, bitter gourd extracts possess potent antioxidant and free radical scavenging activities. The antioxidative effect of *Momordica charantia* evidenced that it could be a very good source of natural medicines on standard formulation. These antioxidant activities could have contributed, at least partly, to the therapeutic benefits of the certain traditional claims of bitter gourd. Since, it has great ability in suppressing free radicals, therefore suggested that it can serve as a potent antioxidant tool in food as well as nutraceutical product development.

Keywords: Antioxidant, Bitter gourd, Ferric Reducing, Metal chelating, radical scavenging.

VARIATION IN MORPHOLOGICAL AND REPRODUCTIVE BEHAVIOUR OF JACKFRUIT GENOTYPES IN THE TARAI REGION OF UTTARAKHAND

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An experiment was conducted to evaluate 10 genotypes of jackfruit collected locally, based on morphological and reproductive characteristics in the tarai region of Uttarakhand. The experiment was laid out in RBD with ten treatments and three replications and a considerable variation was found among them. Tree height ranged from 9.66 m in JG-1 to 5.16 m in JG-8, tree spread from 8.49 m in JG-2 to 4.53 m in JG-10, stem girth from 137.72 cm in JG-3 to 82.95 cm in JG-10, cross sectional trunk area from 1511.09 cm² in JG-3 to 559.72 cm² in JG-10, leaf length from 14.69 cm in JG-5 to 9.20 cm in JG-6, leaf width from 9.56 cm in JG-5 to 5.50 cm in JG-6. Early flowering was observed in JG-7 (25th January) and late flowering was found in JG-10 (15th March). Longest duration (80 days) of flowering was observed in JG-6 and shortest duration (45 days) was in JG-5. Highest (47.66) female flower was recorded in JG-9 and lowest value (4.66) was recorded in JG-3. Maximum lowest height of fruiting (2.36 m) was recorded in JG-10; minimum lowest height of fruiting (0.13 m) in JG-7. Maximum fruiting height (6.42 m) was found in JG-10 and minimum (2.36 m) was found in JG-4. JG-7 recorded highest fruit weight (10.77 kg), while the lowest fruit weight was recorded in JG-4 (4.89 kg). Highest yield (309.67 kg/tree) was recorded in JG-9 and lowest yield (31.56 kg/tree) in JG-3. Based on evaluation better genotypes are identified and further more studies can be taken to evaluate its performance.

EXTENT OF PARTICIPATION AND DECISION MAKING OF MAN ALONE AND JOINTLY WITH WOMEN IN DIFFERENT AGRICULTURAL ACTIVITIES.

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A survey based study was carried out in the month of April to August, 2017 in the district Deoria of Uttar Pradesh to know participation and decision making of man alone and jointly with female in different agricultural activities. A personal interview schedule was developed and used. One hundred twenty farmers were selected. Data collected included the extent of participation and decision making of man alone and jointly with women in various agricultural activities. Study revealed that in agricultural activities various intervention points are addressable such as activities done by male alone include ploughing, farm yard manure application, formation of ridges and furrows, and plant treatment. The operations done by male jointly with female dominations are cleaning of land, hoeing and weeding, transplanting of nursery, storage of seed and processing of cereal pulse and vegetable. The works dominated by male are seed treatment, raising vegetable nursery, application of pesticide and weedicide and marketing. The activities in which both the groups showed their equal participation are sowing of seeds, scaring of birds, rodents and animals, nursery after care and harvesting. Non participation of women in various operations is due to high fatiqueness, requirement of more muscle power and lack of knowledge and awareness. With respect to decision making it is also observed that prominent role was performed by male, women played only supportive role. Less participation of women in decision making could be attributed to custom, tradition social barrier, their illiteracy ignorance and less participation in extension programmes. Women education, technical training and adequate extension facilities can create a positive impact leading to a better tomorrow.



Key words-Extent of Participation, Agricultural activities, decision making, man, woman.

EFFECT OF INTEGRATED USE OF INORGANIC WITH CHEMICAL FERTILIZERS ON GROWTH PARAMETERS OF RICE CROP

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Rice is one of the most important cereal crops of the world. Presently more than 90% of total rice production and consumption is in Asia. Nutrient management in soil is an important aspect for increasing yield of rice. In cultivation of rice, health and nutrient status of soil declined even in irrigated areas due to application of inadequate and unbalanced quantity of fertilizers. The direct and residual effects of 75% NPK + green manure on grain yield of rice and wheat were more than those through addition of 100% NPK, which indicates that green manure could easily substitute 25% NPK to each of rice and wheat crop. A field experiment was conducted to study the direct effect of organic manures (poultry manure and *Azotobacter*) and chemical fertilizers on rice of *Kharif* season (2010) to find out the effect of integrated use of urea, zinc, poultry manure and *Azotobacter* on growth parameter and yield attributes of rice crop (*Oryza sativa* L.). The experiment was laid out in Randomized Block Design (RBD) during *kharif* seasons with seven treatments and three replications. The details of various treatments applied to rice crop are as follows: T₁ (Control); T₂ (100% RDF); T₃ (100% RDF+ Zn); T₄ (50 % RDF + 50 % N through urea); T₅ (50 % N through poultry manure + 50 % N through urea + Zn); T₆ (50 % N through poultry manure + 25 % N through urea+ *Azotobacter*); T₇ (50 % N through poultry manure + 25 % N through urea + *Azotobacter* + Zn). The integrated use of poultry manure along with urea, zinc and *Azotobacter* were found to yield attributes and nutrients uptake under rice plants significantly over the sole use of chemical fertilizer. The plots which had received poultry manure and chemical fertilizers with *Azotobacter* showed significant improvement in residual soil fertility. It could also be concluded that the application of poultry manure with *Azotobacter* has good performance over sole application of manure. "Effect of integrated use of inorganic with chemical fertilizers on growth parameters of rice crop" is conducted.

Key word: Azotobacter, Poultry manure, Urea, Zn and nutrients concentration

BASED ON M.SC. (AGRIC.) THESIS OF THE FIRST AUTHOR

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Management of Trees outside the Forest (TOF) and Plantations

A tool for prudent management of bountiful tree resources (Theme II)

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Trees have been part of local land use systems for millennia. With increasing population and growing consumerism, there has been severe pressure on food production, environment stability and employment generation, particularly in agro-based developing countries like India. (Hegde, 2010).The trees outside forests (TOF) play a significant role in livelihood of rural and urban people of the country both economically and ecologically. TOF exist in the form of small woodlots and block plantations, trees along linear features such as roads, canals, bunds etc. and scattered trees on farmlands, homesteads, community lands and urban areas (Kumar and Lakhchaura, 2008). The study focuses on diverse issues on tree grower & co-operatives management of degraded village common lands and forest species plantations. The current rate of tree plantation is about 1.5 m ha. per annum where as deforestation is taking place @ 1.0 m ha. per annum, hence, 5.0 m ha. /annum plantation area is to be increased to achieve the target object of 33% area under forest/tree cover.FAO (2010) reported maximum forest area in Russian Federation (809 m. ha.) among top ten countries in the world while India ranks 10th with 68 m. ha. Only.

According to the report of FSI (2001), maximum area of tree cover was noted in Andhra Pradesh (9,011 Sq. Km.) i.e. 3.28% of geographical area which was followed by Maharashtra (8,269 Sq.Km.) i.e. 2.69 % but the maximum percentage tree cover of geographical area was found in Pondicherry (7.19%) which was followed by Dadra Nagar and Haveli (5.54 %) then Tamilnadu (4.65%).

The total cumulative area of forest plantations (in '000 ha) was found 31,209.17 by all agencies from 1951-1999 in India. It was found maximum in UP (4,185.77) which was followed by MP (3,364.13), Gujarat (2,981.08) and Maharashtra (2,965.07) (FSI, 1999). Attempts should be made to do original data collection as first time done in Gujarat (2011) i.e. total tree enumeration in all urban areas. Some incentives should be provided by the government in the form of income tax relaxation with respect to plantation area annually. (Solutions, 2001). It can be concluded that tree outside the forests and plantations has expanded rapidly in all aspects. There is an urgent need to review and reform the existing policies and laws relating to growth and felling of trees with consistent efforts for establishment of forest plantations and tree outside the forest on private lands in perpetuity. Not only the mentioned strategies are sufficient for increasing the tree outside the forest/plantations but also their protection, regular care and monitoring is necessary for fruitful results.

Keywords: Forest trees, Management, Tree outside the forests (TOF), Plantations, FSI

SCREENING OF POTATO GENOTYPES FOR FOLIAR AND TUBER RESISTANCE AGAINST *PHYTOPHTHORA INFESTANS* CAUSING LATE BLIGHT OF POTATO UNDER SUBTROPICAL PLAINS OF INDIA

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The late blight disease caused by *Phytophthora infestans* (Mont.) de Bary, is a serious threat to potato cultivation worldwide. The chemical management is best option for quick control, however due to high cost of chemicals, toxic effect and development of resistant to *P. infestans*. Use of chemicals should be reduced. However, the varietal resistant is cheapest and environment friendly for management of this disease. Therefore, a total of twenty two (two sets) advanced potato hybrids along with four control varieties namely Kufri Bahar (HS), K. Garima (MR), K. Girdhari (HR) and K. Shailja (MR) were evaluated during crop seasons (2012-14; 2013-15) for foliar and tuber resistance against late blight at



CPRI, Regional Station, Meerut. The standard methodologies were followed for disease observation and calculation of both the resistance. In first set, based on field evaluation result revealed that advanced hybrid MS/9-723 showed highly resistant AUDPC (45), another hybrid MP/04-578 showed AUDPC (82) was resistant and 8 hybrids showed AUDPC (150-375) were moderately resistant and remaining one was susceptible (>375) against HS cv. K Bahar (AUDPC-794) during 2012-14. In second set, two advanced hybrids viz, MS/10-885 (75) and MP/07-214 (13) were highly resistant, MS/10-966 (87) was resistant and remaining 9 were moderately resistant during 2013-15 against HS cv. K. Bahar (AUDPC-749). In detached leaf test, five hybrids were moderately resistant (MS/8-88, MS/8-861, MS/9-723, MS/9-2185 & MP/04-816) and remaining were susceptible during 2012-14 whereas MS/10-940 was resistant, eight were moderately resistant and two were susceptible during 2013-15. For tuber resistant three hybrids viz, MS/8-861, MS/9-912 & MP/04-816 were moderately resistant and remaining were susceptible whereas MP/06-39 & HT/10-2505 were resistant and remaining hybrids were susceptible during 2013-2015. The hybrids namely MS/9-723, MS/10-885, MS/10-966, MP/04-578 and MP/07-214 possessed high level of foliar resistance to late blight and two hybrids MP/06-39 & HT/10-2505 possessed high level of resistance to tuber. These hybrids further can be used for varietal development for resistance to late blight of potato.

BIOLOGICAL CONTROL OF DAMPING OFF OF TOMATO CAUSED BY *PYTHIUM APHANIDERMATUM*

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Biological control is a harmless disease control method causing less environmental pollution and reducing hazardous pesticides use, biological control offers an environmental friendly approach to the management of plant disease.

Seedling damping off disease is an important disease at nursery stage caused by *Pythiumaphanidermatum*. It is the most important seedling disease in tomato production in India. The disease causes seed losses of upto 30%. Damping off is managed mainly by application of synthetic pesticides. Concerns about environmental hazards associated with the use of synthetic pesticides in tomato production have increased the need for alternative control methods. Biological control agents have been effectively used in controlling various diseases caused by *Pythium spp.* In addition to managing plant diseases bio control agents can also promote plant growth by enhancing uptake of micro and macro nutrients.

EFFECT OF DIFFERENT SPACING ON SNAPDRAGON (*ANTIRRHINUM MAJUS* L.) CV. AFRICAN MIX".

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Snapdragon is an important annual grown in the winter season, though traditionally they cultivated as perennial, due to its curious shape of flowers, which resemble a dog, rabbit or dragon, so it is popularly called as snapdragon, dog flower, bunny rabbit or bunny mouth. It is ideally suited for beds, pots, edging, window boxes, rockers and mixed borders or with herbaceous plants. Snapdragon flowers used as cut flower, floral arrangements and in bouquets. Antirrhinum belong to the family *Scrophulariaceae* Juss. Snapdragons may be propagated by seeds, or by cuttings which root readily. The seed germinates in 10 to 14 days at 70-degrees F. Growth and flower production in snapdragon is affected by spacing. Closer spacing provides more number of plants but deteriorates the quality of flower and reduce yield. Optimum spacing provides optimum population of plants and better quality of flower and higher yields. Wider spacing provides less number of population and best quality but lower yield, so it is necessary to transplant at appropriate spacing.

The experiment was laid out in Randomized Block Design (factorial) with 3 levels of spacing (30×10 cm, 30×20 cm and 30×30 cm) to studies the effect on snapdragon. It can be concluded from the overall experimental findings that Closer spacing (30×10 cm) enhanced plant height, number of spike/ha. and yield of spike/ha. However, wider spacing (30×30 cm) resulted more spread, number of branches and leaves per plant. Flowering behavior and quality of spike and vase life enhanced in wider spacing 30×30 cm planting distance.

SCREENING AND EVALUATION OF HIGH YIELDING NITROGEN EFFICIENT ADVANCED HYBRIDS OF POTATO (*SOLANUM TUBEROSUM* L.).

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An experiment was conducted at ICAR-CPRS, Patna, Bihar during Rabi 2015-16 and Rabi 2016-17 to evaluate advanced hybrids/lines developed at Jalandhar, Punjab, for identification and evaluation of nutrient efficiency, a replicated field trial of nine advanced hybrids namely N/9-42, N/9-64, N/9-230, N/9-260, N/9-303, N/10-15, N/10-74, N/10-91 and N/10-96 along with three checks (viz., Kufri Pukhraj, Kufri Jyoti, and Kufri Gaurav) were planted at four Nitrogen levels (0, 80, 160 & 240 kg/ha) in four replications. Field observations were recorded for number of tubers and tuber yield in three grades (small, < 25g; medium, 25-75g and large, > 75g). It was observed that maximum numbers of tubers were recorded in N/9-42 (587000/ha) followed by N/10-74 (565000/ha) found significantly better than check varieties. Total yield of tubers differed significantly among genotypes and found maximum in N/10-74 (248.80 Q/ha) followed by N/9-42 (245.16 Q/ha) and both were significantly better than check varieties planted in the experiment. Which indicated that highly efficient advance hybrid to utilize available soil Nitrogen as compared to controls and hybrids.

Keywords: Potato, Hybrids, Tuber yield, Tuber number, Nitrogen levels,



CULTURAL PRACTICES FOR WEED MANAGEMENT FOR SUSTAINABLE PRODUCTION OF TURMERIC (*CURCUMA LONGA* L.)**Puli Sridhar Reddy*, Praveen Khatri, L. Karan Raika, Monika Kapil,**

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Weeds are the main problem in turmeric. Considering turmeric's medicinal value and the environmental problems caused by herbicides, various agronomic practices have been evaluated for weed control in turmeric. Weed emergence and is not affected by different factors like planting depth, seed size, planting pattern, planting space, ridge spacing, and the row number of turmeric until 60 days after planting. This is because turmeric cannot develop a canopy structure until then. Thereafter, weed infestation reduces significantly when turmeric is planted at deeper depths compared to shallower depths. Turmeric grown from seed rhizomes of weight 25–40 g reduces weed infestation significantly and obtains a higher yield compared to smaller rhizomes. The lowest weed infestation is found in turmeric grown in a 20 or 30 cm triangular pattern and the highest yield is obtained with the 30 cm triangular pattern. Turmeric grown on two-row ridges spaced 75 cm apart shows excellent weed control efficiency and obtains the highest yield. This review concludes that turmeric seed rhizomes of 25–40 g and/or the mother rhizome could be planted in 30 cm triangular pattern at the depth of 8–12 cm on two-row ridges spaced 75–100 cm apart during March to April in order to reduce weed interference and obtain a higher yield. Mulching also suppresses weed growth. Weed infestation and yield is higher when turmeric is planted in February than April to June. Biological weed management practices could be integrated in turmeric fields using rabbits, goats, sheep, ducks, cover crops or intercrops for better results.

Keywords: Turmeric, weed management, sustainable turmeric production,**COMMUNITY ANALYSIS OF PLANT PARASITIC NEMATODES ASSOCIATED WITH *VIGNA MUNGO* (BLACK GRAM) IN ALIGARH DISTRICT UTTAR PRADESH****Aiman zafar* and Irshad Mahmood**

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The survey of different locations of Aligarh district was carried out to study the plant-parasitic nematodes associated with *Vigna mungo* during October -2016. Four hundred sixty six soil samples were collected round the roots of black gram. Nine nematode genera were observed in the soil samples collected from black gram fields. Nematode genera observed were *Aphelenchoides*, *Aphelenchus*, *Helicotylenchus*, *Hoplolaimus*, *Meloidogyne*, *Pratylenchus*, *Rotylenchus*, *Tylenchus*, *Xiphinima*. Our survey revealed that among the Nine genera of the plant parasitic nematodes, *Meloidogyne* spp. was present in all the examined localities of Aligarh district, except at Khair. *Meloidogyne* was most prominent nematode genera observed with Prominence value (PV) of **3459.3**, Absolute frequency of **80.69%** and absolute density **143.03** nematodes/200cc soil. This was followed by *Hoplolaimus*, *Helicotylenchus*, *Aphelenchoides*, *Aphelenchus*, *Pratylenchus*, *Tylenchus*, *Rotylenchus*, and *Xiphinima*. In the respective nematodes, the prominence value was observed as 546.9, 373, 328.4, 313.5, 253.6, 177.9, 156.9 and 144.71.

EVALUATION OF MORPHOLOGICAL AND PHYSIOLOGICAL PARAMETERS DURING DROUGHT STRESS IMPOSED BY PEG 6000 IN-VITRO GROWING BARNYARD MILLET FROM KUMAUN REGION OF HIMALAYAN.**Dipti Singh. AshutoshDubey. A.K. Verma**

Maximum and minimum shoot and root length, root/shoot and seed vigor index was observed in variety VL172 and variety VL29 on both the days respectively. Germination index was found maximum in variety VL172 and minimum in variety VL29. Relative water content (RWC), moisture content, fresh weight, dry weight and electrolyte leakage was maximum in variety VL172 and minimum in variety VL29. Percent decreased in total chlorophyll and increased in Chl a/b ratio found in variety VL172 and percent decreased in total chlorophyll was maximum in variety VL29 with minimum increased percent in chl a/b ratio in variety VL29. Variety VL172 found to be tolerant and variety VL29 was susceptible to drought stress.

Keywords: Barnyard millet. Morphological parameters. Physiological parameters. Drought. PEG.**SPECIATION IN CROP IMPROVEMENT****Gobu R.,* Kailash Chandra, Naveenkumar R., Omprakash and Dhanapal R.**

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Speciation is a natural phenomenon, occurring over millions of years which have led to the formation of innumerable number of species in the earth. *Anagenesis* and *Cladogenesis* are the two possible ways of Speciation. *Anagenesis* is the accumulation of heritable traits in a population that transforms that population into a new species. *Cladogenesis* is branching evolution, in which a new species arises as a branch of from the evolutionary tree. There are four geographic modes of speciation in nature, based on the extent to which speciating populations are isolated from one another. They are allopatric speciation, peripatric speciation, parapatric speciation and sympatric speciation. Speciation may also be induced artificially, through animal husbandry, agriculture or laboratory experiments. In plants, artificial speciation may be achieved through hybridization and polyploidization. In the past, it is very difficult to study, how new species are generated in nature, because our life time is too short to observe the entire process of speciation. But in recent years, molecular and genomic techniques have been developed for



identifying and studying the genes involved in speciation. To use speciation as a method of crop improvement, we need to understand the natural speciation process very clearly. We need to know the factors, its mechanism, time taken and so on, so that we can make these things artificially. Also, biodiversity will be greatly enriched by the speciation process, which will serve as the raw material for plant breeding activities. Reducing cultivable area and growing population offers great challenges to the plant scientists, so we need to create novel new species to address these issues through artificial speciation.

Keywords: Speciation, Anagenesis, Cladogenesis, Crop Improvement

INTEGRATED PEST MANAGEMENT FOR OKRA FRUIT AND SHOOT BORER, *Earias vittella* (Fabricius)

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Okra frequently known as lady's finger or bhendi belonging to family Malvaceae, is an important summer season vegetable crop. One of the major constraints identified in okra production is the increasing incidence of insect pests. Pest incidence in okra is very high as that of cotton due to similar botanical family. As high as 72 species of insects have been recorded to attack on okra. Among them *Earias vittella* is the most serious pest which causes direct damage to tender shoots and fruits. It is reported that about 69 per cent losses in marketable yield are due to attack of this insect pest. Enormous conventional insecticides have been used extensively for the control of okra shoot and fruit borer which has resulted a progressive decrease in the effectiveness as well as development of resistance on the pest. So, today there is a great demand for safer and more eco-friendly pest management techniques as a part of IPM programs like; monitoring and mass trapping through Pheromone traps and Light traps, cultural practices (Deep summer ploughing and soil solarisation, Clean cultivation and destruction of crop residue, Erection of bird perches, Crop rotation and Intercropping, Trap Cropping), Mechanical control, Biological Control, Use of biopesticides and minimum use of chemical insecticides which affect specifically harmful pests, while sparing beneficial insect species and other organisms.

Keywords: Okra, IPM, *Earias vittella*.

INTEGRATED PEST MANAGEMENT FOR TOMATO FRUIT BORER, *Helicoverpa armigera* (Hübner)

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Tomato (*Lycopersicon esculentum* Miller) is one of the most important commercial vegetable crops grown all over the world and India. Among many factors responsible for low yields of tomato, insect pests are major ones that have been reported to attack tomato at all stages of crop growth. Tomato crop is subject to attack by a large number of insect pests right from nursery sowing till harvesting of the crop. *Helicoverpa armigera* (Hübner) is a key pest as it attacks the cashable part of the plant i.e. fruits and makes them unfit for human consumption causing considerable crop loss leading up to 55 per cent. In order to minimize the indiscriminate and injudicious use of chemical pesticides, Integrated Pest Management (IPM) has been enshrined as cardinal principle of plant protection. Tomato fruit borer can be managed by using IPM components like cultural, mechanical, biological and chemical measure together and compatible manner.

Keywords: Tomato, IPM, *Helicoverpa armigera*

INTEGRATED PEST MANAGEMENT FOR TOMATO FRUIT BORER, *Helicoverpa armigera* (Hübner)

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Keywords: Tomato, IPM, *Helicoverpa armigera*

YIELD ENHANCEMENT OF PULSES THROUGH INTEGRATED WEED MANAGEMENT

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Pulses occupy an important place in Indian agriculture. Among the different production constraints of pulses, weeds are the major challenge to pulse production through their capacity to compete for resources and their impact on quality produce. Out of different methods of weed control, cultural method is uneconomical and more laborious. Due to non availability of farm labour, the use of herbicides is a better option. There is problem of herbicide resistance in certain weeds due to inappropriate use of herbicides dose and its repetitive use. To overcome these problems, the integrated approach quite effective, in this approach the combination of two or more methods of weed control which reduce the dependence on any one weed control method. Bhowmick *et al* (2015) reported that combination of pendimethalin (0.75 kg ha^{-1}) with one hand weeding at 40 DAS significantly reduced the weed growth and gave higher grain yield of black gram. Rathod *et al* (2017) concluded that integration of pendimethalin (0.75 kg ha^{-1}) with hand weeding at 30-35 DAS or pendimethalin + imazethapyr 1.0 kg ha^{-1} PE with one hoeing at 30-35 DAS was effective in controlling weeds and obtaining highest seed yield in chickpea. Keeping weed population under economical threshold level, prevention of weed shift and improvement in crop productivity and environmental safety are the main goals of IWM.

IMPACT OF CLIMATE CHANGE ON THE POPULATION DYNAMICS OF INSECT-PESTS SPECIES AND THEIR NATURAL ENEMIES

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Climate change may have an effect on all organisms, including plants, insects and their interactions among weather, plants and herbivores. Climate change resulting in increased temperature could impact crop pest insect population in several complex ways. The population dynamics of an insect species is manipulated by the various factors such as host plant, natural enemies and abiotic parameters. Insects are poikilothermic animals and therefore they are highly sensitive to their surrounding climate particularly the temperature. The abiotic parameters are known to have direct impact on insect population dynamics through modulation of insect physiology, behavior, developmental rates, survival, fecundity, voltinism and dispersal. Increasing temperature and elevated CO_2 have substantial impacts on plant-insect interaction and integrated pest management programmes. Rising temperature leading to rapid development of insects and insect voltinism, with the logical assumption that increases in surface temperatures would permit multivoltine species to increase the number of generations per year. Natural enemy and host insect populations may respond differently to changes in temperatures. Parasitism could be reduced if host populations emerge and pass through vulnerable life stages before parasitoids emerge. Hosts may pass through vulnerable life stages more quickly at higher temperature, reducing the window of opportunity for parasitism. Elevated carbon dioxide (CO_2) and fluctuating precipitating patterns as range expansion, increased epizootics (insect outbreaks) and new species introduction in regions where previously these were not reported. The CO_2 is causing indirect effect through host nutrient alteration and it has both positive and negative effects. Climatic change will also reduce the effectiveness of host plant resistance, transgenic plants, natural enemies, bio-pesticides, and synthetic chemicals for pest management.

Keyword: Climate change, Population dynamics, Natural enemies, Carbon dioxide, Temperature.

HIGH TEMPERATURE A PROBLEM FOR WHEAT CROP

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Wheat (*Triticum aestivum* L.) one of the world's leading cereal crop. In India wheat is the second most cereal crop after rice. Wheat is thermo sensitive crop mostly grown in temperate environment. However it is predominantly consumed in tropical and subtropical areas it is cultivated in winter season but it is exposed to high temperature stress in the end of the season's *i.e* grain filling stage. Research finding of ICAR on wheat crop has indicated that there about 3-4% decrease grain yield with 1°C rise in temperature during grain filling stage. Heat stress is one of the major limiting factors for growth and productivity wheat crop particularly in warmer region. Exposure higher to normal temperature or heat stress reduce yield and decrease quality. Occasional and prolonged heat temperature causes different morpho-anatomical physiological biochemical changes in plant. HSP (Heat shock Protein) group of protein that normally exist in cells, but their synthesis accelerated by heat. Molecular Knowledge response to tolerance mechanism will give the way for engineering plant that can tolerate heat stress and could be basis production of crops which can produce economic yield under heat stress conditions. Hence now breeding for heat tolerance has become an integral component of wheat improvement at national or international level.

Keyword: Heat stress, Yield, HSP, Breeding.

POTASSIUM-SOLUBILIZING BACTERIA AND THEIR IMPORTANCE IN SOIL HEALTH

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Potassium (K) is one of the major macronutrients which play an important role in plant growth and development. Total soil potassium reserves are generally huge; however, major section (about 90–98 % of total potassium) in soil exists in unavailable mineral form. Silicate minerals such as K-feldspars and biotite are the most general minerals in the earth's crust and are a source of inorganic nutrients in soils to provide optimal nutrition for crops. There are certain microorganisms which use a number of biological processes to make potassium obtainable from



unavailable forms. Recently, K-solubilizing bacteria have been isolated from rhizosphere soil of different crops, which cause potassium solubilization by production of organic/inorganic acids or by production of polysaccharides. Efficient K-solubilizing bacteria have been reported to enhance potassium uptake in plants leading to plant growth stimulation under pothouse and field conditions. These K-solubilizing bacteria (KSB) could be applied as potential biofertilizer along with application of rock K materials to provide a continuous supply of available potassium for increasing the crop yield and improve soil health.

Key word:- KSB, soil health, crop yield, mineral

ANTIMYCOTIC ACTIVITY OF *TRICHODERMA* SP. AGAINST *FUSARIUM OXYSPORUM* F. SP. *CAPSICI* CAUSING WILT DISEASE IN CHILLI

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The antimycotic activity of *Trichoderma* species were tested both *in-vitro* and *in-vivo* conditions against *Fusarium oxysporum* f.sp. *capsici* causing wilt disease in chilli. The antagonistic potential was determined by dual culture technique where *Trichoderma harzianum* exhibited its maximum potentiality in arresting radial growth of *Fusarium oxysporum* f.sp. *capsici* at 36.36% while *Trichoderma viridae* showed maximum inhibition on radial growth at 40.00% as compared to the control. Further, the efficacy of *T. harzianum* and *T. viride* was tested against *F. oxysporum* f.sp. *capsici* under glass house and field conditions. Among the various treatments, T₁ (1% talc based formulation of *T. harzianum*) significantly reduced the wilt disease as 87.55% in *in-vitro* conditions where a maximum of 35.27% wilt incidence was observed in untreated control. While in *in-vivo* conditions, T₁ (1% talc based formulation of *T. harzianum*) significantly reduced the wilt disease as 67.20% where untreated control recorded the maximum wilt incidence as 64.22%. This was followed by T₂ (1% talc based formulation of *T. viride*) which reduces the wilt incidence as 83.93% and 64.74% in *in-vitro* and *in-vivo* conditions respectively. In *in-vivo* conditions with regard to the germination and seedling growth parameters, the treatment T₃ (1% liq. formulation of *T. harzianum*) recorded the highest shoot length (17.20 cm), root length (8.30 cm), vigor index (2217.9) and yield (744 kg/ha). From the findings it can be concluded that seedling treatment with 1% talc based formulation of *Trichoderma harzianum* and *T. viride* showed promising performance against chilli wilt disease.

BIOTRANSFER OF CADMIUM, LEAD AND ZINC FROM FLY ASH AMENDED SOIL IN PLANT- ARTHROPOD FOOD CHAIN.

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The transfer of cadmium (Cd), lead (Pb) and zinc (Zn) from fly ash amended soil in mustard (*Brassica juncea*)-aphid (*Lipaphis erysimi*)-beetle (*Coccinella septempunctata*) food chain and its subsequent implications for the beetle was investigated in the present study. The soil was amended with different rates of fly ash (w/w). The results showed that the uptake of Cd, Pb and Zn from soil to mustard root increased with the increase in fly ash application rates, but their root to shoot translocation was relatively restricted. The transfer coefficient showed that Cd biomagnification in aphids at second trophic level, but no biomagnification was found in adult beetles at third trophic level. Zn biomagnified in all the trophic levels. The Pb was only metal whose transfer coefficient was less at both second and third trophic levels. The elimination of Cd via honeydew of aphids was most efficient. The statistically consistent ($p > 0.05$) biomass and predation rate of predatory beetles indicated that all levels of soil amendments with fly ash did not have any lethal or sub-lethal effects on beetles.

Keywords: Biotransfer; bioaccumulation; heavy metal; food chain; mustard; beetle.

AGROFORESTRY: AN OPPORTUNITY FOR CARBON SEQUESTRATION AND LIVELIHOOD SECURITY

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Agroforestry play a significant role in enhancing land productivity and improving livelihoods in both developed and developing countries. Although carbon sequestration through afforestation and reforestation of degraded natural forests has been considered useful in climate change mitigation, agroforestry offers distinct advantages. The planting of trees along with crops improves soil fertility, controls soil erosion, controls water logging, checks acidification and eutrophication of streams and rivers, conserve and increases biodiversity, decreases pressure on natural forests for fuel and provides fodder for livestock. It also has the ability to enhance the resilience of the system for coping with the adverse impacts of climate change. Agroforestry systems show significant carbon accumulation in living biomass, as well as soil carbon, demonstrating the potential to offer the environmental service of carbon sequestration. Proper design and management of agroforestry practices can make them effective carbon sinks. As in other land use systems, the extent of C sequestration will depend on the amount of C in standing biomass, recalcitrant C remaining in the soil, and C sequestered in wood products. Average carbon storage by agroforestry practices has been estimated as 9, 21, 50, and 63 Mg C ha⁻¹ in semiarid, sub-humid, humid and temperate regions respectively. For smallholder agroforestry systems in the tropics, potential C sequestration rates range from 1.5 to 3.5 Mg C ha⁻¹ yr⁻¹. Furthermore, agroforestry systems can contribute to reducing CO₂ emissions by avoiding burning of forest-based fuelwood and conserving soil. Besides the potential of agroforestry system to accumulate and sequester carbon, these systems could evolve into a technological alternative for reducing deforestation rates in tropical zones while also offering a wide variety of products and services to rural communities.

Keywords: Agroforestry, climate change, Carbon sequestration, Livelihood Security



ADAPTATION AND MANAGEMENT PRACTICES TO MITIGATE THE IMPACT OF HIGH TEMPERATURE ON WHEAT**Vinaya Kumar Yadav^{*A}, R.K. Yadav^B, A.K. Singh^A, Meera Srivastav^A and M.A. Khan**Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002 (U.P.), India^ANarendra Dev University of Agriculture and Technology, Kumarganj, Faizabad-224229 (U.P.), India^B

Change in climate is one of the biggest threats to agriculture. Changes in solar radiation, precipitation variability, relative humidity and CO₂ concentration result in temperature and water stress. This changing climate could strongly affect the wheat production worldwide. Increasing temperature during grain filling stage of wheat causes substantial reduction in grain yield. The impact of high temperature on wheat productivity and various adaptation and management practices time of sowing, water management, and foliar spray of KNO₃, KCl, Urea and GA₃ to mitigate the high temperature stress. The delay in sowing beyond optimum sowing period reduces the vegetative and reproductive phases. Adjustment in sowing time is one of the most important strategies to counteract the adverse effect of temperature. An increase of 0.50°C temperature resulted in decrease in duration of crop by seven days, reducing yield by 0.5 t/ha in north India. High temperature after flowering hastens leaf senescence, thereby reduces grain filling stage and thus decreases grain yield. Ideally the best temperature regime for optimum growth and yield of wheat crop is: 20–22 °C at sowing, 16–22 °C at tillering to grain filling and slow rise of temperature to 40 °C at harvesting stage leads to forced maturity there by reduction in the grain yield.

Keywords: Climate change, water management, foliar spray, sowing time**ROLE OF RHIZOBIUM ON THE GROWTH AND DEVELOPMENT OF PEA PLANT****Aman Deep Ranga¹, Sourav Kumar¹, Bijendra Kumar^{2*}**

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Seed treatment is nothing but a chemical, antimicrobial or fungicidal treatment with which seeds are treated (or "dressed") prior to planting. The main purpose of seed treatment is to subjecting the seeds to solar energy exposure, immersion in conditioned water, etc to prevent from biotic and abiotic factors. The *Rhizobium* culture strains are anti-genetically selective and require particular host or nodulation. The surface antigen on the Rhizobial cells recognizes the binding sites (specific root exudates) on the roots of the leguminous plants. This characteristic of *Rhizobium* culture makes host-specific. The main objective of this study was to determine the effect of Rhizobium seed on damping-off, germination, seedling height, maturity, root nodule mass, leaf size and seed yield of pea. Compared with the controls, treatment of pea seeds with *R. leguminosarum* found significantly reduced incidence of damping-off, promoted seedling growth and increased root nodule mass, seed yield, root biomass and shoot biomass. Although, the level of disease control by *R. leguminosarum* was similar to seed treatment with the fungicide Thiram. Seeds treated with *R. leguminosarum* were more effective in enhancing root nodule for production and promoting plant growth.

Keywords: Antigene, *Rhizobium leguminosarum* Seed treatment, Strains, Thiram**SODIUM FLUORIDE EFFECT ON LINSEED AT ON GERMINATION LEVEL****Amit Nagar, Shashank Gupta, Ramu K**

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Fluoride a toxic substance is present in air, water and soil. Industrial growth as well as human activities are responsible for increasing environmental pollution. Even at lower ambient fluoride concentrations, a number of physiological changes may be initiated in plant without the appearance of visible injury symptoms, levels of Sodium Fluoride (NaF) exhibited a marked reduction in growth parameters i.e. seedling germination percentage, length of root, length of shoot, plant height, number of leaves, size of leaf, number of flower per plant. Toxicity is a great cause of fluoride ion at high concentrations is known to cause several health hazards to human population and live stock including dental and skeletal fluorosis. The main source of Fluoride is groundwater, soil and air but among them groundwater is the most common source of fluoride pollution. Fluoride in groundwater is geological and the fluoride enrichment mechanism is controlled by presence of fluoride bearing minerals in rocks or soils, the degree of weathering as well as amount of leachable fluoride in a terrain. Fluoride presents in soil, water, air and plants in varying concentrations but is not co. Due to this high concentration of fluoride, it results in the necrosis and chlorosis in the plant, reduction in growth of shoot and root and ultimately reduced the yield of linseed. Bioaccumulation of fluoride in wheat grains creates secondary source of fluoride to human population resulting in food-borne fluorosis, primarily considered essential for the normal growth of plants.

INTEGRATED NUTRIENT MANAGEMENT IN FRUITS**Amit Kumar, Vivek Ujjwal, Ajay Yadav, and Vimal Nagar**

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India's horticulture production has increased by 30 per cent in the last five years. This has placed India among the foremost countries in horticulture production, just behind China. During 2012-13, its contribution in the world production of fruits was 12.6 %. Total production of fruits during 2012-13 was 81.2 million tonnes. Though production of fruits has increased manifold over the last decade but there exists a gap between the demand and supply of fruits. The present fruit production in India meets only the 46% of the total demand. The continuous use or excess supply of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing economic inefficiency, damage to the environment and in certain situations, harm the plants themselves and also to human being who consume them. On the other hand, increase in productivity of horticultural produce removes large amounts of essential nutrients from the soil. Without proper management, continuous production of crops reduces nutrient reserves in the soil. Another issue of great concern is the sustainability of soil productivity, as land began to be intensively exhausted to produce higher yields. Overtime, cumulative depletion decreases production, yield and soil fertility



and lead to soil degradation. Thus there is strong need to increase the production and productivity through crop diversification and use of best horticultural techniques among which Integrated Nutrient Management (INM) is the one.

Integrated Nutrient Management is a system that helps to restore and sustain crop productivity and also assists in checking the emerging micro-nutrient deficiencies. Integrated plant nutrient management can also be referred to as maintenance of soil fertility and plant nutrient supply to optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. It envisages the use of chemical fertilizers in conjunction with organic manures, green manures, crop residues, and legumes in a cropping system and locally available resources with objectives of sustaining high yield and ensuring environmental safety.

MICROPROPAGATION OF GERBERA JAMESONII -AN ORNAMENTAL PLANT.

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Gerbera jamesonii L. (Family-Asteraceae) commonly known as Trans-daisy. It was named in the honour of a German naturalist Traugott Gerber. It is a perennial ornamental plant. It is most commercial flower in World and occupies the fifth place among cut flowers. *In-vitro* propagation of *G. jamesonii* was done by using nodal segments as explants. The explants were washed with liquid detergent under running tap water to remove dust particles. The explants were then treated with 0.1% (w/v) mercuric chloride for 3-5 minutes under aseptic conditions. After this, these explants were thoroughly washed 4-5 times with sterilized double distilled water to remove the traces of mercuric chloride. The nodal segments after trimming the ends were finally inoculated on Murashige & Skoog media containing 30 g/l sucrose and 8 g/l agar, supplemented with different concentration of BAP (0.5 - 1.5 mg/l) individually and in combination with IBA and NAA. The culture were incubated under 16 hours of light and 8 hours dark period at 25±2°C. The Maximum numbers of shoots per explants (38.30) were obtained on media containing BAP (0.75 mg/l) + (0.030 mg/l) IBA + NAA. Best shoot length (3.05 cm) followed by MS medium with 0.75 mg/l BAP + 0.030 mg/l IBA + 0.025 mg/l NAA (29.90 and 2.48 cm) followed by MS medium with 0.75 mg/l BAP + 0.030 mg/l IBA + 0.025 mg/l NAA (29.90 and 2.48 cm). However the treatment that gave least number of shoots per explants (17.97) minimal shoot length of (2.12 cm) was observed with 0.5 mg/l BAP + 0.030 mg/l IBA + 0.025 mg/l NAA. For rooting response, half MS media various combination fortified IBA (0.1-2.0 mg/l). Most efficient rooting response (95.28%) with average length (1.48±0.3 cm) and number of roots (5.40±0.25) was observed on half MS media supplemented with (0.4 mg/l). Minimum response for rooting was found on half MS medium with 0.1 mg/l IBA (73.33%). The rooting percentage was differed. The regenerated plantlets were successfully transferred to pots containing sterilized soil and sand mixture (3:1) and acclimatized with more than 70% survival rate in the field conditions.

Keywords: *In-vitro*, *Gerbera jamesonii*, BAP, IBA, NAA.

ANTIMYCOTIC ACTIVITY OF *TRICHODERMA* SP. AGAINST *FUSARIUM OXYSPORUM* F. SP. *CAPSICI* CAUSING WILT DISEASE IN CHILLI

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The antimycotic activity of *Trichoderma* species were tested both *in-vitro* and *in-vivo* conditions against *Fusarium oxysporum* f.sp. *capsici* causing wilt disease in chilli. The antagonistic potential was determined by dual culture technique where *Trichoderma harzianum* exhibited its maximum potentiality in arresting radial growth of *Fusarium oxysporum* f.sp. *capsici* at 36.36% while *Trichoderma viridae* showed maximum inhibition on radial growth at 40.00% as compared to the control. Further, the efficacy of *T. harzianum* and *T. viride* was tested against *F. oxysporum* f.sp. *capsici* under glass house and field conditions. Among the various treatments, T₁ (1% talc based formulation of *T. harzianum*) significantly reduced the wilt disease as 87.55 % in *in-vitro* conditions where a maximum of 35.27% wilt incidence was observed in untreated control. While in *in-vivo* conditions, T₁ (1% talc based formulation of *T. harzianum*) significantly reduced the wilt disease as 67.20% where untreated control recorded the maximum wilt incidence as 64.22%. This was followed by T₂ (1% talc based formulation of *T. viride*) which reduces the wilt incidence as 83.93% and 64.74% in *in-vitro* and *in-vivo* conditions respectively. In *in-vivo* conditions with regard to the germination and seedling growth parameters, the treatment T₃ (1% liq. formulation of *T. harzianum*) recorded the highest shoot length (17.20 cm), root length (8.30 cm), vigor index (2217.9) and yield (744 kg/ha). From the findings it can be concluded that seedling treatment with 1% talc based formulation of *Trichoderma harzianum* and *T. viride* showed promising performance against chilli wilt disease.

BREEDING FOR ENHANCING NUTRITIONAL QUALITY IN TOMATO (*LYCOPERSICON ESCULENTUM* L.)

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Once considered inedible, the tomato has become one of the most popular and extensively consumed vegetable crop. The improvement of the tomato through breeding for nutritional quality and processing attributes is vigorously pursued worldwide. Enormous efforts have been undertaken in breeding for enhancing vitamin A in case of tomato. In tomatoes red fruit colour is mainly due to lycopene which occurs in 12:1 to 18:1 ratio with β -Carotene. The trait high β -Carotene content was transferred from *L. hirsutum*, the green fruited wild species native to South America. The high β -Carotene trait in the lines derived from the cross between *L. esculentum* X *L. hirsutum* was governed by 2 major genes from *L. hirsutum*. In addition, some modifying genes from *L. esculentum* also affected β -Carotene content. These lines were used in hybridization programme and an agronomically acceptable variety "Caro Red" rich in β -Carotene (10 times more β -Carotene) was developed. However, it was not accepted by consumer mainly due to its colour being different from the preferred Red colour. The potential impact of corticoids



enhancement, therefore be judged against benchmark that include the importance of particular crops in term of global food security, the amount of bio available β -Carotene and the amount of food must be consumed to achieve the reference daily intake of vitamin A.

Keywords: Nutritional Quality, β -Carotene, Hybridization, Vitamin A, Caro Red

INTEGRATED NUTRIENT MANAGEMENT (INM): A WAY TO IMPROVE ECOLOGICAL BALANCE AND FARM INCOME (Theme- Integrated Nutrient, Weed, Disease and Pest Management)

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The transformation of agriculture from subsistence farming to commercial farming with the use of efficient varieties, pesticides, fertilizers and mechanization has increased production, but at the cost of natural resources destruction. In the present context, therefore, there is a need to sustain and enhance the physical, chemical and biological health of our ecosystem. Plant nutrition by the use of chemicals alone has lower efficiency and exclusive reliance on chemicals (fertilizers) has caused several problems viz., chemical residues in food chain, loss of soil organic matter i.e. decreasing soil fertility and environmental pollution including destruction of biodiversity. To overcome these problems, integrated resource management including integrated nutrient management is the best with using on farm inputs to maximum extent and decreasing dependence on purchased inputs.

Integrated nutrient management (INM) is an ideal combination of agronomical, biological, chemical and other methods in a planned, sequential and sustainable manner to achieve the desired objective. It encompasses organic manures (FYM, compost, vermicompost, animal wastes, green manures, plant residues, agro-industrial by products, etc.), biofertilizers (N-fixing, P-solubilising and different consortia), inorganic fertilizers (straight, complex and mixed fertilizers, nano-fertilizers, slow release fertilizers, liquid fertilizers, etc.). The adoption of INM leads to increased net return of farmers, development of rich biodiversity S(including soil micro-organisms) and ecosystem (Ecological balance), quality food and fodder production as well as sustainable output growth and adequate buffer stocks.

Keywords: Ecosystem, Organic manures, Fertilizers, Biodiversity, Net Return, Ecological Balance

CONSERVATION FOR SUSTAINABLE DEVELOPMENT CHANGE IN BIODIVERSITY: IMPORTANCE OF FOREST RESOURCE CONSERVATION

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One of the reasons biodiversity is important because it helps to keep the environment in natural balance. Biodiversity offers many natural services such as Ecosystem services, water conservation, soil formation and protection, Nutrient storage and recycling, pollution break down and absorption, contribution to climate stability, maintenance of ecosystem, recovery from unpredictable events. Climate change has been identified as one of the most important concerns of the contemporary civilization. Forest resources such as food, medical resources and pharmaceutical drugs, wood products, ornamental plants, breeding stocks, population reservoirs, diversity in genes, species and ecosystem, social benefits such as research education and monitoring, recreation and tourism, building materials, fuel, paper product, fiber, industrial product, regulating global process such as atmosphere, climate and soil conservation, control of agricultural pests, genetic library. Results of the study also suggests to think over possible shift in current forest management practices optimizing other factors to which fulfill the criteria of Sustainable Forest Management (SFM) and Millennium Development Goals (MDG). To conserve biomass of these natural forests there is need to provide other alternative sources of energy to people and also aware them better management and conservation of forest in more sustainable way.

KEYWORDS: Biodiversity, Climate change, Forest resources, Management etc.

MANAGEMENT OF SOIL BORNE DISEASES THROUGH BIOAGENTS

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Trichoderma harzianum is a [fungus](#) that is also used as a bioagent. It is used for [foliar](#) application, seed treatment and soil treatment for suppression of various disease causing fungal pathogens. Commercial biotechnological products such as 3TAc have been useful for treatment of [Botrytis](#), [Fusarium](#) and [Penicillium sp.](#) It is also used for manufacturing [enzymes](#). Most *Trichoderma* strains have no sexual stage but instead produce only asexual spores. However, for a few strains the sexual stage is known, but not among strains that have usually been considered for biocontrol purposes. *Trichoderma* spp. are fungi that are present in nearly all soils. They also exist in many other diverse habitats. *Trichoderma* readily colonizes plant roots and some strains are rhizosphere competent i.e. able to grow on roots as they develop. *Trichoderma* spp. also attack, parasitize and otherwise gain nutrition from other fungi. They have evolved numerous mechanisms for both attack of other fungi and for enhancing plant and root growth. Different strains of *Trichoderma* control almost every pathogenic fungus for which control has been sought. However, most *Trichoderma* strains are more efficient for control of some pathogens than others, and may be largely ineffective against some fungi. *Trichoderma viride* was found to be parasitic on *Aspergillus*. The mycoparasitism was characterized by frequent coiling, penetration and hyphal growth of the parasite inside the conidiophores of *Aspergillus*. The volatile and non-volatile metabolites of *T. viride*, more or less, inhibited radial growth of all the *Aspergillus* spp.

Keywords: Trichoderma; Plant Disease; Biological Control; Disease Suppression



NATURAL RESOURCES CONSERVATION: AGROFORESTRY FOR IMPROVING CARBON SEQUESTRATION**Sandya.N.R* and K. Hemalatha**Department of agronomy, Institute of Agricultural sciences
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Never before in the history of human civilization has environmental issues attained so much global prominence as it does today. Between 2000 and 2017; atmospheric concentration of CO₂ has increased from 369 to 410 ppm. Even with a temperature rise of 1– 2.5 °C, the IPCC predict serious disastrous effects, including reduction in crop yields in tropical and subtropical areas leading to increased risk of food shortage, spread of climate responsive diseases such as malaria, and an increased risk of extinction of 20 – 30% of all biodiversity present on earth. One of the approaches to reduce CO₂ concentration in the atmosphere is carbon sequestration, the process of capturing atmospheric CO₂ and storing for long term through natural (soils/vegetation) and engineering techniques. Agroforestry is “a dynamic, ecologically based, natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels.” The actual aim of agroforestry method was improving rural livelihood and meeting various needs, viz. food, fuel, timber, fodder of the farmers. But in recent era of climate change, the role of agroforestry in stabilizing the CO₂ levels and increasing the C sink potential has attracted considerable attention and became economically and ecologically very attractive tool for mitigating harmful effect of GHGs since, the Kyoto Protocol allowed industrialized countries with a GHG reduction commitment so as to invest in mitigation projects in the developing and least developed countries under the Clean Development Mechanism (CDM) and there is an attractive opportunity for major practitioners of agroforestry, especially the resource poor farmers. Besides the potential of agroforestry systems to accumulate and sequester C, these systems provide the unique opportunity to increase the tree cover to a level of 33% in India.

PERFORMANCE RELATIONSHIPS BETWEEN NIGHT SATELLITE AND OCO-2 SIGNATURE- IN THE CASE OF DELHI (INDIA)**Ambreen Matloob, Jung-Sup Um**

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DMSP-OLS is a special night-time imageries source that offers capabilities to represent human activities on the Earth's surface through the observation of artificial lighting at night. Temporal night-time DMSP-OLS satellite data was used over the Indian region in the current study to detect urban footprints with emphasis on Delhi. This paper analyses nightlight of the earth at night derived from the DMSP-OLS data, and explores performance of OCO-2 XCO₂ signature (level 2 data of column averaged CO₂ concentration that were collected from orbiting carbon observatory) in investigating causal relationship between them. The objective of this paper is to predict the relationships between the nightlights and CO₂ emissions, through geographically weighted regression (GWR). The higher value of pixel (0-63) represents the more urban and built-up areas which generally show higher XCO₂ mean concentration. The higher pixel value shows highest local R² while lowest local R² is generated from lower pixel values. The adjusted R² (0.6) were statistically significant on nightlight. This study could provide useful insights that improved spatial resolution of OCO-2 could explain co relationship between CO₂ and nightlights for specific area.

INTELLECTUAL PROPERTY RIGHTS (IPR) ISSUES IN HORTICULTURE AN INDIAN SCENARIO WITH PARTICULAR REFERENCE TO VEGETABLE CROPS**Sunil K. Maurya¹, Sandeep K. Mauriya¹, Ragini Maurya¹, Jyoti Singh²**¹Department of Horticulture Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP)²Department of Horticulture Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P)

The coverage of intellectual property rights (IPR) has expanded to cover even resources that were previously deemed to be part of the public domain. A major concern particularly for developing countries is the TRIPs Agreement which obliges all members to provide patents in all fields of technology and also to provide IPRs (either patents or a sui generis system) for plant varieties. Several declarations, at national and international level, emphasize the need for identification, evaluation, conservation, and sustainable utilization of plant genetic resources (PGR) particularly vegetable crops. These declarations have assumed greater significance under post-WTO era where the TRIPs Agreement requires patent protection for at least 20 years for any invention of pharmaceutical product or process. The present paper highlights salient features of recent national and international efforts concerning the utilization of plant genetic resources and assesses the implications of these developments with particular reference to vegetable crops in India. This lack of co-ordination led to critical research gap relating to socio-economic and policy aspects of vegetable crops. In the absence of such policy framework, the illegal intellectual property protection and misuse of plant genetic resources would continue and our share in the global market would remain meagre. Optimal institutional framework is necessary for carrying out species-specific and socio-economic environment specific research in vegetable crops.



SEASONAL INCIDENCE PATTERN OF MUSTARD APHID, *LIPAPHIS ERYSIMI* (KALT.) IN TARAI REGION OF UTTAR PRADESH AND UTTARAKHAND**C.P. SINGH and SHWETA PATEL**

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Rapeseed-mustard is the main oilseed crop sown during the *Rabi* season in India. Among the different oilseeds crops, rapeseed-mustard is the second largest oilseed crop providing 13% of the world supply. Even after availability of good production technology mustard crop is unable to give potential yield in the country. This is because *Brassica* crops suffer heavy loss in yield due to various biotic and abiotic factors. Among the biotic constraints, insect-pests are one of the most important biotic factors in reducing the crop yield. About 50 insect species have been found infesting rapeseed-mustard in India. Out of many insect pests, mustard aphid (*Lipaphis erysimi*) has gained the status of key pest. It was found causing damage at flowering stage of the crop and measurable yield losses to the range of 9 to 99%. The pattern of its incidence was observed very erratic. It appeared in 3(1), 4(2), 51(0.6), 52(5.7), 4(1.6), 2(19.5), 6(4.53), 1(0.20), 4(27.33), 1(0.79), 4(19.3), 3(126.33), 4(25.40), 4(20), 52(3.3), 51(181.6), 52(79.3) and reached to its peak in 5(13), 5(7), 5(39.4), 2(21), 7(18.4), 4(121.5), 8(27.73), 6(12.93), 6(73.67), 5(108.87), 7(125.67), 6(500), 7(103.67), 6(53), 3(143), 52(334), 323(5) standard week(SW) during 1998-99, 1999-2000, 2000-01, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2009-10, 2010-11, 2011-12, 2013-14, 2014-15, 2015-16 and 2016-17, respectively. The migratory recorded was also not regular and has been found very erratic.

ROLE OF POTASSIUM SOLUBILIZING MICROBES IN PLANT NUTRITION**Alka Arya**

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Potassium (K) is an essential macronutrient and plays important role in growth, metabolism and development of plant. Although, it constitutes about 2.5 per cent of the lithosphere but actual soil concentrations of this nutrient vary widely ranging from 0.04 to 3.0 per cent (Sparks and Huang, 1985). Plants absorb potassium mainly in three forms from the soil and out of these three forms, soil minerals make up more than 90 to 98 per cent of soil potassium (Sparks, 1987). With the introduction of high yielding crop varieties and the imbalanced fertilizer application, soils are getting depleted in potassium reserve at a faster rate. Moreover potassium deficiency is becoming one of the major constraints in crop production forcing to find an alternative indigenous source of K for plant uptake (Supanjani *et al*; 2006; Sindhu *et al*; 2012). In this context, potassium solubilising microorganisms present in the soil could provide an alternative means to make potassium available for plants (Groudev, 1987; Rogers *et al*; 1998). A wide range of microbes i.e. *Pseudomonas*, *Burkholderia*, *Acidithiobacillus ferrooxidans*, *Bacillus mucilaginosus*, *B. edaphicus*, *B. circulans* and *Paenibacillus* sp. etc. release potassium in accessible form from potassium-bearing minerals by secreting the organic acids. Among these, *Bacillus mucilaginosus* strain released large amount of K from different minerals and increased the groundnut crop production (Sugumaran and Janarthnam, 2007). K content in soil and crop shoots was also improved due to the application of KSB (Bagyalakshmi *et al.*, 2012). In addition, KSB also play an important role not only in maintaining soil structure by the formation and stabilization of water-stable soil aggregates but also produce the substance that stimulate plant growth or inhibit root pathogens (Egamberdiviya, 2006). Therefore, it can be concluded that efficient potassium solubilizing microbial biofertilizers could be further exploited for plant growth and nutrition and reducing the outflow of foreign currency from the country.

A NEWFANGLED TOOL OF NANO-TECHNOLOGY- AGNPS MEDIATED CONTROL OF *MELOIDOGYNE INCOGNITA* (ROOT-KNOT NEMATODE) ON *VIGNA UNGUICULATA* (COWPEA)**Atirah Tauseef, Hisamuddin, Mohd Danish, Chanchal Chaudhary, Yasar Nishat**

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Root-knot nematodes are one of the major agriculture constraining pests with world-wide distribution. They parasitize almost all kinds of the crops thereby declining agricultural productivity, hampering international trade, social and economic development. On cowpea, the root-knot nematode (*Meloidogyne incognita*) represents the major curtailing factor in waning the amount of produce. The most common available control measures deploy the use of chemical nematicides. Taking into account, the numerous hazards associated with these nematicides, the gravity of situation demands to switch over to the use of biologically synthesized nanoparticles as a cogent nematicide. The intent of present study was to investigate the impact of biologically synthesized AgNPs on cowpea infected with *M. incognita*. Forty pots were inoculated with 1,000 second stage juveniles per pot at the time of planting. After a week, 32 pots were treated with different doses of Ag NPs, and the remaining 8 pots served as a control. It was observed that *M. incognita* exhibited a sensitive response towards AgNPs in a concentration dependent fashion. At higher doses, high mortality rate was encountered.

Key words-*Meloidogyne incognita*, *Vigna unguiculata* (cowpea), biologically synthesized silver nano-particles, nematicides.

NANOTECHNOLOGY FOR SUSTAINABLE AGRICULTURE**Sheeba Malik, Anupama Singh**Department of Post Harvest Process and Food Engineering
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Nano science and nanotechnology are new frontiers of this century. It has been extensively used in various fields such as computer electronics, communication and medicine. Now days the application of nanotechnology to agriculture and food industries is also getting attention. As



population of the world is ever increasing, more and more food is required. Million people worldwide lack access to sufficient food to lead a healthy active life. Climate change, population growth and land degradation further challenge ending hunger. To cope up with this situation there is a need for sustainable agriculture. The use of nanomaterial in agriculture aims in particular to reduce applications of plant protection products, minimize nutrient losses in fertilization, and increase yields through optimized nutrient management. The sustainable growth of agriculture totally depends on the new and innovative techniques like nanotechnology. Nanotechnology devices and tools, like Nano capsules, nanoparticles and even viral capsids, are examples of uses for the detection and treatment of diseases, the enhancement of nutrients absorption by plants, the delivery of active ingredients to specific sites and water treatment processes. The potential of nanotechnology in agriculture is large, but a few issues are still to be addressed, such as increasing the scale of production processes and lowering costs, as well as risk assessment issues. In this respect, particularly attractive are nanoparticles derived from biopolymers such as proteins and carbohydrates with low impact on human health and the environment. For instance, the potential of starch-based nanoparticles as nontoxic and sustainable delivery systems for agrochemicals and biostimulants is being extensively investigated. Nanomaterials and nanostructures with unique chemical, physical, and mechanical properties – e.g. electrochemically active carbon nanotubes, nanofibers and fullerenes – have been recently developed and applied for highly sensitive biochemical sensors. These nanosensors have also relevant implications for application in agriculture, in particular for soil analysis, easy biochemical sensing and control, water management and delivery, pesticide and nutrient delivery.

SOIL HEALTH MANAGEMENT THROUGH CARBON SEQUESTRATION FOR SUSTAINABLE AGRICULTURE

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Agricultural soils generally have lower organic matter content than natural lands because of reduced C input (due to annual harvest and removal of crop residue, etc.), high organic C decomposition (due to frequent tillage), increased soil erosion (Lal, 2004) and other factors. Many studies have demonstrated that improved management practices can increase the C content of arable soils towards the levels found in natural lands (Smith *et al.*, 2000; West and Post, 2002). Increasing agricultural soil stocks has been suggested as an important measure to sequester CO₂ from the atmosphere to help stabilize atmospheric CO₂ concentrations and has been estimated that 0.4–0.9 Pg C year⁻¹ can be sequestered within global agricultural soils (Paustian *et al.*, 1998).

Addition of organic manures (FYM, poultry manure, pressmud) alone or in combination with N or NP fertilizers for 16 years brought variations in soil pH, EC and organic C over the initial value. The decrease in pH was more with the addition of FYM compared to poultry manure and pressmud. Highest soil pH (7.87) was observed in plots where only NP fertilizers were applied. It might be due to the leaching of soluble salts from surface soil. A significant increase in EC of the soil was observed with the combined application of organic manures plus NP fertilizers over application of NP fertilizers alone (Kumara *et al.*, 2014).

Increased biochar application resulted to gradual increase in most of the chemical properties in the soil except H+Al. 10t/ha of biochar produced the highest levels of (pH, = 6.91; %TN, = 0.38; K (mg/Kg), =1.59; %OC, = 0.56; Mg (mg/Kg) = 2.50, and CEC (Cmol/Kg) = 11.35 compare to the other rate and control. However, application of 5t/ha of biochar did not show any significant effect compared with the control (Ndor *et al.*, 2015).

Therefore, it may be concluded that carbon sequestration must be viewed as a long-term process in order to see meaningful impact of conservation tillage, residue management, manure and fertilizer use, crop rotation etc on soil health and sustainable agriculture.

STUDIES ON *XANTHOMONAS AXONOPODIS* PV. *PUNICAE*, CAUSING BACTERIAL BLIGHT OF POMEGRANATE IN PUNJAB

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Bacterial blight of pomegranate caused by *Xanthomonas axonopodis* pv. *punicae*, have economic importance to reduced crop yield in India. Farm survey was undertaken in the pomegranate research block, Fruit Research Station, Jallowal- Lesriwal Jalandhar during 2015. It was revealed that the maximum disease incidence (91%), severity (14.41%) and fruit cracking (12%) was found in cv. Ganesh. Twenty isolates of *Xanthomonas axonopodis* pv. *punicae* showed different virulent reaction with respect to incubation period, fruit cracking and drooping. It was observed that 9 isolates viz. Xap4, Xap5, Xap6, Xap9, Xap12, Xap14, Xap15, Xap16 and Xap17 were highly virulent on Ganesh cultivar. The optimum growth of bacterium was observed at 30 °C while 5 and 50 °C temperatures did not show any growth on Kings B Medium. All the five chemical treatments showed control of bacterium under *in vitro* conditions. However, the combination of Blitox (2500ppm) and Kocide (2500ppm) with Cristocycline (100ppm) showed maximum inhibition zone of 53 and 52 mm respectively followed by streptomycin (50.12 mm) and Cristocycline (50mm) with 500 ppm concentration. While Bordeaux mixture with concentration (1%) showed 45 mm inhibition.

RECENTLY EMERGED TECHNOLOGY: CONSTRUCTED WETLAND COUPLED WITH MICROBIAL FUEL CELLS FOR WASTEWATER TREATMENT AND ENERGY PRODUCTION

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Microbial fuel cells (MFCs) have been widely applied in bio-electricity generation from organic matters in the presence of electrochemically active bacteria (EAB) under mild reaction conditions. The constructed wetland- microbial fuel cell (CW-MFC) is a newer treatment



system in which the cathode and anode of an MFC are embedded in a constructed wetland (CW). CWs are used widely in wastewater treatment and have been applied to treat many types of wastewater including domestic, industrial, urban, and agricultural. MFCs can recover renewable energy from organic sources, and they are considered a promising wastewater treatment technology. CW-MFCs have the advantages of both CWs and MFCs for wastewater treatment. They can transform chemical energy directly into electrical energy, thereby reducing energy loss. Moreover, they are reliable and suitable for long-term operation. Research has shown that MFCs can be used to treat various types of wastewater, including domestic sewage and food processing wastewater. In addition, CW-MFCs have been used in domestic sewage treatment, showing better disposal efficiencies than conventional treatment systems based on studies conducted under closed circuit promoted pollutant degradation. In recent, novel power generation technologies, MFCs are integrated with constructed wetlands (CW-MFCs) and significant progresses have been made. It has reported that the maximum power density (15.73 mW m^{-2}) and current density (69.75 mA m^{-2}) were obtained with wastewater containing 1000 mg L^{-1} dye. Combining the two technologies (termed as CW-MFC) has emerged in recent years with the aim of improving the wastewater treatment capacity of wetlands while simultaneously producing electrical power. The outcome of the new integrated process may develop a cost-effective clean and green technology.

SOIL BIOLOGICAL PARAMETERS AND THEIR MANAGEMENT FOR SOIL HEALTH AND CROP PRODUCTION. A REVIEW

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Soil is a dynamic living body that contains enormous numbers of diverse living organisms ranging from invisible microbes, bacteria, algae, protozoa and fungi to the more familiar macro fauna such as earthworms, mites, ants and insects. The soil biota can be conceived of as the “biological engine of earth”. Soil biota plays important role in ecosystem services which are critical to the ability of soils to produce crops, viz. carbon cycling, nutrient cycling, soil structure integrity, biotic regulation and mutualism. Soils and their biodiversity thus play a critical role in maintaining soil health. Physical and chemical proprieties of soil are shaped by biological activity and biological activity is enhanced or limited by chemical and physical condition. Soil biological properties respond quickly for a change in soil quality and have been suggested better indicators than soil physical and chemical properties which alters only after drastic change in soil quality. Relevant biological properties include microbial biomass, respiratory activity, nitrogen mineralization, soil enzymes, soil fauna and population of suppressive organisms. Soil micro organisms mainly bacteria and fungi are the major component of soil organisms and contribute to 80–90% of soil biological activity. Non return or diminished return of organic matter and residues deprive the soil biota of their food with loss of soil health and fertility. Proper management of soil biodiversity will help in sustainable agriculture and reduce the cost of external inputs especially for nutrient supply and crop production. Strategies for improvement in soil biological properties requires understanding of numerous interactions among soil biological community and diversity, climate, soil type, plant species and soil management practices. Soil biological properties can be improved by soil management practices which vary with soil type, climate and vegetation. The beneficial effect of microbial inoculation, zero tillage or reduces tillage, cropping system, INM, long term fertilizer use and soil amendments on microbial population, biomass C and N and activities of soil enzymes have been demonstrates in several studies. In order to obtain benefits of soil organisms in sustainable crop production, a greater understanding of linkages among the soil organisms, soil biological processes, soil physical, chemical and biological properties, ecosystem functions, and impact of human interventions is required. Studies are required to establish indices of various biological properties for soil health assessment under different soil type, cropping system and climatic conditions.

COW URINE BOON FOR SUSTAINABLE AGRICULTURE

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The Indiscriminate use of agrochemicals led to problems like pest outbreak, resistance to insecticides, elimination of natural enemies, risk to human health and adverse effect on the soil fertility, crop productivity, quality of produce and more specifically on the environmental system. The current scenario under such situations firmly emphasizes the need to adopt eco-friendly agricultural practices for food production by considering the sustainability of soil and environment. The use of cow urine can be considered as a low cost agricultural practice for farmers and had been extensively used in traditional agriculture in India for medicinal and agricultural purposes since Vedic period. Among different organic sources cow urine is good source of nitrogen besides it contains sulphur, phosphate, potassium, sodium, manganese, carolic acid, iron, silicon, chlorine, salt, enzyme and hormones. It strengthens the fact that cow's urine is not a toxic effluent as 95% of its content being water, 2.5% urea and the remaining 2.5% a mixture of minerals, salts, hormones and enzymes. It is also considered as a natural disinfectant and pest repellent and forms the main component of Panchagavya (urine, dung, milk, curd, and ghee), an organic crop booster prepared and sprayed by Indian farmers. As products of ecological sanitation, urine is therefore in many ways suited for use as fertilizer as they contain essential nutrients needed for plant growth. Favourable effect of cow urine application has been reported in enhancing the productivity of different crops viz. maize, mustard and rice etc. Protein content and chlorophyll content of methi and bhindi were increased with increased concentration of urine as compared to control (Jandaik *et al.*, 2015). Urine increased the N concentration of grass and increased the potassium concentration of grass and clover (Ledgard *et al.*, 1982). Tewari *et al.*, 2016 reported that cow urine reduce the poisonous effects of pesticides to pollinators and natural enemies. Cow urine spray for honey bee disease management has adopted by several beekeepers of Uttarakhand. Cow urine are very effective against mustard aphid, *Lipaphis erysimi* and wheat aphids, *Microsiphum miscanthi* and *Rhopalosiphum padi* and showed higher attractancy of natural enemies and pollinators (in mustard crop) with increase in grain yield. It is the best remedy to cure fungal and bacterial diseases. It has an excellent germicidal power, antibiotics and antimicrobial activity. Therefore, cow urine can kill varieties of germs and it also boosts immunity. It has been considered that cow urine is very useful in agricultural operations as a biofertilizer and biopesticide as it can kill number of pesticide and herbicide resistant bacteria, viruses, and fungi. Cow urine in combination with plant extracts is used to prepare disinfectant which is biodegradable and ecofriendly with good antibacterial action. Majority of people in India use cow urine to get rid of various diseases due to its therapeutic values. Cow



urine has several biological activities such as antioxidant, antidiabetic, antitumor, antiprotozoal, and molluscicidal. Therefore cow urine is an best alternative as compare to agrochemicals. It is good for sustainable agriculture.

CHALLENGES OF LAND DEGRADATION AND STRATEGIES OF THEIR MANAGEMENT

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Land degradation is generally defined as a human-induced or natural process that negatively affects the land to function effectively. It is the temporary or permanent lowering of the productive capacity of the land (UNEP, 1992). Soil degradation in India is reported in the area of 147 Mha. This is extremely serious for Indian scenario, as it has 18% of world's human population as well as 15% of world's livestock population on a tiny land area (2.4%) of the world (Bhattacharyya *et al.*, 2015). Combating to reduce further land degradation and investing in land conservation are the major task for sustainable management of degraded land and their natural conservation. Management options include various agronomic, mechanical and forestry practices, which lead to better physical soil conditions, improve soil quality, soil productivity and soil fertility as well. Improved grazing practices, efficient irrigation management, controlled urban sprawl and sustainable mining could play the crucial role in the prevention of land degradation.

CLIMATE CHANGE AND ITS IMPACT ON POLLINATORS

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Pollinators are products of millions of years of evolution and play a crucial role in sustaining wildlife and ecosystem health, both as part of the complex food chain and in the reproduction of plants thereby provide food security to growing global population. Evidently, measures are needed to ensure that our native and managed pollinator population is maintained and protected. Today there is evidence that, pollinators are being threatened by various anthropogenic factors that includes habitat fragmentation, invasive species, interspecific competition, pathogens and parasites, climate change, monoculture, genetically modified crops, electromagnetic radiation, application of pesticides and many others, of which, climate change being one of the major one. The impact of anthropogenic climate change on all living organisms has been predictable on every continent. Climate change affects the pollinator population in both direct and indirect ways. It affect the pollinators diversity directly through effect on foraging activity, body size at maturity, life span and changes in physiology, behavior and life history parameters, as well as indirectly, through changes experienced by host plants in their morphology. The host plants will experience new environmental conditions in the near future, such as elevated CO₂ and O₃ concentrations, elevated temperature and UV radiation, and changes in rainfall patterns over the seasons as a consequence of recent human activities and its effects on global climate. This direct and indirect effect of climate change has both ecological and economic impact on society by affecting the plant-pollinator interaction. Thus, the maintenance of plant-pollinator interactions in the face of climate change though complex is an important conservation goal for the coming decades.

SALT STRESS: A SERIOUS ENVIRONMENTAL ISSUE IN AGRICULTURE PRODUCTION

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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. Salinity is one of the most brutal environmental factors limiting the productivity of crop plants. Losses caused by salinity in agriculture are difficult to assess but estimated to be substantial and expected to increase with time. Secondary salinization of agricultural lands is particularly widespread in arid and semi arid environments, whereas the world's population continues to rise. The need for increased food production, therefore, needs to be met by increases in yield per land area. There is a wide range of adaptations and mitigation strategies are required to cope with such impacts. However, many strategies being long drawn and cost intensive but there is a need to develop simple and low-cost biological methods for salinity stress management, which can be used on short term basis. Microorganisms could play a significant role in this respect if we exploit their unique properties such as tolerance to saline conditions, bio-control ability, production of plant growth promoting hormones, synthesis of compatible solutes and their interaction with crop plant.

CLIMATE CHANGE IMPACT ON RIVERINE SYSTEMS OF INDIA

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Rivers provide a special suite of goods and services valued highly by the public. The diverse river system in India harbour one of the richest fish genetic resources in the world. Rivers exhibit a complex mix of artisanal, subsistence and traditional fisheries. Climate change will add the presenting risk and also magnify it so it will alter the rainfall season, the runoff pattern, temperature. It also disturbs the biological communities and ecological linkages. The impact is manifested in the breeding failure, geographic shift of fishes, altered species richness, habitat loss/gain and increased invasion of exotic species. Lowflows in rivers would be more severe along with ageneral water stress. Increase in water



temperature, extreme events like flood and drought, storms and water stress are important climate variables to riverine fisheries. They require specific adaptation actions. The establishment and management of a natural riparian zone and vegetation is a strategy to reduce climate change effect on rivers.

KEYWORDS: climate change, fisheries, rainfall, river, snow, species, temperature.

MITIGATION AND ADAPTATION STRATEGIES FOR CLIMATE CHANGE

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Climate change represents a significant change, *i.e.*, a change with important economic, environmental and social effects, in the mean values of a meteorologic element, such as temperature and amount of precipitation during a certain period, for which the means are computed across a decade or longer (WMO, 1992). Concentrations of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) have all shown large increases since 1750 (40%, 150% and 20%, respectively) (IPCC, 2014). Climate change is a well-recognized, significant, man-made, global environmental challenge and agriculture is strongly influenced by it. Among the global atmospheric changes, the increasing concentrations of greenhouse gases such as CO₂ may have significant effect on crop productivity due to increase in both the average surface temperature and the amount of CO₂ available for photosynthesis. In the absence of temperature increase, the net effect of doubling of CO₂ was increase in the yield of rice (Krishnan *et al.*, 2007). The increase in minimum temperature during both wheat and rice cropping seasons increases the maintenance respiration requirement of the crops and shortens the time to maturity thus reduces net growth and productivity.

Mitigation refers to any action taken to permanently eliminate or reduce the long-term risks and hazards of climate change to human life and/or property. Adaptation to climate change refers to the ability of a system to adjust to climate change, to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. Agronomic management of crops, such as method of sowing, can be an effective adaptation strategy under the climate-change scenario. The strategies for mitigating methane emission from rice cultivation could be alteration in water management, particularly promoting mid-season aeration by short-term drainage.

SEASONAL ASSESSMENT OF DEHYDROGENASE AND UREASE ACTIVITIES IN MULBERRY SOILS UNDER TEMPERATE CLIMATIC CONDITIONS OF KASHMIR

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The leaf of mulberry plant is the exclusive food to silkworm which is reared to yield silk, the queen of textiles. Quality of leaf influences the healthy growth of silkworm larvae and thereby the quality of cocoons. The mulberry plant hardly gets any attention in terms of inputs like fertilizers, manures, etc. But even then it grows well and produces more biomass which should be compensated with continuous supply of nutrients but it is never so. The soil therefore supplies continuous flow of nutrients to this plant which could be due to organic matter decomposition by means of enzyme activities in soil. The present study was conducted to investigate the seasonal changes in enzyme activities of different mulberry gardens in three regions (north, central and south) of Kashmir. Observations in present study revealed that dehydrogenase and urease activities were maximum during spring season followed by summer, autumn and lowest during winter season. Among the regions, central region (Poohu, Galander and Srinagar) registered the maximum value for both the activities whereas northern region registered the lowest in case of dehydrogenase activity and southern region in case of urease activity. The subsequent decrease in dehydrogenase and urease activities from spring to winter may be because of fluctuations in temperature, moisture, organic matter which suppress microbial activity during these seasons.

Keywords: - Seasons, Dehydrogenase, Urease, Mulberry, Regions.

DIVERSITY AND COMMUNITY STRUCTURE OF NEMATODES ASSOCIATED WITH AGRICULTURAL FIELDS NEAR YAMUNA IN DELHI REGION

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A survey of agricultural fields near Yamuna in Delhi was conducted to study the diversity and community structure of the soil inhabiting nematodes. Vegetables like Tomato (*Solanum lycopersicum*), Okra (*Abelmoschus esculentus*), Cauliflower (*Brassica oleracea*), Carrot (*Daucus carota*), Ginger (*Zingiber officinale*), Mustard (*Brassica juncea*), Chilli (*Capsicum* spp.), Eggplant (*Solanum melongena*), Cabbage (*Brassica oleracea* var. *capitata*), Potato (*Solanum tuberosum*), Coriander (*Coriandrum sativum*), Castor (*Ricinus communis*), Rose (*Rosa* spp.) etc. are grown in these fields.

A total of 29 genera belonging to 7 orders and 20 families were recorded. In terms of abundance, order Tylenchida was most abundant while in terms of number of genera, order Rhabditida was most frequent. Out of 29 genera, 9 *viz.*, *Pratylenchus*, *Psilenchus*, *Helicotylenchus*, *Hemicriconemoides*, *Hoplolaimus*, *Meloidogyne*, *Rotylenchulus*, *Tylenchorhynchus*, *Xiphinema* belonged to plant-parasitic nematodes. Overall *Meloidogyne* was the most abundant among all the nematode genera. The information generated through this investigation will be helpful to provide advisory services and to undertake pest risk analysis.



EVALUATION OF BARLEY GERMPLASM FOR ROOT SYSTEM ARCHITECTURE UNDER POLYETHYLENE GLYCOL STIMULATED DROUGHT STRESS**Manju^{1*}, Vikender Kaur², Kamal Sharma¹ and Sunder Singh Arya³**¹Department of Botany, Baba Mastnath University, Asthal Bohar, Rohtak- 124021, India²National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi – 110012, India³Department of Botany, Maharshi Dayanand University, Rohtak, Haryana- 124021, India

A set of 128 diverse germplasm accessions of barley including released cultivars and wild relatives were evaluated for root traits under induced osmotic stress. The surface sterilized seeds after germination were subjected to 15% polyethylene glycol (PEG 6000, -0.295 Ψs at 25°C) for a period of 10 days in a growth chamber under long-day photoperiod (16 h light/8 h dark) at 22°C and RH 70%. Half strength Hoagland solution was used as control. Phenotypic data on seminal root length (SRL), seminal root surface area (SRSA), seminal root diameter (SRD), seminal root volume (SRV) and relative change in the above traits under stress conditions was recorded using flatbed scanner and analysed with WinRHIZO Pro software. In addition, other root traits such as seminal root number (SRN), lateral root number (LRN), root hair abundance (RHA) and root dry weight (RDW) were also recorded. The stress susceptibility index (SSI) was used to characterize the relative stress tolerance of various accessions (SSI≤0.50- highly stress tolerant, SSI>0.50≤1.00- moderately stress tolerant and SSI>1.00- susceptible). The mean SRL, SRSA and SRV under osmotic stress treatment showed decline of 39 to 50% compared to control showing negative effect of stress treatment on root growth. Variety PRB501 and accessions EC578789 and EC492217 were most tolerant (SSI=0.11, -0.01 and -0.05 respectively) showing least reduction or almost equivalent root growth under stress. An increase in SRN and LRN with abundant root hairs on seminal roots was recorded in these accessions showing their better stress tolerance capacity, while accessions EC578829, EC578822 and variety DWRB73 proved to be most susceptible (SSI=1.82-1.92) showing a reduction of upto 85% in SRL, SRSA as well as SRV. Also LRN, RDW and RHA were reduced under stress treatment. This study would help in identification of germplasm with suitable root traits for the efficient acquisition of soil resources and adaptation to drought and other abiotic stresses.

Keywords: barley germplasm, drought tolerance, polyethylene glycol, root traits**FLOWERS: A NEW POTENTIAL SOURCE OF NUTRACEUTICALS FOR FOOD APPLICATIONS****Vivek Saurabh*, Kalyan Barman and Anil K. Singh**

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Since ancient time flowers has been a part of human nutrition in many cultures around the world. Flowers like rose, dahlia, calendula, chrysanthemum, marigold, etc. were being consumed in Europe and Asia as ingredients in different meals, salads, foodstuffs and drinks. In recent years, growing interests among researchers for nutraceuticals and functional foods led to increased search for new source of bioactive compounds having health benefits. As a result, interest in consumption of flowers have again renewed due to their nutritional value and therapeutic properties. Studies have revealed that flowers contain a variety of phytochemicals like phenolics, flavonoids, and pigments like carotenoids or anthocyanins which exhibit high antioxidant activity. Owing to rich source of antioxidants, these flowers reveal several therapeutic properties like anti-inflammatory, antimicrobial, anticancer, antidiabetic, hepatoprotective, etc. One recent study has also revealed that content of macro and micronutrients in flowers are also comparable with that of the mostly consumed fruits and vegetables. However, flowers for consumption must be healthy, clean, free from diseases or pesticide residues and must be tested for its safety. Because, sometime flowers although free from pathogen may induce some allergic reactions in the sensitive people. Therefore, owing to high nutritional value and antioxidant activity flowers can be a new promising source of nutraceuticals for wide spectrum use in food products for human nutrition.

INVOLVEMENT OF NITRIC OXIDE AND GLUCOSE IN ALLEVIATION OF SALT STRESS INHIBITED PHOTOSYNTHESIS IN MUNG BEAN (*VIGNA RADIATA* L.)

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Salt stress is known to reduces productivity of various crop species and mung bean is one of the most susceptible crops known. The present study was conducted to assess the involvement of nitric oxide (NO) and glucose (Glu) in reversal of salt inhibited photosynthetic characteristics in mung bean (*Vigna radiata* L.) Mung bean cultivar (pant mung) was subjected to 100 mM NaCl treatment exhibited decreased growth and photosynthetic characteristics, nitrogen assimilation and cysteine metabolism. In contrast, proline content was found to be induced under salt stress. Supplementation of 50 μM Nitric oxide (SNP, sodium nitroprusside) and 6% glucose (Glu) to salt grown plants increased photosynthetic potential of plants through increase in nitrogen and sulphur- assimilation capacity and proline accumulation. The interaction effect between NO and Glu was additive on photosynthetic responses. The results of the study bears an important impact on the involvement of NO and Glu in alleviating salt stress effects and provide new ways to mitigate salt stress problems in crop plants.

Keywords: glucose, nitric oxide, photosynthesis, salt stress.**GROWING MORE RICE WITH LESS WATER****Deo Narayan Singh^{1*}, Subodh Kumar² and Deepak Kumar Jaiswal³**¹Assistant professor, Department of Agronomy, UP College, Varanasi.²Assistant professor cum junior scientist, Department of Agronomy, BKSCOA, Dumrao Buxar, BAU, Sabour, Bihar.³Research scholar, Department of Entomology and Agricultural Zoology, I. Ag. Sc., Banaras Hindu University, Varanasi.

Rice (*Oryza sativa*) is the staple food of more than half of the population of the world, is an important target to provide food security and livelihoods for millions. 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. Considering the food basket of India, rice cannot be replaced by other arable crops. To withstand the scarcity of water, growing of rice as direct seeded rice (DSR) is one of the best options for the areas where rainfall occurrence do not support the growing of conventional rice. DSR refers to the process of establishing the crop from seeds sown in the field rather than by transplanting seedlings from the nursery. Direct seeding avoids three basic operations, namely, puddling (a process where soil is compacted to reduce water seepage), transplanting and maintaining standing water; thus saves water, labour and time.

DECOMPOSITION OF KITCHEN ORGANIC WASTE

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Kitchen organic waste includes vegetable & fruit peelings, used tea leaves, leftover etc. It is an organic source of nitrogen which should be recycled into manure instead of going into garbage. This waste, if collected at municipality kura sangrah and thrown at dumpsite in large heaps, it starts releasing carbon di oxide, ammonia, methane and hydrogen sulphide. These actions not only damage ecosystem, it reduces the nutritional and economic value of the food waste. By adopting decomposition at domestic level, we can save the all values of food waste. With the aim of decomposition of food waste as soon as it is generated at source, present study was undertaken. 10-12 holes were carved in an empty wrapper of wheat flour and placed it under sunlight. Daily kitchen waste was thrown in it which was then covered with 3-4 handful of bio decompose mix (BDM). Every day, over this material, same process was repeated. When one wrapper was filled, process was done in another wrapper. Bio decompose mix was the mixture prepared by mixing 45 kg of cow dung manure, 8 kg of dry leaves manure and approximately 1 kg of sand. As soon as the BDM spread on nutritive peeling, microorganisms and physical decomposer present in the mix started eating and taking their growth cumulatively. Within four days after filling the wrapper, whole food waste was found decomposed completely. In the above process, cow dung manure acted as starter culture. Dry leaves and sand helped to maintain moisture level and oxygen level for decomposition respectively. C:N ratio of the compost was 30:1. Finished compost gave Nitrogen=6%, Phosphorus=4%, Potassium=2%. pH was near neutral. Microbial load varied between 2.4×10^6 to 2.0×10^7 cfu/ml for bacteria and 3.5×10^4 to 2.0×10^7 for fungi.

CHANGING CLIMATE AND ADAPTIVE CAPACITIES OF MOUNTAIN COMMUNITIES: A CASE STUDY FROM RUDRAPRAYAG DISTRICT, UTTARAKHAND

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Discussion on agriculture has become more intense in the recent years in context of recurrent food crisis and agro-biodiversity loss, particularly in the rural areas of Himalayan region. The changing climate has numerous implications for mountain communities who feel the both physical and social impacts of climate change. In the Garhwal Himalayan region of India, a majority of inhabitants maintain their livelihood through a combination of subsistence or small-scale agriculture, livestock rearing, seasonal or long-term migration, and also through natural resource extraction. The increasing temperatures, erratic rainfall and irregular patterns of snowmelt with changing biological systems create many challenges to the viability of traditional livelihood strategies. In this paper, we present a case study from the Rudraprayag district of Garhwal Himalaya (Uttarakhand, India) that outlines the impacts of climate change on farmers of the area and also highlights the potential of eco-tourism and agro-forestry as a form of livelihood diversification for strengthening livelihood assets and adaptive capacity of local communities, more broadly. The agroforestry practices in the traditional farming systems have gained wider attention among academicians and policy makers for their multifunctional role and dynamics of ecosystem services. The primary data on were collected by using semi-structured questionnaire and interview method from randomly selected villages. Study revealed that multifunctional agroforestry system with environmental friendly eco-tourism not only supports the ecosystem services but also enhance the livelihood options for mountain communities. It also reveals from the study that the area under study proves to be a complicated region which requires considerable care and area specific policies for intensive development of the region.

STRUCTURE AND COMPOSITION OF VEGETATION IN KOSI RIVER WILDLIFE CORRIDOR OF TERAI ARC LANDSCAPE, UTTARAKHAND, INDIA

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Tigers can be conserved for long term at landscape level. Degradation, fragmentation and loss of potential habitat is happening due to ever growing needs of humans and un-regulated developmental activities. In the present scenario, Wildlife corridors provide opportunity to maintain connectivity in the habitat and ensure genetic diversity in the population of the tigers. Again it is important to understand vegetation structure and composition of the corridors which in terms also provide temporary refuge to the dispersing animal besides passages. Therefore, vegetation structure and composition were studied by laying nested plots of varying sizes in Kosi River corridor of Uttarakhand, India. Data was collected from 71 sampling plots laid over 29 transects covering total distance of 35.5 km. In this corridor, five vegetation communities were identified based on cluster analysis with ward's linkage method using the software PCORD. Among naturally growing trees, based on the IVI calculations, *Shorea robusta* and its associate was found dominating the four vegetation communities. Tree species richness and diversity among the



communities ranges from 1.6 to 6.5 and 0.6 to 3.0 respectively. Community level diversity, species richness and evenness was calculated using PRIMER software.

PERSPECTIVES AND APPROACHES OF CONSERVATION TILLAGE IN SUSTAINABLE AGRICULTURE: A REVIEW

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Modern agriculture aims at obtaining sustainable production without degrading the natural resources like soil, water, nutrients, energy etc, thus conserving the environment with the advent of modern agricultural technologies during the Green Revolution Era, yield targets could be achieved by intensive cultivation but there has been tremendous degradation and exploitation of natural resources. This has led to an imbalance in agro-ecosystem. Therefore, development of alternate crop /soil/ water management practice for conserving these resources is vital. Conservation tillage is one of the options in this context. Conservation tillage is the most extreme form of minimum tillage, which not only include methods resulting in reduced tillage intensity but also combines the use of several implements in one operation. Major advantages of conservation tillage over conventional tillage are improvement in soil structure, higher aggregate stability. Zero tillage helps in improving Organic Carbon, total N content and water holding capacity of the soil. The cost of cultivation is reduced in case of zero tillage and it achieves overall sustainability of ecosystem. Though, there are certain limitations of conservation tillage but from resources conservation points of view the overall performance of conservation tillage is better than conventional tillage. Therefore, the adoption of conservation tillage in the modern context seems to be a viable and profitable proposition.

Keywords: Conservation tillage, conventional tillage, soil quality, Sustainable agriculture.

ESTIMATION OF MICRONUTRIENT UPTAKE BY MAIZE(ZEA MAYS L.) PLANTS UNDER HARYANA ECOLOGICAL CONDITIONS

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The current investigation was carried out at the Regional Research Station, Karnal of CCS Haryana Agricultural University during the *kharif* 2015. The experiment was carried out to estimate the nutrient uptake by maize plants under Haryana conditions. Micronutrient (Zn, Fe and Mn) were determined in DTPA solution using atomic adsorption spectrophotometer as proposed by Lindsay and Norvell (1956). Diethylene triamine penta acetic acid (DTPA) extracts the easily soluble zinc, iron and manganese by forming soluble complexes. The extracting solution was buffered at pH 7.3 by triethanolamine (TEA) and also includes CaCl_2 to prevent dissolution of CaCO_3 . These conditions permit the right amount of Zn, Fe and Mn to be extracted and CaCl_2 to stabilize the pH of the extractant. DTPA extract has the ability to chelate Zn, Fe and Mn in competition with Ca^{++} and Mg^{++} . The element in the DTPA extract was determined by atomic absorption spectrophotometer. The results of investigation were revealed that the treatments where in Fews applied T_7 , T_{10} and T_{11} showed significantly higher concentration of iron in the leaves (≤ 9108.2 g/ha) as compared to having no application of iron i.e. T_1 to T_6 , T_8 , T_9 and T_{12} (≤ 5723.8 g/ha). Manganese T_8 and T_{11} showed significantly higher concentration of manganese in the leaves (≤ 970.1 g/ha) as compared to having no application of manganese i.e. T_1 to T_7 , T_9 , T_{10} and T_{12} (≤ 886.3 g/ha). Zinc application T_6 , T_9 to T_{11} showed significantly higher concentration of zinc in the leaves (≤ 463.9 g/ha) as compared having no application of zinc i.e. T_1 to T_5 , T_7 , T_8 and T_{12} (≤ 350.5 g/ha). Based on the findings, *kharif* maize variety (HQPM-1) may be grown by judicious use of fertilizers and nutrients. Absence or addition of micro nutrients viz., (Fe, Mn and Zn) affected the grain yield and quality. Moreover, soil health also affected the quality and quantity of grain yield and protein content in *kharif* maize. Addition of micronutrients (Fe, Mn and Zn) improved the quality of maize by increasing the uptake of nutrients by the plants.

RECENT DEVELOPMENT IN DETERMINATION OF MICRONUTRIENT CATIONS IN SOIL: A REVIEW

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The range between deficiency and toxicity of micronutrients is very narrow. Deficiency of micronutrients adversely affects the use efficiency of major nutrients. First fractionation scheme was developed by McLearn and Crawford (1973) later on several workers namely Tessier (1979) Miller *et al.* (1986) and Iwasaki and Yoshikawa (1990) modified and improved the same. Recently Sanchez and Martin *et al.* (2007) developed a fractionation scheme which is less tedious and easy. Chelating agent like DTPA as developed by Lindsay and Norvell (1978) for estimating plant available cationic micronutrients is widely used (Rattan *et al.*, 2008). Experiment conducted by Gupta and Mittal (1981) on 22 non-calcareous soils to evaluate the suitability of various extractants for estimating available zinc (Zn) revealed that order of extractability of the different extractants was $1\text{ N HCl} > 0.1\text{ N HCl} > \text{EDTA}-(\text{NH}_4)_2\text{CO}_3 > \text{EDTA}-\text{NH}_4\text{OAc} > \text{DTPA} + \text{CaCl}_2 > 1\text{ M MgCl}_2$. Critical limits of extractable Zn in these soils were estimated to be 2.2, 0.70, 0.80 and 0.48 mg kg^{-1} for 0.1 N HCl, EDTA $(\text{NH}_4)_2\text{CO}_3$, EDTA NH_4OAc and DTPA + CaCl_2 , respectively. Tiwari *et al.*, 1982 examined the relative efficiencies of five chemical extractants for assessing available copper using rice



as a test crop. The correlation coefficients of copper uptake with extractable copper were as follows: 0.1 N HCl ($r = 0.847$), 0.05 M EDTA (0.788), 0.01 M EDTA in 1 N NH_4OAc (0.441), NH_4OAc pH 7.0 (0.417), and NH_4OAc pH 4.8 (0.292). DTPA-extractable Zn in soil was found to be significantly correlated with tissue zinc concentration in rice ($r = 0.717$) and wheat ($r = 0.851$) Sakal *et al.*, 1985. There is a need of developing new and effective soil test method for these two micronutrients as well as multi-nutrient extractants in compatibility with ICP.

Keywords: micronutrients, fractionation, cations, chelating agent, critical limits and suitability of extractants.

MITIGATIVE EFFECTS OF POTASSIUM ON DROUGHT STRESS IN SWEET CORN

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Drought stress is the most serious abiotic stress which poses threat on crop productivity worldwide. Drought affects more than ten percent of arable land, causing desertification especially in arid and semi arid areas. The response of water deficit on crop plants varies substantially according to cultivars. First effect of drought is impaired germination and poor stand establishment. Water stress tolerant cultivars possess certain physiological, biochemical and molecular adaptation to reduce water availability. Drought stress induces physiological responses which includes recognition of root signals, loss of turgor pressure and osmotic adjustment. Decrease in stomatal conductance to CO_2 reduces its influx therefore decline in net photosynthesis occurs. Biochemical responses include decreased efficiency of Rubisco, accumulation of stress metabolites like Proline, Glycinebetaine, polyamines, carotenoids which helps in reducing reactive oxygen species accumulation. Increase in antioxidant enzymes like SOD, CAT, APX, POD, GR also occurs during drought stress. Molecular responses include increase in expression in ABA biosynthetic genes, stress responsive genes like LEA, dehydrins, DSP and RAB which in turn tolerate drought stress. Potassium requirement for drought stressed plants could be related to enhancing CO_2 fixation, transport of photosynthates and inhibiting the transfer of photosynthetic electrons to O_2 , thus reducing ROS production.

Impact of Salinity on Different Valuable Crops: Physiological, Biochemical and Molecular Characterization

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Understanding and eventually curbing crop susceptibility to abiotic stresses such as salt, heavy metal, high and low temperature, drought and flooding, could allow for higher yields during stress environment in the cultivated areas of the world. It may also allow arid and semi arid areas of the planet to support sustainable yields and profitable crops. To mitigate these effects, current agricultural approaches need to be modified and innovative adaptation strategies need to be in place to efficiently generate more food in stressed conditions. Current biotechnological research could show how plants can overcome the stress of the environment. Plants respond to different types of stress, through multifaceted physiological, biochemical and molecular mechanisms. Understanding these mechanisms, identifying the key molecules and their specific roles, provide a treasure trove of opportunity for molecular breeding approaches to enhance the ability of crop plants to survive under stressful conditions without major yield loss. Thus, the present research was undertaken in different crops including wheat, rice, rye, fenugreek and tomato to screen various physio-biochemical effect of salt stress. To create salinity stress, sodium chloride (NaCl) at the levels of 0 (as control), 50, 100, 150 and 200 mM were used. The current investigation includes comparative study of various growth, physiological, biochemical and molecular aspects together with the analysis of diverse proteins concerned with salinity tolerance. Results showed significant differences in evaluated indices viz. seed germination, moisture content, shoot and root length, fresh and dry weight, photosynthetic pigments, carotenoids, soluble protein and sugar content. The results conclude that among different crop fenugreek exhibit maximum tolerance followed by wheat.

Keywords: Abiotic stress, Growth parameters, Salinity tolerance, vigour index.

MANAGEMENT AND HARVESTING OF GROUND WATER IN JAIPUR RAJASTHAN

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Water is the most vital resource for sustenance of life and many development activities. The state of Rajasthan suffers from two problems, one of less rainfall and other high potential evapo-transpiration rate. The resultant effect is less natural recharge to ground water. The ground water level in general is showing depleting trend due to over withdrawal from the water aquifers. The present study has identified difficulties in this regard and suggested means to augment recharge to ground water resources by artificial means. Ground water recharge problem may be solved by management of water uses and by harvesting of water from different sources. Ground water recharge may be done by the conservation of water assets by minimizing the water usage and prevention of water quality and harvesting of rain water. Artificial recharge structures as proposed we can meet out the demand of drinking water supply for people. In alluvials as well as hard rock area there are 100 of dug well/tubewell which have either gone dry or the water level decline continuously. Those abandoned dug well/tubewells can be used as structure to recharge. Artificial water harvesting management, concept plan and design of storm water harvesting through a abandoned dug well has been prepared so that storm water or roof top /pavement run-off can be diverted into these structures to directly recharge the dried aquifers at very low cost.

Keywords: water aquifer, water harvesting, evapo-transpiration, rain fall, roof top water, alluvials, water recharge



DRINKING WATER MONITORING IN AGRICULTURE INTENSIVE AREA OF RIVER KRISHNI CATCHMENT, BAGHPAT, UTTAR PRADESH, INDIA

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India is a land of faith and religions. Indians have a spiritual perspective towards River like Ganga and called here 'Ganga mayya'. Rather this River like Yamuna and its tributary Hindon facing problem of pollution. Pollution in Yamuna is responsible due to pollution in Hindon and its tributary. Krishni River is a tributary of Hindon River, which carries Agricultural runoff as well as sewage from a number of Industry and population centres of its catchment. Due to this it carries blackish water with an unpleasant odour. The ground water of Krishni River catchment contaminated due to the same. Pre-monsoon sampling from the Krishni River catchment was performed as per APHA standard. 20 Samples were collected from India Mark-II hand pumps. Physiochemical parameter such as pH, Conductivity, Total alkalinity, Total hardness, TDS and TOC have been analysed and the results were compared with BIS-10500. The pH of drinking water in the study area varies from 6.5-8.6. The pH of two sample was above than BIS permissible limit i.e. 6.5-8.5. TDS in groundwater samples was above the BIS limit at seven points. Conductivity in the drinking water sample varies from 279- 1427 μ S. The present study indicates that alkalinity is above the permissible limit at 13 points. Hardness of 3 samples is above the permissible limit. The value of TDS varies from 230-1372 which is above the permissible limit at 7 points. The value of TOC varies from 6.245-19.370 indicate the presence of Organic components in drinking water.

Keywords: Ground water, TOC, TDS, Alkalinity

IMPACT ASSESSMENT OF NATIONAL FOOD SECURITY MISSION WITH RESPECT TO CHANGE IN AREA AND PRODUCTION OF DIFFERENT CATEGORIES OF CHICKPEA GROWERS

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Government of India had launched Centrally Sponsored Scheme, 'National Food Security Mission' (NFSM) in August 2007 with the objective to increase production and productivity of wheat, rice and pulses on a sustainable basis so as to ensure food security of the country. In order to promote pulse production in the country, National Food Security Mission (NFSM) -Pulses programme was started in 2007-08. The NFSM-Pulses scheme is also running in Madhya Pradesh. For this purpose the study was conducted in purposively selected district Narsinghpur during 2016-2017. Five villages were selected by using simple random sampling method. Twenty four chickpea growers from each village who benefited under NFSM-Pulses were randomly selected thus 120 chickpea growers were selected for the investigation purpose. The study revealed that there is significant difference between change in area and production of different categories of chickpea growers before and after intervention of National Food Security Mission (NFSM). The mean value of area of small farmer, before was 0.32 while after was 0.76, medium farmer before was 0.76 while after was 1.14, and large farmer before was 1.17 while after was 2.21. In case of change in production, the mean value of production of small farmer before was 5.12 while after was 14.42, medium farmer before was 14.22 while after was 28.23, and large farmer before was 24.55 while after was 48.20. The National Food Security Mission has increased the production of chickpea, it may be due to improved chickpea production technology, and in area, it may be due to training and facilities provided by National Food Security Mission.

SOIL AND WATER CONSERVATION EVAPORATION ESTIMATION BY MULTIPLE LINEAR REGRESSION AND ARTIFICIAL NEURAL NETWORK SYSTEM BASED MODELS

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Evaporation is an essential component of the hydrologic cycle, in hydrologic cycle water is transferred from the ocean to the atmosphere, and then from atmosphere to the earth and again to the ocean. It is used to estimate the potential evapotranspiration and water resources management. Evaporation is calculated from the direct measurement and indirect measurement. In the present study the Multiple Linear Regression (MLR) and Artificial Neural Network (ANN) models were developed for estimating evaporation. The data set consisted of four years of daily records from 2010 to 2013. The daily data consist of temperature, relative humidity, wind speed, sunshine hour and evaporation. The daily data of temperature, relative humidity, wind speed, sunshine hour were used as input and the evaporation was used as the output. For estimation of evaporation 70% data was used for training and 30% for testing of MLR and ANN models. ANN was used for designing of models based on activation function; Sigmoid Axon and learning rule; Levenberg Marquardt with 1000 number of epochs, three hidden layers (1, 2, 3) with 1, 2, 3...8 neuron in each hidden layers. The performance of MLR and ANN models was compared on the basis of statistical functions such as RMSE, R², and CE. The results indicate that the ANN performed superior to the MLR. In which the values of RMSE, R² and CE were 0.447, 0.894 and 89.94% respectively for best ANN network. It was concluded that the ANN model can be successfully employed for the estimate on of daily evaporation at Hawalbagh, Almora.

PESTICIDE RESIDUES IN FRUIT CROPS AND REMEDIES TO OVERCOME THEIR ILL EFFECT

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Plant protection products (more commonly known as pesticides) are widely used in agriculture to increase the yield, improve the quality, and extend the storage life of food crops. Pesticide residues are the deposits of pesticide active ingredient, its metabolites or breakdown products present in some component of the environment after its application. Residue analysis provides a measure of the nature and level of any chemical contamination within the environment and its persistence. The pesticides must undergo extensive efficacy, environmental, and toxicological testing to be registered by governments for legal use in specified applications. The applied chemicals and their degradation products may remain as residues in the agricultural products, which becomes a concern for human exposure. All the fruit samples showed the presence of pesticide residues with one or other group of pesticides viz., chlorpyrifos, captan, dichlorvos, oxyfluorfen, fipronil, 4-bromo-2-chlorophenol and indoxcarb. Eight fruit samples of apple, guava, orange, grapes, persimmon, banana and pear were analysed for residues of pesticides of organophosphate (OP), pyrethroid and organochlorine (viz., dichlorvos, fenvalerate, dimethoate, methyl parathion, fenitrothion, cypermethrin, endosulfan, deltamethrin, mevinphos, chlorpyrifos, profenofos and dicofol) and were monitored in fruit samples by Gas Chromatography (GC). The processes viz., drying, fermentation, freezing, juicing, peeling, storage, washing, led to large reductions in residue levels in the prepared food. The samples were extracted by Multiresidue Method and determined by Gas chromatography. The results showed that all the samples were contaminated with pesticides beyond the maximum residual limit. Pesticides have many uses and we may expose them in several ways. To avoid pesticide residues pre-treatment has to be done before consumption. As far as possible eat organically produced fruit. Create awareness among the farmers about the consequences of unsafe pesticide usage and residue problems. Development of IPM and enforcement of IPM strategies should be adopted for management of pests of fruit crops.

WATER QUALITY STATUS OF KRITHUA WETLAND, DISTRICT, MAINPURI, U.P.

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Krithua wetland has been habitat for many local and migratory birds. So the water quality plays an important role in the survival of aquatic organisms and various local and migratory birds also. The quality parameters such as pH, Total Dissolved Solids (TDS), Hardness, Chloride, Nitrate, Nitrite, Carbonate, Fluoride, Phosphate were investigated. The limnological parameters reveal the condition of Krithua wetland, Mainpuri as a suitable place for birds and aquatic organisms.

KEYWORDS: Limnology, Aquatic organisms.

HYBRID SEED PRODUCTION TECHNIQUE OF RICE IN CROP IMPROVEMENT

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Rice (*Oryza sativa*) is a well known cereal belonging to the family Gramineae. It is the second important cereal next to wheat in Asia. It is a staple food for more than 60% of the population. The commercial viability of the hybrid rice technology mainly depends on the efficient and economic seed production package. Development of efficient hybrid rice seed production techniques both at farm and farmers level helped to a great extent in development of hybrid rice. Success of hybrid rice production depends on efficient and economic seed production on large scale. At present, several farmers are taking up hybrid seed production with the help of public and private sector production plots. It is reported that the yield of F_1 hybrids will decrease by 0.8% when the seed purity decreases by 1%, so it is very important to establish a sustainable system of seed production to ensure the purity of hybrid seeds in hybrid rice development. The commercial production of hybrid rice in India is developed by using cytoplasmic genetic male sterility and fertility restoration system (CMS system). This system involves three lines viz., cytoplasmic genetic male sterile line (CMS or 'A' line), maintainer ('B' line) and restorer ('R' line) lines for developing rice hybrids. Rice is a self-pollinated crop with cross-pollination to the extent of 0-5%. Therefore, hybrid rice seed production requires specialized techniques which need to be thoroughly understood before embarking upon this venture. The success of hybrid seed production depends on various factors such as choice of field, isolation, seeding time, planting pattern and weather conditions during the period of flowering, roguing synchronization in flowering of parental lines, supplementary pollination techniques, proper harvesting, processing, packing and effective seed.

Keywords: Hybrid, Rice, Production, Seed

HISTOLOGICAL OBSERVATION OF TANNERY INDUSTRY WASTE WATER ON INDIAN MAJOR CARPS LABEO - ROHITA

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This paper investigates the impact of tannery industry waste water on Labeo - rohita. The histological changes observed in gills, liver of studied fish have demonstrated the quality status of industrial waste water. In the vital organ, the following marked changes were observed: filament cell proliferation, cellular infiltration, haemorrhage and epithelial lifting in gills, vacuolation of hepatocytes and necrosis in liver. These changes might be due to the various components of tannery waste water on fish. Hence, proper treatment of tannery industry waste water is highly recommended through this study.

Key words :- Labeo - rohita, acute toxicity, histology, tannery waste water, gills, liver.



WATER RETENTION CHARACTERISTICS OF SOILS OF NAGALVADI MICRO-WATERSHED OF WARDHA DISTRICT, MAHARASHTRA**Nilima S. Sadanshiv¹ and M.S.S. Nagaraju²**

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The water retention characteristics of five soil series of Nagalvadi micro-watershed of Wardha district, Maharashtra revealed that the water retention decreased with increasing soil water suction. The water retentivity at 33 and 1500 kPa tensions was significantly and positively correlated with clay, pH, Cation exchange capacity and Calcium carbonate but negatively with sand and silt content. The effect of organic carbon on water retentivity, both at 33 and 1500 kPa tensions was non-significant. The soil series with high clay content had more water storage capacity suggest their suitability for growing two crops in a year whereas the shallow rooted crops of short duration can only be grown on the soil series with low clay, shallow depth and lower water retention capacity.

Keywords: Water retention, available water capacity, crop planning, soil depth

IMPACT OF CLIMATE CHANGE ON WEED FLORA SHIFT**Manish Kushwaha* Pooja Gupta Soni, TaramaniYadav, Sourabh Kumar**

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Climate change is caused by the release of greenhousegases in the atmosphere due to anthropogenic activities which makes alarming attention. The impact of climate change depends on single or combined effects of contributing factors like temperature, precipitation, CO₂ and composition of other atmospheric gases. Climate conditions exert a significant influence on the spread, population dynamics, life cycle duration,infestation pressure and the overall occurrence of the majority of agricultural weeds. It is expected that climate change will bring about a shift in the floral composition of several ecosystems at higher latitudes and altitudes, as changes in temperature and humidity will be reflected on flowering, fruiting andseed dormancy. Changes in atmospheric CO₂ levels, rainfall, temperature and other growing conditions will affect weed species' distribution and their competitiveness within a weed population and within crop. As weeds are highly dynamic and will adapt quickly to new conditions so weed management is difficult in a new environment. Lack of knowledge of the effects of weeds is a major obstacle in the prediction of effects of climate change and their shift in a new environment. So this information regarding weed shift due to climate change will be more helpful in the making strategies of effective weed management.

THEME- BIO-NANOTECHNOLOGY AND GREEN TECHNOLOGY FOR SUSTAINABILITY NANOMATERIALS FOR SUSTAINABLE AGRICULTURE**Priyal Pandey* and Nirmal De**

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Major challenges related to agriculture are low productivity in arable areas, large non-arable areas, shrinkage of arable lands and wastage of inputs such as water, fertilizers and pesticides. Adverse effects of agro-chemicals on the agroecosystems (*i.e.* soil, flora, fauna and water bodies), and also on the health of the farmers using them and the society consuming the chemically grown food, have now started to become more evident all over the world (Mura *et al.*, 2011). As a result, the use of *green technology* to mitigate the environmental damage is becoming a high priority. Today, nanotechnology represents a promising approach to improve agricultural production. Nanotechnology is a science that deals with objects of nanometer size (1-100 nm) for at least one dimension, possessing unique properties, such as size dependent qualities, high surface-to-volume ratio, and promising optical properties. The main categories of nanomaterials are carbonaceous materials, zero-valent metal, nanopolymer, with different kinds of features, such as nanofibers, nanowires, and nanosheets (Nair *et al.*, 2010). General applications of nanomaterials are found in water purification, wastewater treatments, industrial and household purposes, smart sensor development, environmental remediation, food industry for products processing and packaging, medicine, *etc.* Present article deals with types of nanomaterials used in agriculture and exploitation of nanomaterial for sustainable agriculture. Keywords:- Nanotechnology, Nanomaterials, agrochemicals, sustainable agriculture.

RAW MANGO AND ITS VALUE ADDED PRODUCTS**Merionydd Langtang¹ and A. K. Chaurasiya***

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Mango (*Mangifera indica* L) is an important tropical fruits which ranked 5th in the world production among the major fruits crops. In India, the total area under fruits is about 6405 '000 ha with a production of 91443 '000 MT out of which 2237 '000 ha comes under mango with the production of 18779 '000 MT (2015-2016). Mango fruit is rich in pre-biotic dietary fibre, vitamins like A, B, C, minerals, poly-phenolic flavanoids antioxidant like beta-carotene, alpha-carotene and beta-cryptoxanthin. It has been found to protect from colon, breast, leukemia and prostate cancer. Raw mango fruits are valued for their tangy taste, nutritional content and as a therapeutic uses. Value added products like mango chutney, mango pickle, green mango powder *etc.* The optimum stage of fruit harvesting for use in the preparation of green mango powder (amchur) could be considered after the 7th week from the flowering period. Mango powder has several uses in the culinary purposes. Powder is used to add flavour to curries, chutneys, soups *etc.* It has tenderising qualities similar to lime and lemon juice. It has also some health benefits like it helps to boost digestion, aids in weight loss, prevents cancer, promotes healthy skin, protect heart.



Keywords: Beta-carotene, *Mangifera indica*, mango powder, value added

CARBON TRADING: A STEP TO MITIGATE GLOBAL WARMING

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Progressive increase in the concentration of GHGs particularly carbon dioxide since industrial era has created worldwide interest to reduce concentration of these gases in the atmosphere. Fossil fuel combustion and land use change results in an increase in atmospheric concentration of CO₂ by 31% since 1750, this increased CO₂ concentration necessitates identification of strategies for mitigating the threat of the increasing global warming. Another severe risk for mankind is increasing world temperature by two degree Celsius in past century, if it exceeds more than it is a severe risk it will become harmful for mankind. To couple greenhouse gas (GHG) emission mitigation with economic growth is a major key issue for policy formulation. There are numerous management strategies for drawing carbon out of the atmosphere and holding it in the soil. These strategies vary in effectiveness across different climates, soil types, and geographies. To encourage 'Sustainable Development' and to achieve target of 20-25% emissions intensity reduction relative to 2005 levels by 2020, world has to adopt certain technologies or strategies one such strategy is Emission Trading Scheme or carbon trading. Thus, with the intention of controlling global warming and the rising CO₂ emissions, the Kyoto Protocol was set up in 2005 to compel the developed countries to lower their greenhouse gas (GHG) emissions thus giving rise to the concept of carbon credits, devised to reduce global carbon emission levels. The carbon trading technology is a truly win-win strategy. Carbon trading is a growing research topic that addresses one important aspect of an overall strategy for carbon management to help mitigate the increasing emissions of CO₂ into the atmosphere.

Keyword: - Climate Change, Carbon trading, Kyoto Protocol, Green House Gas emissions

CARBON TRADING: A STEP TO MITIGATE GLOBAL WARMING

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The climate change problem has exacerbated over the past few decades and, therefore, requires a prompt and focused approach to deal with it. In 1997, the international framework to acknowledge the issue of climate change entered a new stage when the Kyoto Protocol was brought to light. This helped increase the level of ambition in developed countries while enhancing mitigation actions in a broad segment of the economy in developing countries. The carbon market is nowadays seen to be among the fastest growing markets wherein the European Union Emissions Trading Scheme (EU ETS) has played a major role in pushing it up to this level. Though most parties to the Protocol have secured a cut in their emissions, still the world CO₂ levels have escalated. A considerable portion of this increment has been ascribed to large developing countries that were not a part of the treaty.

MICROORGANISMS: A KEY TO IMPROVE SOIL HEALTH

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Soil health has been defined as the "continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, promote the quality of air and water environments, and maintain plant, animal, and human health". Microorganisms play a very important role for improving soil health by the process of nutrient cycling (nitrogen, sulfur and phosphorus) and decomposition of organic residues. A dark brown jelly-like substance is formed after the process of decomposition of organic residues, called as humus that can remain unchanged in the soil for potentially millennia. Humus helps the soil to retain moisture and encourages the formation of soil structure. Humus molecules are covered in negatively charged sites that bind to positively charged ions (cations) of plant nutrients, thus forming an important component of a soil's cation exchange capacity. Some soil microbes secrete polysaccharides, gums and glycoproteins, which glue soil minerals together, forming the basis for soil structure. Fungal hyphae and plant roots further bind soil aggregates together. These microorganisms also have the capacity to promote plant growth by the production of phytohormones like auxins, gibberellins, cytokinins and antibiotics. All these functions of microorganism maintain the physical, chemical and biological properties of soil promoting soil health.

Keywords: Soil health, nutrient cycling, humus, water holding capacity, cation exchange capacity

SOIL PROPERTIES IN RELATION TO RESOURCE CONSERVATION TECHNOLOGIES

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Indian agriculture has been successful in increasing food grain production in the past, guided by the goals of the "self sufficiency" in the country. The mission of increasing food grains production somehow stands achieved, however, accompanied by series of problems related to the environment and natural resources. We have reached a situation where we must look for new directions, learning from our past (**Abrol and Sanger, 2006**). The resource conservation technologies primarily focus on resource savings through minimal tillage, ensuring soil nutrients and moisture conservation through crop residues and growth of cover crops, and adoption of spatial and temporal crop sequencing (**Singh et al., 2011**). Over the past three decades or so, internationally, rapid strides have been made to evolve and spread resource conservation



approaches like zero and reduced tillage systems, better management of crop residues, planting systems, laser land leveler, site specific nutrient management (SSNM), leaf colour chart (LCC), green seeker, soil test crop response, fertigation, customized fertilizer and Agro-forestry, which enhance conservation of soil, water and nutrients.

Physical, chemical and biological properties of the soil environment are considered to be most influenced by the soil tillage operation in agricultural production. Tillage would aim to create a soil environment favorable to the plant growth (Klute, 1982). Based on 8 years of studies Zhang *et al.*, (2003) reported that the mean soil bulk density was 0.8-1.5 % lower in ST (sub-soiling with retention of all surface plant residues) and NT (consisted of zero tillage; planting was through the previous plant residues) treatments than in CT (Conventional tillage). A significant increase in available water capacity by 18-35% and total porosity by 35-46% in silt loam soil under the application of mulch at 0, 2, 4, 8 and 16 Mg/ha/year without crop cultivation (Mulumba and Lal, 2008). Micro organism such as bacteria, fungi and actinomycetes influence profoundly the physical, chemical and especially the biological properties of soils. The microbial indicators of soil quality viz., soil microbial carbon (SMBC) and soil microbial biomass nitrogen (SMBN) were significantly present in higher concentrations under RCT's as compared to the conventional tillage (Kaur *et al.* 2006). Soil carbon or organic matter in general, is important because it affects all soil quality functions (Fenton *et al.* 1999). Carbon and Nitrogen in dryland soil could conserve better with the reduced tillage and increased cropping intensity and crop residues than the traditional conventional tillage with wheat- fallow system in Northern Great Plains (Sainju *et al.*, 2007). It is estimated that carbon in soil stores five times more than conventional tillage in indian crop land situation. It is also of particular importance to reduce tillage on organic soils because of their high carbon content, these soils were found to emit more C when disturbed as compared to mineral soils.

In contrast the nature and dimensions of the problems being faced today are much different and complex than those faced in 1960s and 1970s. Past strategies are no longer taking agriculture forward therefore conservation agriculture can be seen as a new way forward for conserving resources and enhancing productivity to achieve the goals of sustainable agriculture, which demands a strong knowledge base and a combination of institutional and technological innovations by the way of strategies, policies and actions which must be adopted to move forward in new directions.

THE STATE OF ANAEROBIC DIGESTION PROCESS IN RENEWABLE ENERGY SECTOR OF INDIA

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India being the fourth largest consumer of energy mainly depends on imported oil, gas and locally available fossil fuel to meet its energy requirements. However the fast depletion of fossil fuels and their adverse effects on the environment have forced policymakers to search for renewable and non-conventional sources of energy for sustainable development. As a result usage of biodegradable waste is receiving huge attention. The biodegradable waste is converted through various processes into energy efficient forms. Anaerobic digestion is mostly preferred for the handling of biodegradable wastes to generate biogas mainly composed of methane and carbon dioxide in closed loops. The process of anaerobic digestion is applicable for all biodegradable wastes, given that the solid can be introduced to the system at a suitable concentration. India being an agrarian country generates a huge amount of cattle dung and agricultural residues, so anaerobic digestion can be used to handle these wastes for energy recovery, and methane produced in this way can be used as a replacement for fossil fuels and also to lower drudgery of a rural woman from collecting firewood. Besides biogas slurry can be used as fertilizer in agricultural fields as it lowers the pathogen count and odorous emissions from wastes. Ministry of new and renewable energy has been supporting for the promotion of family type biogas plants all over the country. This paper reviews the process of anaerobic digestion and the current status of biogas generation in India.

Keywords: anaerobic digestion, renewable energy, biogas, biodegradable wastes

IMPACT OF TEXTILE INDUSTRIAL EFFLUENTS ON ENVIRONMENT AND ITS MANAGEMENT

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A huge amount of effluents generated from tanning and textile industries is being discharged on land or into water courses. These effluents are characterized by high BOD, COD, Na and total dissolved solids. These effluents also contain several major primary and secondary plant nutrients (N, P, K, S, Mg, Ca, etc.) as well as micronutrients and heavy metals. Addition of tannery effluents is reported to cause deflocculation of soil particles and increase in the N, P and K levels of soils. Similarly, deleterious effects, such as increase in pH, sodicity and EC in soils due to the use of textile effluents are reported. However, it is pointed out that the adverse effects of these effluents get progressively reduced with dilution of effluents. Indicate the effect of long-term use of these effluents on soil health, trees and shrubs as well as water bodies is discussed. Salinisation and alkalisation of ground water due to application of these effluents are also reported. The physicochemical characteristics of these effluents do not permit its disposal directly into inland water or on land for irrigation, Textile industries have their own importance in Indian economy. It consumes large amount of water and as a result huge amount of waste water is generated. Textile effluent comprises of suspended solids, mineral oils, residual oils and is characterized by high BOD (from 700 to 2000 mg/l) and COD loads. It is necessary to treat the waste water so that it does not have any threat to the environment. WH Perkins in 1856 discovered the use of synthetic dyes. Synthetic dyes have provided a wide range of colorfast, bright hues. However their toxic nature has become a cause of grave concern to environmentalists. Use of synthetic dyes has an adverse effect on all forms of life. Presence of sulphur, naphthol, vat dyes, nitrates, acetic acid, soaps, enzymes chromium compounds and heavy metals like copper, arsenic, lead, cadmium, mercury, nickel, and cobalt and certain auxiliary chemicals all collectively make the textile effluent highly toxic. Other harmful chemicals present in the water may be formaldehyde based dye fixing agents, chlorinated stain removers, hydro carbon based softeners, non bio degradable dyeing chemicals. These organic materials react with many disinfectants especially



chlorine and form by products (DBP'S) that are often carcinogenic and therefore water in hand pumps making it unfit for human consumption. It is important to remove these pollutant from the waste waters before their final disposal. The presence of these toxic chemicals in the environment poses a serious threat to the health and safety of human and wildlife [10]. Moreover, colour effluent if discharged without proper treatment may provoke serious environmental impacts with resultant change in ecological balance

Keywords: Effluent . Salinisation . Carcinogens .

CONSERVATION AGRICULTURE: A FUTURE OF SUSTAINABLE CROP PRODUCTION

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Soil productivity as well as health has been declining over the passing years owing to erratic precipitation patterns, inadequate input uses, excess tillage practices, destruction of biodiversity *etc.* resulted in lowering the agricultural productivity and unsustainability in production systems. Therefore, crop production in the next decade will have to produce more food from less land by making more efficient use of natural resources and with minimum impact on the environment to meet the food demand of the burgeoning population. Only by doing this, it will keep the food production in pace with demand and the productivity of land be preserved for future generations. The use of productive but more sustainable management practices will help to solve the problem. Crop and soil management systems that help in improving soil health and reduce farmer costs are essential for long term sustainable crop production. Conservation Agriculture (CA) which comprises of the maintaining permanent or semi-permanent soil cover, minimal soil disturbance, no-till, regular crop rotations, utilization of green manures/cover crops, no burning of crop residues, integrated disease and pest management, reduction in fossil fuel use and greenhouse gases (GHGs) emissions and controlled/limited human and mechanical traffic over agricultural soils; is increasingly being seen as a farming system that can deduct the negative impacts of some of the factors that are limiting the agricultural productivity. CA aims to achieve sustainable and profitable agriculture through the application of three principles viz., minimal soil disturbance, permanent soil cover and crop rotation. It helps in reducing the cost of production (15-16 %) by saving energy, labor and water, thereby increase farm income; enhancing biodiversity and reduction in poverty and enhance food and nutritional security due to higher and more stable yields and lower food prices. CA also helps in improving the habitation of organisms, from larger insects down to soil borne fungi and bacteria, which improve soil biological, physical and chemical properties, thereby contributes in increasing crop productivity in a sustainable manner.

Keywords: Soil health, Conservation agriculture, Bio-diversity, No-till, Crop residue

SOIL CARBON SEQUESTRATION TO MITIGATE CLIMATE CHANGE AND ADVANCE FOOD SECURITY

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World soils have been a source of atmospheric carbon dioxide since the dawn of settled agriculture, which began about 10 millennia ago. Most agricultural soils have lost 30% to 75% of their antecedent soil organic carbon (SOC) pool or 30 to 40 t C ha⁻¹. The magnitude of loss is often more in soils prone to accelerated erosion and other degradative processes. On a global scale, CO₂-C emissions since 1850 are estimated at 270 ± 30 giga ton (billion ton or Gt) from fossil fuel combustion compared with 78 ± 12 Gt from soils. Consequently, the SOC pool in agricultural soils is much lower than their potential capacity. Furthermore, depletion of the SOC pool also leads to degradation in soil quality and declining agronomic/biomass productivity. Therefore, conversion to restorative land uses (e.g., afforestation, improved pastures) and adoption of recommended management practices (RMP) can enhance SOC and improve soil quality. Important RMP for enhancing SOC include conservation tillage, mulch farming, cover crops, integrated nutrient management including use of manure and compost, and agroforestry. Restoration of degraded/desertified soils and ecosystems is an important strategy. The rate of SOC sequestration, ranging from 100 to 1000 kg ha⁻¹ year⁻¹, depends on climate, soil type, and site-specific management. Total potential of SOC sequestration in the United States of 144 to 432 Mt year⁻¹ (288 Mt year⁻¹) comprises 45 to 98 Mt in cropland, 13 to 70 Mt in grazing land, and 25 to 102 Mt in forestland. The global potential of SOC sequestration is estimated at 0.6 to 1.2 Gt C year⁻¹, comprising 0.4 to 0.8 Gt C year⁻¹ through adoption of RMP on cropland (1350 Mha), and 0.01 to 0.03 Gt C year⁻¹ on irrigated soils (275 Mha), and 0.01 to 0.3 Gt C year⁻¹ through improvements of rangelands and grasslands (3700 Mha). In addition, there is a large potential of C sequestration in biomass in forest plantations, short rotation woody perennials, and so on. The attendant improvement in soil quality with increase in SOC pool size has a strong positive impact on agronomic productivity and world food security. An increase in the SOC pool within the root zone by 1 t C ha⁻¹ year⁻¹ can enhance food production in developing countries by 30 to 50 Mt year⁻¹ including 24 to 40 Mt year⁻¹ of cereal and legumes, and 6 to 10 Mt year⁻¹ of roots and tubers. Despite the enormous challenge of SOC sequestration, especially in regions of warm and arid climates and predominantly resource-poor farmers, it is a truly a win-win strategy. While improving ecosystem services and ensuring sustainable use of soil resources, SOC sequestration also mitigates global warming by offsetting fossil fuel emissions and improving water quality by reducing nonpoint source pollution.

SUPER ABSORBENT POLYMERS - AN INNOVATIVE WATER SAVING TECHNIQUE FOR OPTIMIZING CROP YIELD

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Arid and semi arid regions face the scarceness of water. Spatially heterogeneous soil characteristics, shortage of enormous agricultural lands and disadvantaged condition of farmers don't permit them to adopt advantageous and economical application of ancient irrigation ways moreover as micro irrigation techniques (drip and mechanical device irrigation). Though, not abundant analysis in Republic of India has been undertaken on the employment of Super Absorbent Polymers (SAP) in agriculture, specifically Persia, China, Europe and USA have extensively worked on utilizing SAP for increasing water use potency and enhancing crop yield. Numerous studies have powerfully suggested that soil acquisition with Super Absorbent Polymers may be Associate in nursing innovative side within the field of agriculture, that works as miniature water storage reservoirs. Analysis evidences counsel that issues related to ancient micro irrigation and also the factors that square measure catalyst in active economical irrigation techniques is taken care of by acquisition the soil with SAP. Higher water management is earned with the appliance of polymers and respectable water saving is refrained from compromising the crop yield. Present literature review has been conducted to have a quick access in understanding various properties of Super Absorbent Polymers (SAP, Hydro-gels, and Polymers) to be used in agriculture. Science of SAP, deliquescent property, irrigation potency, effects beneath drought stress, effects over the morphological options of the plant, optimum use of fertilizers, biodegrade ability and application rates beneath completely different condition square measure totally reviewed. The current review would supply associate in nursing initiative for the experimental analysis on use of SAP and its rate of application to optimize water use potency and also the yield of cash crops in arid and semi-arid regions.

Keywords: Super Absorbent Polymer, Water absorption, Irrigation efficiency, Drought stress, Crop yield

EFFECT OF ASCORBIC ACID IN COMBINATION WITH NaCl FOR MITIGATING THE SALINITY STRESS IN SUGARCANE (*SACCHARUM OFFICINARUM* L.) VARIETY CO 0118 AND CO 0238 UNDER IN VITRO CONDITION

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The ameliorating effect of exogenous application of ascorbic acid (AA) in combination with NaCl under *in vitro* culture on growth and associated biochemical parameters in *Saccharum* species Co 0118 and Co 0238 were studied in the presence and absence of ascorbic acid (1mM) in combination with NaCl [0 (control), 20, 40, 80, 160 and 200 mM]. Plant growth measurements like Shoot length, fresh weight, number of shoot per explant and antioxidant enzyme activities peroxidase and catalase were recorded and found significant after 4 weeks. NaCl containing medium shows the reduced growth and antioxidants activity in all the combination as compare to ascorbic acid containing medium. The ascorbic acid application not only mitigated the inhibitory effects of salt stress but also induced a stimulatory effect on all the studied growth parameters. Hence, the application of AA under *in vitro* culture significantly alleviated the adverse effects of salinity on growth and biochemical parameters of sugarcane plantlets.

Keywords: Ascorbic acid, NaCl, *in vitro*, antioxidant enzyme, salinity

CALIBRATION AND VALIDATION APSIM-WHEAT MODEL FOR SUB HUMID REGION OF WESTERN HIMALAYAS FOR CLIMATE CHANGE STUDY

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Various crop models have been widely used over the globe for assessing the effect of climate change on crop yields. The experiment was laid in Randomized Block Design (RBD) replicated three times. The data for calibration and validation were collected from field experiments conducted during *rabi* season of 2014-'15 and 2015-'16. APSIM-Wheat model was calibrated for flowering day, maturity day, leaf area index, biomass, grain yield. The cultivar was wheat cultivar UP2565. Recommended package of practices were carried out for the crop raised during both the years of the study. It was found that model was able to accurately simulate anthesis, maturity date, maximum leaf area index, biomass, grain yield with root mean square error of less than 10 per cent. There was a good agreement between the observed grain and biomass yield of wheat as compared to the predicted ones. The error in prediction on days to flowering and date to physiological maturity for both seasonal crops was within one day. The measured grain yield of wheat at harvest was 4.1 t ha⁻¹ compared to the simulated grain yield of 4.3 t ha⁻¹. The measured total biomass and the predicted biomass values were also comparable.

Key words : calibration, RBD, management, anthesis, maturity

CLIMATE CHANGE AND GLOBAL WARMING: MODERN GLOBAL CLIMATE CHANGE

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Modern climate change is dominated by human influences, which are now large enough to exceed the bounds of natural variability. The main source of global climate change is human-induced changes in atmospheric composition. These perturbations primarily result from emissions associated with energy use, but on local and regional scales, urbanization and land use changes are also important. Although there has been progress in monitoring and understanding climate change, there remain many scientific, technical, and institutional impediments to precisely planning for, adapting to, and mitigating the effects of climate change.

Climate change over the past 30 years has produced numerous shifts in the distributions and abundances of species and has been implicated in one species-level extinction. Using projections of species' distributions for future climate scenarios, we assess extinction



risks for sample regions that cover some 20% of the Earth's terrestrial surface. Climate change over the past 30 years has produced numerous shifts in the distributions and abundances of species and has been implicated in one species-level extinction. There is still considerable uncertainty about the rates of change that can be expected, but it is clear that these changes will be increasingly manifested in important and tangible ways, such as changes in extremes of temperature and precipitation, decreases in seasonal and perennial snow and ice extent, and sea level rise. Anthropogenic climate change is now likely to continue for many centuries. We are venturing into the unknown with climate, and its associated impacts could be quite disruptive. These estimates show the importance of rapid implementation of technologies to decrease greenhouse gas emissions and strategies for carbon sequestration.

Keywords: Global Climate Change, Atmospheric Composition

NATURAL RESOURCE CONSERVATION

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The term resource means anything that we use from our environment to achieve our objective. A resource can be defined as 'any natural or artificial substance, energy or organism, which is used by human being for its welfare'. All that the nature has provided such as soil, air, water, minerals, coal, sunshine, animals and plants etc are known as natural resources. These natural resources can be divided into exhaustible and inexhaustible resources. Exhaustible resources are again classified into renewable and non-renewable resources. With the increasing industrialization and urbanization of the modern human society, the use of all resource is rising. If they are not properly used and managed, a serious scarcity will result. Therefore we need to conserve the natural resources. There is an urgent need to conserve the nature. Some of the needs are to maintain ecological balance for supporting life, to preserve different kinds of biodiversity, to make the resources available for present and future generation, to ensure the survival of human race etc. The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving the nature and natural resources. Natural resources were conserved in the form of sacred groves, sacred pools, sacred species etc. This practice is wide spread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals. History recalls numerous instances where people have laid down their lives in protecting the trees. Recent chipko movement in India is one of the best examples. This movement was started by the women in Gopeshwar village in Garhwal in the Himalayas.

Keywords: Resource, biodiversity, nature etc.

NATURAL RESOURCES AND ENVIRONMENTAL ISSUES

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Natural resources and environmental concerns have been prevalent not only in India, but in other countries of the world as well, but in most cases, India has been the major country that has experienced the depletion of natural resources and environmental degradation. In this research manuscript, main focus has been laid upon India; India is the most populous country in the world and with the impact of population explosion, there is exhaustion of natural resources and environmental degradation. The main areas that have been highlighted are rural poverty and environmental degradation, effects of disasters and natural hazards, assessing risks, impacts and opportunities from natural resources and the environment, precise insinuations for environment, sustainability and green development, greening rural development and economic growth and environmental sustainability. The issues have been taken into account and the measures also have been underscored that are essential in order to lead to preservation and sustenance of natural resources and the environment.

Keywords: Environmental degradation; Disasters; Natural hazards; Sustainability; Green development; Economic growth.

MANAGEMENT OF EMERGING WEED SPECIES IN CONSERVATION AGRICULTURE (CA) AN OVERVIEW

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Conservation agriculture (CA) is gaining popularity around the globe due to its sustainable approaches such as permanent soil cover, minimal soil disturbance, planned crop rotations and integrated weed management. Even though the adoption of CA in India is still in an early stage, it has been successfully used in the irrigated rice-wheat cropping systems of the Indo Gangetic Plains (IGP). Weed control is the biggest challenge to CA adoption. Weed species shifts and losses in crop yield as a result of increased weed density have been found as major hurdles to the widespread adoption of CA. The shift from conventional puddle transplanted (CT-TPR) to dry direct-seeding (DSR) in rice with reduced or ZT, typically results in changes in tillage, crop establishment method, irrigation practices, and weed management that influence weed diversity and abundance. Increased weed problems during the 'transition period' tends to be the most common hurdle in adoption of CA by farmers. Research has shown that cover crops could play an important role in weed management in CA systems; however, their level of adoption at present is fairly low. Changes in patterns of tillage, planting systems, and other management strategies can alter the soil environment and lead to a major change in weed flora. Herbicide use has been an extremely important component of weed management in CA but greater effort is needed to integrate non-chemical weed control tactics with herbicides. In CA, the presence of residue on the soil surface may influence soil temperature and moisture, which may affect weed seed germination and emergence patterns over the growing season. Soil surface residues can interfere with the effectiveness of herbicides, so there is a greater likelihood of weed escapes if residue is not managed properly or herbicide application timings or rates are not adjusted. In the absence of tillage, perennial weeds may also become a more serious challenge in this system. Thus integrated weed management compatible to cropping patterns and climatic conditions offers the best results in CA. Efforts are required to increase the rate of adoption of direct seeded rice and zero-till wheat throughout the IGP. At present, residue retention on farmer fields tends to be low.



Greater awareness of the benefits of residue retention for improved soil health is needed. Research effort needs to be enhanced to develop CA and promote its adoption in non-rice-wheat cropping systems in India.

Keywords: Conservation agriculture, Weed dynamics, Weed management strategies, Herbicide challenges

IN VITRO REGENERATION AND CONSERVATION OF DECALEPIS SALICIFOLIA- A CRITICALLY ENDANGERED PLANT OF WESTERN GHATS, INDIA

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The present studies describe a protocol for high frequency in vitro propagation through nodal segments and shoot tips in *D. salicifolia*, a critically endangered medicinal liana of the Western Ghats, India. Nodal segments were more responsive than shoot tips in terms of shoot multiplication. Murashige and Skoog's (MS) basal medium supplemented with 2.5 μ M 6-benzyladenine (BA) was optimum for shoot induction through both the explants. Among different combinations of plant growth regulator (PGRs) and growth additive screened, MS medium supplemented with BA (2.5 μ M) + indole-3-acetic acid (IAA) (0.25 μ M) + adenine sulphate (ADS) (10.0 μ M) induced a maximum of 9.0 shoots per nodal segment and 3.9 shoots per shoot tip with mean shoot length of 8.5 and 3.9 cm respectively. Half-strength MS medium supplemented with Naphthaleneacetic acid (NAA) (2.5 μ M) was the best for in vitro root induction. After successful acclimatization in Soilrite™, 92 % plantlets were survived in field conditions. Acclimatized plantlets were studied for chlorophyll and carotenoid content, net photosynthetic rate (P_N) and related attributes such as stomatal conductance (G_s) and transpiration rate during subsequent days of acclimatization. The rise and fall of different biochemical enzymes (SOD, CAT, APX and GR) were also studied during successful days of acclimatization. The present protocol assuredly can be used for the conservation of this critically endangered plant.

Keywords: *D. salicifolia*, PGRs, SOD, CAT, APX.

DEGRADED SOILS, THEIR PROBLEMS AND MANAGEMENT FOR ENHANCING CROP PRODUCTION

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Soil degradation is a global problem that is especially severe in the tropics and sub-tropics. It is defined as the rate of adverse changes in soil qualities resulting in declining productive capacity of land due to processes induced mainly by human intervention (UNEP, 1992). In India it is estimated to be occurring on 147 million hectares (Mha) of land, including 94 Mha from water erosion, 16 Mha from acidification, 14 Mha from flooding, 9 Mha from wind erosion, 6 Mha from salinity, and 7 Mha from a combination of factors (NBSS&LUP, 2005). This is extremely serious because India supports 18% of the world's human population and 15% of the world's livestock population, but has only 2.4% of the world's land area. The pervasive problems associated with soil degradation are low soil fertility, nutrient depletion, multi nutrient deficiency, physical degradation and accelerated erosion. Mechanisms that initiate soil degradation include physical, chemical and biological processes. Soil structure is the important property that affects all three degradative processes. The overall decline in soil quality, both by natural and anthropogenic factors, has strong positive feedbacks leading to a decline in ecosystem services and reduction in nature conservancy.

Restoration can be defined as re-establishing the presumed structure, productivity and species diversity that was originally present at a site that has been degraded, damaged or destroyed (SER, 2004). Ecological restoration improves biodiversity, human livelihood, empowers local people and improves ecosystem productivity. Adoption of techniques like contour farming, agroforestry, conservation agriculture, recycling run-off etc. can combat soil degradation. Nair (2011) stated three environmental benefits of agroforestry systems: water-quality enhancement, C sequestration, and soil improvement. In the Indo-Gangetic Plain region, bed planting under conservation tillage and zero tillage saved irrigation water without sacrificing crop productivity (Gathala et al., 2011). Mandal et al., (2013) observed in Vertisols (of Central India) that broad bed and furrow system decreased soil loss to a greater extent (31% to 55%) compared to that of flat on grade system. Improvement in ground water levels, soil and moisture conservation, water regeneration capacity, forestry and horticulture development, change in land use pattern and cropping pattern in an integrated watershed management were noticed by Adhikari et al., (2013). Ghosh et al., (2011) reported that intercropping cowpea with maize (2 rows of cowpea with 1 row of maize) decreased runoff by 10% and soil loss by 28% compared to pure maize.

Sustainable agricultural intensification using innovative farming practices have tremendous potential of increasing productivity and conserving natural resources, particularly by sequestering soil organic carbon (both labile and recalcitrant) and improving soil quality. Improved grazing practices, irrigation management, control on urban sprawl and mining are a few other solutions for preventing land degradation.

UTILIZATION OF AGRICULTURAL WASTES FOR ENVIRONMENTAL SUSTAINABILITY

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Agricultural waste is the waste produced as a result of various *agricultural* operations and from agro based industries. Agricultural waste includes crops residues such as straw, stem, stalk, leaves, husk, peels, cane trash, corn leaves and cobs, cassava stem, coconut shell and leaves etc. and also Agro-industrial wastes such as sugarcane bagasse, oil cakes, by-product of sugar industry, vegetable and fruit processing wastes, wheat bran, rice bran, corn cobs, cassava peels, peanut shells, coffee husks and wheat straw, fruit peels etc. About 600 to 700 metric tons of



agricultural wastes are generated in India every year, but most of it is not used properly. Agricultural waste, if not properly utilized, like left in the field to rot or burned down, can cause short-term and long-term effects on ecosystems, land and broader environments. Agricultural wastes are most renewable and cost-effective resources; we can develop many economical processes for implementation on industrial scale. Utilization of agricultural wastes can solve the energy crises, fuel and environmental problems. Large amount of the agricultural wastes are mainly composed by “lignocellulosic materials” which gives complex structure to these agricultural waste biomass. These lignocellulosic materials can be converted into simpler one with the help of microorganisms used as a tool in environmental biotechnology. So, with the help of Environmental biotechnology agricultural wastes biomass can be converted into variety of value added products such as Bioethanol, Biohydrogen, Biocompost, Bioplastics, Biochar, Biogas, Biosurfactants, Bioactive compounds, bioinsecticides etc. These Environmental friendly methods are very important for converting waste to wealth.

ROLE OF CROP WASTE IN SUSTAINABLE AGRICULTURE

Komal and Joginder Kumar

Crop residue, the largest product of agricultural harvests, contains approximately 60 element, which contain large amounts of assimilated carbon, primary and secondary nutrients such as nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. All these elements must be recycled for the sustainable development of agriculture. Crop residue management should serve a double function, both overcome global warming and food security by increasing carbon sequestration in agriculture and increasing grain yields. While direct burning in the field remains an environmental problem in the region, crop residue amendment triggers benign cycling of C and nutrients in agriculture. Soil organic carbon (SOC) content, which plays an important role in soil sustainability, is a key indicator of soil fertility. The main source of SOC in cropland is crop residue; therefore, crop residue amendment is considered one of the most important management practices in maintaining soil fertility. Soil is the second largest terrestrial carbon (C) reservoir, estimated at 1500 Pg C (1 Pg = 10¹⁵ g) to 1 m in depth, in which 168 Pg C is contained in agricultural soils (Paustian et al., 1997; Jacinthe et al., 2002). The direct amendment of crop residue is just the first step in improving agro-ecosystem conditions that have deteriorated as a result of past management practices. There are various uses for crop residue. Extending energy and nutrient cycling and improving use efficiency is the main goal of crop residue management

GROWTH, YIELD AND CANOPY ENVIRONMENT IN ARBOREUM, HIRSUTUM AND BT COTTON UNDER HIGH DENSITY PLANTING SYSTEM

Arvind kumar and A.P. Karunakar

A field experiment was conducted to know the effect of various genotypes and different plant density on cotton growth, yield and environment at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during the kharif season of 2015-16. Three cotton genotypes viz. *hirsutum* cotton AKH-081, *arboresum* cotton AKA-7 and *Bt* cotton Balwan, with three plant densities at the population level of 100 %, 150 % and 200 % of normal for respective genotype, were laid out in factorial randomized block design with three replications. Soil of experimental plot was medium deep black. Cotton crop was sown on June 18. Total rainfall of 590.8 mm was recorded during the crop growing season.

Bt cotton Balwan recorded higher growth in terms of leaf area, dry matter weight and yield attributes plant⁻¹. Plant height and sympodial branches plant⁻¹ were significantly more with AKA 7. Cotton planting at 150% to 200% of normal population density lowered growth and yield attributes plant⁻¹ and caused earlier maturity of crop compared to normal population density. AKA-7 recorded maximum seed cotton yield (1715 kg ha⁻¹) than *Bt* Balwan (1571 kg ha⁻¹) and AKH 081 (1466 kg ha⁻¹). High density planting at 200% of normal density produced maximum seed cotton yield (1802 kg ha⁻¹) at par with 150% of normal plant density (1679 kg ha⁻¹). Increased number of plants compensated for fewer yield attributes plant⁻¹ and cumulatively yield output was higher in conventionally close spaced genotype (AKA-7) and with the high density planting system (150% to 200% of normal population density).

Over the cotton canopy, fraction of intercepted PAR (Photosynthetically Active Radiation) was more and transmitted PAR was less with increased plant density from 100 to 200%. Fraction of intercepted PAR was maximum in AKA-7 and lowest in *Bt* Balwan. Fraction of transmitted PAR was lowest in conventionally close spaced AKA-7 and maximum under widely spaced Balwan. Canopy temperature was lowest in AKA-7 with high canopy temperature depression, indicative of comparatively lower degree of field-scale plant water stress in AKA-7 and its greater tolerance to environmental stress comparative to genotypes AKH 081 and Balwan. Thermal units availed during the total growing period of crop were more by AKA 7 (2273.2 °Cday) followed by Balwan (2222.3 °Cday) and AKH 081 (2190.2 °Cday). AKA 7 recorded higher thermal use efficiency with respect to both seed cotton and biomass production followed by *Bt* Balwan and AKH 081.

ROLE OF GREEN MANURING IN SUSTAINABLE CROP PRODUCTION

Rakesh Kumar Jogendra Kumar and Surgyan Rundla

Green manuring is most impactful component of organic farming for sustaining crop production and soil health. Incorporation of cover crops into the soil allows the nutrients held within the green manure to be released and made available to the succeeding crops. This results immediately from an increase in abundance of soil microorganisms from the degradation of plant material that aid in the decomposition of this fresh material. This additional decomposition also allows for the re-incorporation of nutrients that are found in the soil in a particular form such as nitrogen (N), potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg), and sulfur (S). Average biomass yields of several legumes by crop eg Sweet clover, Berseem clover, Crimson clover, Hairy vetch (1.75, 1.10, 1.40 and 1.75 respectively) and nitrogen yields (120, 70, 100 and 110 lbs acre⁻¹) respectively. Green manure is broken down into plant nutrient components by heterotrophic bacteria that consumes organic matter. Warmth and moisture contribute to this process, similar to creating compost fertilizer. The plant matter releases large amounts of carbon dioxide and weak acids that react with insoluble soil minerals to release beneficial nutrients. Soils that are high



in calcium minerals, for example, can be given green manure to generate a higher phosphate content in the soil, which in turn acts as a fertilizer. The ratio of carbon to nitrogen in a plant is a crucial factor to consider, since it will impact the nutrient content of the soil and may starve a crop of nitrogen, if the incorrect plants are used to make green manure. The ratio of carbon to nitrogen will differ from species to species, and depending upon the age of the plant. The ratio is referred to as C:N. The value of N is always one, whereas the value of carbon or carbohydrates is expressed in a value of about 10 up to 90; the ratio must be less than 30:1 to prevent the manure bacteria from depleting existing nitrogen in the soil. Rhizobium are soil organisms that interact with green manure to retain atmospheric nitrogen in the soil. Legumes, such as beans, alfalfa, clover and lupines, have root systems rich in rhizobium, often making them the preferred source of green manure material.

STABILITY ANALYSIS FOR TERMINAL HEAT TOLERANCE IN BREAD WHEAT (*TRITICUM AESTIVUM* L. EM. THELL.)

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The present investigation was carried out with 32 diverse genotypes of bread wheat in completely randomized block design with 3 replications at G.B. Pant University Pantnagar for screening out terminal heat tolerance. The genotypes were sown under 3 conditions viz. timely sown condition (stress free), late sown and very late sown conditions (heat stress). The observations were recorded on 15 agronomic traits like days to 75% flowering, days to 75% maturity, 1000 grain weight, grain yield etc. and 3 physiological traits viz. canopy temperature depression, SPAD value and relative water content. The statistical analysis for stability was done by using Eberhart and Russell model and heat tolerance was measured by calculating heat susceptibility index. On the basis of stability parameters, the results revealed that different genotypes were found stable for different agronomic and physiological traits. Genotypes BWL-0814, BWL-1771, BWL-9022 and C-306 were found stable for most of the agronomic and physiological traits. On the basis of heat susceptibility index, most of the genotypes were found tolerant and moderately tolerant for heat stress conditions viz. late sown and very late sown conditions. The genotypes BWL-0814, CUS/79/Prulla, Chirya-3, IC-118737 and HD-2967 were found tolerant & the genotypes BWL-1771, BWL-0924, BWL-1793, Dharwar Dry, Raj-3765, HI-1563, WH-730, Raj-4037, Babax were found moderately tolerant in both heat stress conditions with high yield performance. The findings may be helpful in exploiting these heat stress tolerant genotypes in the future breeding programme for developing the heat tolerant varieties. These genotypes can be used as donor parents in heat tolerance breeding programme.

INFLUENCE OF INM ON REDUCING SOIL N₂O EMISSIONS, NUTRIENT USE EFFICIENCY, SOIL FERTILITY AND PRODUCTIVITY OF RICE CROP

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Rice (*Oryza sativa* L.) is one of the most important staple food crops in the world. Exploiting the production potential of high yielding rice varieties through agronomic management is one of the alternatives to feed the ever growing population. For this, fertilizers from different sources have contributed substantially to the spectacular increase in rice yield and to improve soil properties. Rice yield and yield contributing traits significantly increased with the use of compost, vermi-compost, sasbania, green manure and FYM in combination with chemical fertilizer than individual sources in most of the findings. Higher total nutrient uptake by rice crop was also recorded under integrated nutrient source. Moreover integrated application of inorganic and organic fertilizers helped in increasing the availability of nutrients and improves major physical and chemical characteristics of the soil. In conclusion, application of 50 % fertilizers from organic sources and 50 % from inorganic sources is the best combination and reported by many scientists for rice yield and soil properties improvement. It remains unclear whether INM increases or decreases soil nitrous oxide (N₂O) emissions compared to organic nitrogen inputs, which may represent an overlooked environmental tradeoff. In general, INM treatments having low carbon to nitrogen ratio C:N combined use of organic and inorganic sources of N has resulted in better rice yield than inorganic source alone. So also their residual effect boosted the productivity of succeeding crop. It has beneficial influence on physico-chemical properties of the soil in respect of lowering bulk density and pH and improving the organic carbon as well as available nutrient status of soil in general and N in particular apart from improving N use efficiency in rice-based cropping systems. Application of 50% recommended dose of fertilizer (RDF) + 50% recommended dose of nitrogen (RDN) through mustard oil cake (MOC) or 75% RDF + 25% RDN through MOC + biofertilizer recorded significantly higher grain and biomass yields, greater NPK removal and higher partial factor productivity of applied nutrient (PFPN) than those of the crop having 100% RDF.

Keywords: INM, Organic source, N₂O, Bulk density, soil fertility.

SUSTAINABILITY REALIZATION THROUGH CONSERVATION AGRICULTURE

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Soil dilapidation is a major threat to our food and environment security. Nutrient Mining and loss of organic matter are causing decline in soil fertility in intensively cropped areas. The expected climate change due to imbalanced fertilizer use, unplanned crop management has further aggravated the issue of sustainability of agriculture. Conservation agriculture therefore presents an opportunity to cater the requirements of the hour to move into the next phase of Indian agriculture. According to FAO "Conservation agriculture is a concept for saving agricultural crop production that strives to achieve acceptable profit together with high and sustainable production levels while concurrently conserving the environment". Continuous minimum mechanical soil disturbance, permanent organic soil cover with crop residues or cover crops and diversified, efficient and economical viable crop rotations are the three pillars in this improving the resource use efficiency and mitigating green



house gas emissions. The concept of conservation agriculture is based on resource saving agricultural crop production that strive to achieve acceptable profits together with high and sustain production levels, while concurrently conserving the environment. It is based on enhancing natural biological processes above and below the ground. Various long term studies were undertaken to introduce conservation agriculture technologies in selected cropping systems as a way of improving crop yields, soil health and income, whilst reducing environment degradation. The use of zero tillage and conservation tillage manage the crop residues as well as act as a mulch over the soil surface. This has a positive correlation with the soil bulk density, soil microbial population, phosphatase activity, glomalin content, soil respiration and lastly on soil aggregations. The water holding capacity, infiltration rate and moisture content is sharply enhanced by these technologies. Soil organic carbon level and carbon sequestration also increased with the incorporation of crop residues. The energy requirement is decreased up to 15-20% by use of zero tillage. The adoption of intercropping with pulse crops in combination with conservation tillage has a smothering effect on the weeds there by reducing the yield loss (Behera *et al.*, 2014). Minimum tillage + crop residue gave 11% higher maize and toria yields and 40% reduced runoff over conventional tillage in Uttarakhand (Sharma *et al.*, 2008). Hence conservation agriculture is the mission for the new paradigm of arresting and reversing the downward spiral of resource degradation and decreasing production in rainfed scenario moving it towards the path of sustainability.

Keywords: Conservation, Minimum tillage, Zero tillage

SOIL AND WATER CONSERVATION

BORON CONTENT AND ITS UPTAKE BY COTTON (*GOSSYPIMUM HIRSUTUM* L.) AS AFFECTED BY APPLICATION OF BORON IN CALCAREOUS SOILS OF SOUTH-WEST PUNJAB

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A field experiment was conducted during Kharif 2015 to study the effect of boron application on boron content and its uptake by cotton (*Gossypium hirsutum* L.) in calcareous soils of south-west Punjab at Regional Research Station, PAU, Bathinda. Two sources of B viz. borax and granubor were applied. The treatments comprised of six levels of soil applied B (0.0, 0.5, 1.0, 1.5, 2.0 and 2.5 mg B kg⁻¹soil) and two levels of foliar applied B (0.1 and 0.2 percent borax and granubor solution) along with the common control. Foliar application of boron was done between 85 to 105 days after sowing. The experiment was laid out in RBD factorial design with 3 replications. For soil application method, boron content and uptake increased significantly at 1.0 mg B kg⁻¹ treatment level and remained non-significantly with further higher levels of boron application over the control. Among foliar applied boron, 0.1 per cent solution was better than 0.2 per cent solution and significant over control irrespective of boron sources. Soil applied boron was at the par with foliar applied boron. The trend of boron content in different was Leaves > Roots > Overall plant > Seed cotton. The trend of boron uptake in different parts of the crop was and overall plant > Roots > Seed cotton. Among sources, efficiency of borax and granubor was found to be equal and affected the above discussed parameters non-significantly. Interaction between two factors (B application levels and sources) affected the boron content and boron uptake non-significantly.

Keywords: Boron, calcareous soils, cotton, boron uptake

CLIMATE CHANGE AND INCIDENCE OF INSECT PESTS

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As a result of global warming the relative efficacy of pest control measures such as host-plant resistance, natural enemies, bio-pesticides and synthetic chemicals is likely to change as a result of global warming and climate change. There is an urgent need to assess the efficacy of various pest management technologies under diverse environmental conditions, and develop appropriate strategies for pest management to mitigate the adverse effects of climate change. Insect response to rise in atmospheric temperature and carbon dioxide differ from one region to the other. The latest assessment report from the Intergovernmental Panel on Climate Change (IPCC) predicts an increment in mean atmospheric temperature from 1.1 to 6.4°C toward the year 2100 with equally increasing atmospheric carbon dioxide (CO₂). Such climatic changes could profoundly affect insect's population on essential crops. Climate can influence pathogens, vectors, host defenses and habitat. Diseases carried by mosquito vectors are particularly sensitive to meteorological conditions.

Keywords: Environment, Climate Change, Efficacy, Insecticides, Pest control,

IMPACT OF CLIMATE CHANGE ON HORTICULTURAL CROPS

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Climate change, also known as global warming, refers to the rise in average surface temperatures on earth & warming of the atmosphere. Climate differs from the weather in terms of, what are conditions of the atmosphere over a short period of time (Weather), and how the atmosphere “behaves” over relatively long periods of time (climate). Climate change is caused by several factors such as biotic processes and abiotic



factors. The climate change is real phenomena and it will have impact on productivity and livelihood of primary farming options. It is mainly caused by increasing concentration of greenhouse gases (GHGs) in the atmosphere. Increase in temperature and rainfall was noticed in the country in tune with the global warming and climate change though spatial and seasonal differences were evident. Due to increase in temperature, fruit crops like citrus, grapes, melon, *etc.* mature earlier by about 15 days. Fruit firmness is also affected by high temperature condition during growth. In case of thermo sensitive crops like cashew, cocoa, tea, coffee, and cardamom, the projected increase of 2-3°C in temperature may directly affect the production and productivity. Therefore, proactive technologies need to be developed against the global warming and climate change for sustainable crop production in horticulture as a part of “climate resilient horticulture”.

WATER QUALITY ASSESSMENT BETWEEN OF RIVER HINDON BETWEEN GHAZIABAD AND GREATER NOIDA, U.P

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River Hindon, a tributary of River Yamuna originates in the Saharanpur District, from Upper Shivalik in Lower Himalayan Range. The river is entirely rainfed and has a catchment area of 7,083 sq.km. The catchment area is a part of the Indogangetic Plain, it lies between latitude 28°30' to 30°15'N and longitude 77°20' to 77°50'E. It flows between Ganges and Yamuna river for about 400 km through Muzaffarnagar, Meerut, Baghpat, Ghaziabad, Noida and Greater Noida before it joins Yamuna river just outside Delhi. The River is subjected to varying degree of pollution caused by numerous untreated or partially treated waste inputs of municipal and industrial effluents. In the present investigation, assessment of the water quality was done by analyzing different physico-chemical parameter and heavy metal. The various Physico-chemical parameters analyzed are temperature, pH, DO, BOD, COD, Free CO₂, Electrical Conductivity, Acidity, total Hardness (TH), chloride (Cl) and Alkalinity. During the study DO ranged from 0.05 mg/l, BOD ranged from 44.3 mg/l, THD ranged from 320mg/l to 690 mg/l, EC ranged from 788 µS/cm to 1625 µS/cm and the pH ranged from 6.4 to 8.2. Temperature was found strongly negative correlated (-0.906) with DO while a strong positive correlation was found between pH and DO (0.909) and COD (0.914). Based on the heavy metal concentration values observed during the study it was concluded that the concentration of most heavy metal were very high. The order of different metal based on concentration was found as Fe > Mn > Zn > Ni > Cr > Cu > Cd. The iron was found in maximum concentration and Cd was found in minimum concentration. The average values of all the heavy metals were found as Fe (11.27±3.50), Mn (4.00±1.26), Ni (0.63±0.17), Cr (0.16±0.07), Cu (0.15±0.07), and Cd (0.08±0.07). Howell post hoc test shows that there are statistically significant differences ($p > 0.05$). Which indicate the high degree of organic and inorganic pollutants rendering the water unsuitable even for bathing purpose.

EMERGENCE OF SPACE TECHNOLOGICAL SOLUTION FOR NATURAL RESOURCE CONSERVATION AND CLEAN ENVIRONMENT

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India, as fast developing nation in the world working and indulge in space research technology and field experiments for successful results to become strong in space technological mission in the global level. Recent time space technology play vital role in various environmental issues and natural resource conservation, wildlife management, conservation of biological diversity (Mangroves and Coral reef), water resources management, forest conservation, exploration as well management of mineral resources, ecotourism and alternative energy sources like solar/wind/Hydropower/ geothermal *etc.* for the Sustainable Development Goals (SDG) and also achieving Millennium Development Goals (MDG) for national growth. Due to drastic increment in population raise problem of pollution caused high temperature resulting global warming which effects ozone layer depletion due to ozone depleting substances (ODS) in the atmosphere ultimately climate change and disasters directly impact to the human being on this planet.

Space technology (Remote sensing (RS) and Geographical Information System (GIS) technology with the use of Global Positioning System (GPS) are boon for the global, national, regional and local people for in this era of technology. The satellite data based synoptic coverage and information providing the data and selected sites for the conservation of natural resources of the area and proper management & monitoring station can help government in planning and policy making for the developmental projects. This integration of technology act as lab to land technology transfer, need of the time which also conserves the natural resources, save time, energy and economically cost effective for the national and international growth.

KEYWORDS: Space Technology, Environment, Conservation, Management

SOIL PROPERTIES IN RELATION TO RESOURCE CONSERVATION TECHNOLOGIES

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Indian agriculture has been successful in increasing food grain production in the past, guided by the goals of the “self sufficiency” in the country. The mission of increasing food grains production somehow stands achieved, however, accompanied by series of problems related to the environment and natural resources. We have reached a situation where we must look for new directions, learning from our past. The resource conservation technologies primarily focus on resource savings through minimal tillage, ensuring soil nutrients and moisture conservation through crop residues and growth of cover crops, and adoption of spatial and temporal crop sequencing. Over the past three decades or so, internationally, rapid strides have been made to evolve and spread resource conservation approaches like zero and reduced tillage systems, better management of crop residues, planting systems, laser land leveler, site specific nutrient management (SSNM), leaf colour chart (LCC), green seeker, soil



test crop response, fertigation, customized fertilizer and Agro-forestry, which enhance conservation of soil, water and nutrients. Physical, chemical and biological properties of the soil environment are considered to be most influenced by the soil tillage operation in agricultural production. Tillage would aim to create a soil environment favorable to the plant growth. Based on 8 years of studies reported that the mean soil bulk density was 0.8-1.5 % lower in ST (sub-soiling with retention of all surface plant residues) and NT (consisted of zero tillage; planting was through the previous plant residues) treatments than in CT (Conventional tillage). A significant increase in available water capacity by 18-35% and total porosity by 35-46% in silt loam soil under the application of mulch at 0, 2, 4, 8 and 16 Mg/ha/year without crop cultivation. Micro organism such as bacteria, fungi and actinomycetes influence profoundly the physical, chemical and especially the biological properties of soils.

IMPACT OF HORTICULTURAL WASTE ON ENVIRONMENT

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Waste occurs in all steps of the horticultural production chain. The most obvious reason for this is of cause that fresh food is delicate by nature, and simply does not keep for very long. The lack of co-ordination among producers and distributors , as well as in efficient purchase and meal planning among consumers, further increases waste of food. Due to lack of post harvest management infrastructure. India losses a big chunk (40%) of their production of fruits and vegetables. These waste can be source of atmospheric pollutions and contaminations. They can also provide valuable raw material for gas reactors, organic manures and extraction of several types of useful by-product. These may be many options for utilization of waste especially from the processing factories. There are about 7500 processing units in India. These units have no organized method of waste disposal. This waste can be a rich source of value added by-product and can be used as feed and other possible by-products such as juice, wine, vinegar, pectin essential oil, juice fat, tannins, starch. This is a urgent need to develop suitable technologies /processes and hard ware for production of fibre, yam, mattress, geo textiles, soil conservation structure etc. from empty fruit bunches, shell charcoal powder production through gasification from shell waste and particle board, soilless culture , composting and conservation structure etc. from mesocarp fibres

BENEDICTIONS OF GLOBAL WARMING – A CONTRADICTIONARY REVIEW

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Global warming is the most controversial issue of the century. Emphasizing a single issue for the sake of whole humanity isn't worth it. Over the last hundred years the average temperature at the earth's surface has gone up by 0.5^o C. Although it has created some sort of imbalances in the nature, it has been dealt by it through its own methodologies. A warmer climate has fostered longer growing season, opening the new territory of farming in the Northern latitudes. For the first time in hundreds of years, it has been possible to raise cattle and start dairy farms in Greenland with the effects of global warming. The higher temperatures combined with more CO₂ favors plant and crop growth and could well provide more food for our burgeoning global populations. C₃ plants, grasslands, legumes benefits with temperature rise. Sowing to maturity period has reduced and harvesting index has increased. Moreover the enrichment of the atmosphere with CO₂ fertilizes plants making for more vigorous growth reducing dependence on chemical fertilizers. Even the livestock survives climate change better than crops. Geologic history reveals that warmer temperatures produce more, not less precipitation. A warmer climate lowers transportation costs, reduces snow and ice tormenting truckers and automobile drivers, fewer storms and bad weather disrupts air travel, a lower incidence of storms and less fog facilitates water transportation. Higher temperature benefit oil drilling in the northern seas and mining in the mountains. Warmer climate may develop new tourism opportunities at higher elevations. The overall effect on the world and domestic economies would be small as reduced production in some areas would be balanced by gains in others, according to an economic model of the effects of climate change on world agricultural markets. Life expectancy rate increases with increase in temperatures. The warmest periods, the Neolithic, Bronze Age and England in the 13th centuries enjoyed the longest life spans of the entire record. History reveals and overwhelmingly supports the proposition that during warm periods human prospered. They multiplied more rapidly, lived longer and they apparently were healthier. Based on history, however, global warming is likely to be positive for most of mankind while the additional carbon, rain and warmth should also promote plant growth that can sustain an expanding world population. Global change is inevitable; warmer is better; richer is healthier.

Keyword: Global Warming, High temp., Climate change

AN OVERVIEW ON OUR ANCIENT WATER CONSERVATION SYSTEM

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Our ancient religious texts and epics give a good insight into the water storage and conservation systems that prevailed in those days. Over the years rising populations, growing industrialization, and expanding agriculture have pushed up the demand for water. Efforts have been made to collect water by building dams and reservoirs and digging wells; some countries have also tried to recycle and desalinate (remove salts) water. Water conservation has become the need of the day. Conservation of water in the agricultural sector is essential since water is necessary for the growth of plants and crops. The Indus Valley Civilization, that flourished along the banks of the river Indus and other parts of western and northern India about 5,000 years ago, had one of the most sophisticated urban water supply and sewage systems in the world. We focus on our ancient water conservation methods in this paper.



Keyword - water conservation methods, benefits, needs.

RESPONSE OF SUMMER GROUNDNUT TO NUTRIENT SOURCES AND NUTRIENT SOLUBILIZERS IN BLACK CALACEROUS SOIL IN SOURASHTRA REGION

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Keywords: Enriched compost, FYM, Neemcake, Nutrient solubilizers, Organic farming

A field experiment entitled “Response of organic manures and nutrient solubilizers on summergroundnut (*Arachis hypogaea* L.) in black calcareous soil” was conducted during summer 2015 at Instructional Farm, Department of Agronomy, College of Agriculture JAU, Junagadh. The experiment comprising of 4 levels of nutrient sources in main plots (RDF @ 25:50:50 kg ha⁻¹, FYM @ 5 t ha⁻¹, neemcake @ 1 t ha⁻¹ and enriched compost @ 1.5 t ha⁻¹) and 3 levels of nutrient solubilizers in subplots (PSB @ 1 L ha⁻¹, allnutrient solubilizers @ 2.5 L ha⁻¹ and micronutrient solubilizers @ 2.5 L ha⁻¹) was carried out in split plot design with three replications.

Results of the experiment revealed that significantly maximum growth attributes, yield attributes, yield, quality, nutrient content and their uptake (N, P and K) was recorded with RDF @ 25:50:50 kg ha⁻¹. Significantly, maximum available soil N, S, Fe, Mn, Zn and B and soil enzymatic activities at 90 DAS (dehydrogenase, acid phosphatase and alkaline phosphatase) was observed with application of FYM @ 5 t ha⁻¹. Number of branches per plant, root length, root fresh weight and root nodules per plant was at par with FYM @ 5 t ha⁻¹, neemcake @ 1 t ha⁻¹ and enriched compost @ 1.5 t ha⁻¹ at 60, 90 DAS and at harvest. Immature pods per plant, weight of immature pods per plant, 100-kernel weight, pod and kernel yield was at par with FYM @ 5 t ha⁻¹, neemcake @ 1 t ha⁻¹ and enriched compost @ 1.5 t ha⁻¹.

EFFECT OF NITROGEN LEVELS ON LATE SOWN VARIETIES OF WHEAT (*TRITICUM AESTIVUM* L.)

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A field experiment was carried out at Agronomy Research Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during Rabi season of 2014-15 to study the response of late sown wheat varieties to doses of nitrogen application. Eighteen treatment consisted of six doses of nitrogen (0, 40, 80, 120, 160 and 200 kg N ha⁻¹) and three varieties of wheat (PBW-373, HD-2327, and NW-1014). The experiment was conducted in Randomized Block Design R.B.D. (factorial) with three replications on silt loam having low organic carbon (0.37%), nitrogen (194.25 kg ha⁻¹), medium in phosphorus (15.25 kg ha⁻¹) and potassium (250.25 kg ha⁻¹). All the growth and yield parameters increased significantly with increasing nitrogen doses up to 200 kg N ha⁻¹. The growth characters like plant height, dry matter accumulation, number of tillers, leaf area index were significantly higher under 200 kg N ha⁻¹ being at par with 160 and 120 kg N ha⁻¹ over rest of the levels and among the varieties NW-1014 was at par with HD-2327 while significantly superior over PBW-373. The yield components like number of spikes m⁻², spike length (cm), number of grain spike⁻¹, grain weight spike⁻¹ (g), grain yield (q ha⁻¹), straw yield (kg ha⁻¹) and nitrogen content in grain (%), nitrogen content in straw (%), nitrogen uptake in grain (kg ha⁻¹), nitrogen uptake in straw were maximum under 160 kg N ha⁻¹ and among the varieties NW-1014 being at par with HD-2327. The maximum net return (Rs. 40712 ha⁻¹) was obtained at 160 kg N ha⁻¹ with NW-1014 and B:C ratio 1.19 followed by same variety at 120 kg N ha⁻¹. Thus it may be concluded that application of 160 kg N ha⁻¹ proved appropriate levels of nitrogen for exploration of the yield potential of the late sown wheat varieties. Among the varieties NW-1014 found most suitable for cultivation under late sown condition for Northern East Plain zone.

Theme – Integrated Nutrient, Weed, Disease, and Pest Management

BIO-COMPATIBLE LIGAND COATED Gd₂O₃ NANOMATERIALS AS MRI CONTRAST AGENTS

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We report a facile method to synthesize high quality and bio-compatible ligands (BL) coated Gd₂O₃ nanoparticles for use as contrast agents in magnetic resonance imaging (MRI). The bonding status of ligand coated Gd₂O₃ nanoparticles were confirmed by FT-IR and TGA. The surface coating amount was estimated to be from 45% to 60% in weight percent from a TGA analysis. High voltage electron microscope (HVEM) shows that BL coated Gd₂O₃ nanoparticles were spherical in shape with an average diameter 3 μ m. In addition, the bio-compatibility of the nanoparticles were measured by cytotoxicity tests by using human prostate cancer (DU145) and normal mouse hepatocyte (NCTC1469) cell lines which indicated that BL coated Gd₂O₃ nanoparticles are not toxic up to 200 μ M, making them a promising candidate for bio-medical applications. The BL coated Gd₂O₃ nanoparticles showed r_1 and r_2 from 13.77 to 64.14 s⁻¹ mM⁻¹ respectively. The high relaxivities provide an opportunity to conduct perfusion MRI experiments with significantly lower concentrations than those needed for current commercial agents. A pronounced positive contrast enhancement was clearly observed in 3 tesla T₁ MR images of a rat with a liver tumor after injection of an aqueous sample solution into a rat tail vein.



RESPONSE OF SELECTED LENTIL CULTIVARS AGAINST THE ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA***Taruba Ansari, Mohd Asif, Amir Khan, Moh Tariq, Faryad Khan and Mansoor Ahmad Siddiqui**

Section of Plant Pathology and Plant Nematology, Department of Botany, Aligarh Muslim University, Aligarh, India (202002).

The root-knot nematode, *Meloidogyne incognita* is one of the most serious plant parasitic nematodes causing considerable losses in the yield of pulse crops. Although synthetic nematicides are instantaneously effective but are hazards to the environment. Among all the alternatives to nematicides, the use of resistant cultivars is an inexpensive and eco-friendly strategy. The cultivars resistant to root-knot nematodes have comparatively better crop yield than susceptible varieties and can be employed as a component of integrated nematode management. In the current study, five cultivars of lentil were tested for their response to *Meloidogyne incognita* by inoculating with 1500 second stage juveniles. Tested cultivars were assessed for their susceptibility and resistance behaviour against *M. incognita* on the basis of root-knot index. The nematode displayed variable effects on the reproduction and plant growth of lentil cultivars. During our study, none of the tested cultivars were observed to be immune or highly resistant to nematode infection according to the rating scale. Malika was the only cultivar which was found moderately resistant against *M. incognita* as it showed least value of root-knot index (2.4) whereas Desi was highly susceptible having highest root-knot index (4.4). *Meloidogyne incognita* played key role in altering the normal physiology of the host plant. Chlorophyll and carotenoid content of leaves was significantly reduced on nematode infestation. This suggests that nematode resistant cultivars should be put in practice to limit lentil yield losses in root-knot nematode infested soil.

Keywords: Lentil, Cultivars, *Meloidogyne incognita*, Resistance.

HAPLOID: PRODUCTION AND USE IN CROP IMPROVEMENT”**Deepankar Pandey, Vinay Chaurasiya, Rakesh Chaudhary, Tabassum and Sneha Adhikari**

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The term haploid refers to those plants which possess a gametophytic number of chromosomes (single set) in their sporophytes. Double haploid (DH) refers to individuals with the doubled chromosome number of the haploid (Chawla, 2009). Haploids can originate spontaneously in nature or as a result of various induction techniques. Spontaneous development of haploid plants has been known since 1922, when Blakeslee first described this phenomenon in *Datura stramonium*; this was subsequently followed by similar reports in tobacco, wheat and several other species. However, spontaneous occurrence is a rare event and therefore of limited practical value. The potential of haploidy for plant breeding arose in 1964 with the achievement of haploid embryo formation from *in vitro* culture of *Datura* anthers by Guha and Maheshwari (Murovec and Bohanec, 2012).

Haploids have been classified into euploids whose chromosome number is an exact multiple of the basic number and aneuploids whose chromosome number is not an exact deviation from the basic chromosome number. In general, there are three main approaches for the production of haploids which includes parthenogenesis and apogamy; somatic reduction and chromosome elimination; and anther, pollen and ovule culture (Forster *et al.*, 2007). Species for which well-established protocols exist predominantly belong to field crops or vegetables, but the technique is gradually also being developed for other plant species, including fruit and ornamental plants and other perennials. Wheat cultivars developed from doubled haploid from both anther-culture and maize induction systems have been released for cultivation in all the major continents (Basu *et al.*, 2011).

RESISTANCE OF DIFFERENT MAIZE PROMISING GERMPLASM AGAINST MAIZE STEM BORER *CHILO PARTELLUS* (SWIMHOE) IN KHARIF SEASON**Kaushal Kishor, Neelam Yadav, Ram Kewal, S.k. Dotasara**

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Investigation regarding the screening of maize germplasm against stem borer *Chilo partellus* (Swinhoe) during Kharif season, 2015, respectively, was sown that out of hundred germplasm fourteen germplasm were resistance which ranged 0.0 percent infestation. These are DMR-606, DMR-607, DMR-110, DMR-615, DMR-703, DMR-618, PC-6, CIM-180, TSK-9, CMS-5, CIM-78, TR4-19, DMR-706, DMR-605, and out of hundred germplasm none of the germplasm was found moderately resistance having 1-5 percent damage, only three germplasm were moderately susceptible having 6-15 percent damage e.g. TR-7-89, TSK-90, DMR-702. Out of hundred germplasm twelve were found under the susceptible category and their infestation ranged found 16-30 percent and these are DMR-701, DMR-608, TSK-44, R 9-303, CIMMYT 14/k/13, TR 4-19, DMR 705, TSK -99, TSK-98, SK-10, TR 3-13, DMR -707 out of hundred germplasm seventy one germplasm were found highly susceptible to stem borer having more than 30 percent damage. The resistance germplasm may be utilized as best source of resistance against maize stem borer for developing resistant cultivar of maize crop in Kharif season.

STUDIES ON *XANTHOMONAS AXONOPODIS* PV. *PUNICAE*, CAUSING BACTERIAL BLIGHT OF POMEGRANATE IN PUNJAB**Adesh Kumar¹, Tanjeet Singh Chahal¹, Mandeep Singh Hunjan² and Harminder Kaur²**¹Punjab Agricultural University, Fruit Research Station, Jallowal- Lesriwal, Jalandhar, Punjab.²Department of Plant Pathology, Punjab Agricultural University, Ludhiana-141 004

Bacterial blight of pomegranate caused by *Xanthomonas axonopodis* pv. *punicae*, have economic importance to reduced crop yield in India. Farm survey was undertaken in the pomegranate research block, Fruit Research Station, Jallowal- Lesriwal Jalandhar during 2015. It was



revealed that the maximum disease incidence (91%), severity (14.41%) and fruit cracking (12%) was found in cv. Ganesh. Twenty isolates of *Xanthomonas axonopodis* pv. *punicae* showed different virulent reaction with respect to incubation period, fruit cracking and drooping. It was observed that 9 isolates viz. Xap4, Xap5, Xap6, Xap9, Xap12, Xap14, Xap15, Xap16 and Xap17 were highly virulent on Ganesh cultivar. The optimum growth of bacterium was observed at 30 °C while 5 and 50 °C temperatures did not show any growth on Kings B Medium. All the five chemical treatments showed control of bacterium under *in vitro* conditions. However, the combination of Blitox (2500ppm) and Kocide (2500ppm) with Cristocycline (100ppm) showed maximum inhibition zone of 53 and 52 mm respectively followed by streptomycin (50.12 mm) and Cristocycline (50mm) with 500 ppm concentration. While Bordeaux mixture with concentration (1%) showed 45 mm inhibition.

MUTAGENS EFFECT ON PLANT SURVIVAL IN M₁ GENERATION

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Pulses constitute legumes occupy a unique position in world agriculture by virtue of their high protein content and major source of dietary proteins. In developed countries, grain legumes are also an important indirect source of protein, being animal feed of high biological value. They contain 20-30 per cent protein in their seeds, which is 2 to 3 times more than in the cereals. The experimental work was conducted at JVC, Baraut Baghpat (U.P). The treatments of mutagens were used Gamma rays, EMS and combined EMS and gamma rays. The experimental material was taken Deshi, Kabuli and green seeded varieties of chickpea. The results on plant survival also showed similar trend as germination. The chemical mutagens, EMS with dose (0.30%) had more drastic effect on three varieties (51.3-85.2%). The maximum survival of plants (91.5%) were observed with the lowest dose of gamma-rays (20 kR) in the KSB-220 (green type).

Like germination, all three mutagens drastically reduced plant survival Wellensiek (1965) also found positive correlation between germination, survival and pollen sterility, all of which decreased after treatments with gamma rays and EMS in peas. Several other workers have supported the contention that mutagens reduced plant survival (Blixt *et al.*, 1963, Migacheva, 1972, Selim *et al.*, 1974, Mohan, 1983, Sarker, 1985, Dixit and Dubey, 1986 and Singh, 1988). Among the mutagens tested by 0.30% EMS has maximum effect on plant survival. Similar observations were reported in peas (Mohan, 1983 and Singh, 1988) and lentil (Sarker, 1985 and Dixit and Dubey, 1986). Dose dependent reduction in plant survival was observed with all three mutagens, which is in agreement with the results of Shevtsov (1969).

ACUTE TOXICITY STUDY OF BEES (APIS DORSATA) REARING: PESTICIDES & WEEDICIDES TREATMENT IN VIVO CONDITION.

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The experiment were conducted at the Monad University Campus, Hapur .In this campus mustard crop is cultivated regularly for seed production.. Field studies were conducted to evaluate the effect of pesticides and weedicides (Phenol, Dinitrophenol. Pentachlorophenol, Endosulfan and Neem oil).

Using half of field recommended concentration (CL- 1) and (CL-2) on honey bees mortality , their strength and brood rearing activity under field condition spraying on mustard crop. The bee colonies were treated one by one for the two concentration level of each chemicals using two different crop field simultaneously. The spray was done early in the morning on the blooming crops. The obtained data were analyzed for the analysis of variance through factorial design (Chandel., 1993). The data presented in table indicated that chemicals caused significant toxic effect on foragers in the form of their motility. Concentration level – 2 proved to be more toxic as compare to concentration level – 1 and level – 2 of chemicals. respectively. The result clearly showed significant reduction in strength of bees colonies over control group of bees.

Keywords: - Bees, Pesticides and Weedicides.

APPLICATION OF RADIOTRACER OR ISOTOPIC TECHNIQUES IN AGRICULTURE

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Agriculture is the back bone of India, production as well as security of good quality food, fiber and any other agricultural commodity is main goal for development of country. For solving need of food now a day's nuclear science is effectively involved. Many researchers have worked with radioactive isotopes (radio tracer) and found those material is quite useful in soil fertility management for quantification of available nutrient in soil, fertilizer use efficiency, residual effect of applied fertilizer and relative efficiency of applied organic matter. Application of gamma rays is useful in development of mutant varieties and increase of genetic variability that's another important role of radio tracer techniques. The applications of radioisotopes in agricultural research are inducing genetic variability in crop plants to develop improved varieties, improving fertilizer use efficiency, monitoring the persistence of pesticides in soil, groundwater and environment and reduction of post-harvest losses in agricultural products Animal production and health. The pre-treated seed with gamma rays significantly increase the proline content, POD, disease resistance and salt tolerance in drought climatic region. As a food protection point of view, the application of gamma rays significantly increased PGPR content, enzyme activity, sugar content and carbon mass in different plant part and it also decrease pathogen assessment score in red rot of sugarcane crop. It improves nutrient availability, fertilizer use efficiency and amount of beneficial microbial biomass. To face the new challenges in Indian agriculture radiation and isotope techniques are going to play a very important role in agriculture development. At



present scenario, radio tracer techniques have become essential alternate for agricultural scientists to improve and efficient utilization of agricultural inputs.

Keywords: Radio tracer, gamma rays, fertilizer use efficiency, Isotopic

PHYTOCHEMICAL SCREENING, TOTAL PHENOLICS, FLAVONOID CONTENT AND ANTIOXIDANT POTENTIAL OF DIFFERENT PARTS OF *BETULA UTILIS* D. DON FROM KASHMIR HIMALAYA

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The aim of this study was to compare the phytochemical composition, total phenolic content (TPC), total flavonoids content (TFC) and antioxidant activity of aerial and underground parts of *Betula utilis*. Qualitative phytochemical screening of the three parts indicates the presence of alkaloids, flavonoids, phytosterols, tannins, terpenoids, phenols, proteins, amino acids, anthraquinone glycosides and steroids. Total phenolic content determined by Folin-Ciocalteu method ranged from 0.03 ± 0.003 to 33.6 ± 2.1 , 0.34 ± 0.02 to 23.6 ± 0.67 and 0.08 ± 0.005 to 16.9 ± 1.9 mg/g of dry weight of roots, leaf and bark extracts, respectively, expressed as gallic acid equivalents. The total flavonoid contents as measured by aluminium chloride method ranges from 0.2 ± 0.003 to 7.3 ± 0.31 , 0.3 ± 0.08 to 4.3 ± 0.08 and 0.3 ± 0.008 to 1.3 ± 0.03 mg/g of dry weight of leaves, bark and root extracts respectively, expressed as rutin equivalents. The results showed that TPC and TFC values were higher in methanol extract of root (33.6 ± 2.1) and leaves (7.3 ± 0.31). The antioxidant capacities in the forms of DPPH (2, 2-diphenyl-1-picrylhydrazyl) were evaluated by spectrophotometric methods. A direct correlation between total phenolic content of leaves and free radical scavenging activity was revealed ($r = 0.72$).

Keywords: *Betula utilis*, total phenolic content, total flavonoid content, DPPH radical scavenging activity, IC50.

INFLUENCE OF INDOLE-3-BUTYRIC ACID ON ROOTING EFFICACY IN DIFFERENT CARNATION (*DIANTHUS CARYOPHYLLUS* L.) GENOTYPES UNDER PROTECTED CONDITION

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A study was carried out at Centre for Quality Planting Material, RDS Seed Farm, CCS HAU, Hisar, Haryana during 2016-17, to study the effect of rooting hormone viz., Indole butyric acid on rooting success in different carnation genotypes. In the experiment, terminal cuttings of fifteen genotypes of carnation viz., Friday (T₁), Irene (T₂), Aicardii (T₃), Gaudina (T₄), Ambrose (T₅), White Liberty (T₆), Jureno (T₇), Baltico (T₈), Bizet (T₉), Tasmon (T₁₀), Gwen (T₁₁), Harvey (T₁₂), Golem (T₁₃), Eskino (T₁₄) and IIHR (T₁₅) were treated with 200 ppm and 500 ppm IBA (Indole butyric acid) and were recorded for their rooting success. The experiment was laid out in Completely Randomized Design, with three replications. The study revealed that among the fifteen genotypes experimented, the highest per cent of rooting was recorded in the genotype Gaudina (91.33 %) whereas, the lowest rooting per cent was recorded in the genotype IIHR (44.66 %). As for the concentration of IBA used, 500 ppm resulted in the maximum rooting percentage (72.48%) as compare to that in 200 ppm concentration. Similar tendency of superiority was observed for days for root initiation, number of roots per cutting and length of roots, wherein the genotype Baltico took the least number of days for root initiation (15.83 days) and highest number of roots (18.01) per cutting followed by Golem (16.87).

Keywords: Carnation, genotype, Indole-3-butyric acid, rooting per cent, root length

PHOTOSYNTHETIC ACTIVITIES AFFECTED BY INTERACTIVE EFFECT OF ZINC UNDER DIFFERENT SALINE CONDITION IN WHEAT PLANT

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Wheat (*Triticum aestivum*) is a widely cultivated cereal grain which is a worldwide staple food. In India, wheat is the second most cultivated staple food crop and salinity in soil becomes a problem for deterioration of soil and making the soils unfit for agriculture and responsible for reduction of production of growing crop. Wheat is moderately tolerant to salinity and tolerant varieties can perform well under saline conditions. Thus, the research work had been planned to study the relative tolerance of wheat (Var. KRL-210) and interactive effect of Zn and types of salinity on germination and straw yield of wheat. The experiment was laid out in screen-house by taking two types (Cl⁻ and SO₄²⁻ dominated) and levels of salinity (0 and 12 dS m⁻¹) along with four levels of Zn (0, 5, 10 and 15 ppm) in completely randomized design having three replications. Deleterious effect of salinity on the plant mainly suppress the plant growth and alter the several physiological processes including photosynthetic activities like photochemical efficiency / quantum yield (F_v/F_m), chlorophyll status plants exposed to salinity and especially to NaCl. Photochemical efficiency in chloride dominated salinity decreased from 0.81 to 0.67 whereas, in sulphate dominated salinity, it decreased from 0.81 to 0.69 as the salinity levels increased from 0 to 12 dS m⁻¹. Similarly, total chlorophyll also reduced with increasing level of salinity. All above activities increased with increasing level of Zn across all the salinity levels and responsible for better performance of crop.

Keywords: Chlorophyll content, salinity, wheat and Zn



ROLE OF EXTRACELLULAR LIGNOCELLULOLYTIC FUNGAL ENZYMES IN BIOCONVERSION OF BAMBOO BIOMASS INTO FERMENTABLE SUGARS FOR BIOETHANOL PRODUCTION

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The present study was focused to find a sustainable ecofriendly renewable liquid fuel for replacing petroleum based fossil fuels to meet environment sustainability. Cellulosic plant material from Bamboo biomass could be an untapped source of fermentable sugars for significant production of bioethanol. Although, the polyphenolic lignin of the biomass hinders the digestibility of cellulose, thus the goal of any pre-treatment technology is to remove this structural component to improve the cellulose accessibility for enzymatic saccharification. The extracellular laccase and cellulase enzyme systems from fungi are now considered for eco-friendly biological delignification and saccharification respectively. Therefore, during present study bamboo biomass was pretreated using biological pretreatment. For this potential lignin degrading fungal isolate WDP2 was selected on the basis of maximum extracellular laccase activity (156.79 Uml^{-1}) that goes up to 189 Uml^{-1} after optimisation of culture conditions. Optimization of lignin degrading laccase enzyme production was done using various organic and cheap substrates. The whole cell pretreatment was given using potential fungi and the structural changes on wood were studied using UV vis spectrometry, FTIR and SEM analysis. The biomass from *Bambusa balcooa* was selected due to the high cellulose content (41.6%) and relatively low lignin (29.5%) content. The extracellular laccase enzyme showed thermo-acidophilic nature and highly stable at 4°C . The potential isolate WDP2 was identified as *Lengites elegens*. Highest percent saccharification (46.25%) was obtained when pretreated biomass saccharified using potential cellulase producing fungal isolate PCF1.

24-EPIBRASSINOLIDE MEDIATED CHANGES IN GROWTH AND SOME BIOCHEMICAL ASPECTS OF VIGNA MUNGO (L.) HEPPER UNDER SALT STRESS SOMBIR SINGH AND SOMVEER JAKHAR*

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The presence of salinity in the soil above a threshold level is proposed to check not only growth but also yield and quality of crops. Therefore, in the present study investigations are directed to evaluate the effect of various levels of salinity (0, 8, 12 and 16 dSm^{-1}) in interaction with different 24-epibrassinolide (24-EBL) solutions (10^{-5} , 10^{-7} and 10^{-9} M), on the growth and biochemical parameters. Plants subjected to salt stress exhibited a reduction in all the growth attributes (root and shoot length, fresh and dry mass of root and shoot and leaf area) and photosynthetic pigments (chlorophyll-a, chlorophyll-b, total chlorophyll and carotenoids) but melondialdehyde (MDA) content and proline contents were enhanced. However foliar application of 24-EBL enhanced the growth parameters, photosynthetic pigments and proline content. Salinity induced MDA content was reduced by application of 24-EBL. Overall, deleterious effects of salinity were reduced by foliar application of 24-EBL.

Keywords: 24-epibrassinolide, melondialdehyde, photosynthetic pigments, proline, salt stress

MICROALGAE BIOMASS UTILIZATION FOR BIODIESEL DEVELOPMENT

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Microalgae are the much more diversified group of microorganisms. These are found in a wide range of habitat. Microalgae biomass can be utilized for the development of various products for human use. Some of algae are nutritious, can be used as a source of protein. Microalgae has ability to utilize non-arable land and waste water resources with few competing uses, which makes algal biofuel production systems superior to biofuels based on terrestrial biomass. It has developed great interest in government sector, non-government organization, private sector and among researchers. Recent initiatives clearly indicate this interest at all levels of government and in private sector in the development of algal biofuels technologies and enterprises. The sustainability of algal biofuel production systems is achievable. There is regular research on biodiesel fuel into finding more and more appropriate source to enhance oil yield in algal cells. In order to replace all fossil fuel usage entirely, a large amount of biomass is required to manufacture sufficient bio-oil. Research on biofuel presently focuses on high amount of oil yield. Fossil fuel energy resources are diminishing rapidly and most importantly the liquid fossil fuel will be diminished by the year about 2050. Additionally, the fossil fuel is directly related to air pollution, land and water degradation. In these circumstances, biofuel from renewable sources like microalgae can be a substitute to reduce our dependency on fossil fuel and assist to maintain the healthy global environment and economic sustainability.

Keywords: Algae cultivation; biomass; lipids; biodiesel;

QUANTIFICATION OF THERMAL INDICES IN INDIAN MUSTARD (BRASSICA JUNCEA) VARIETIES AT VARIOUS PHENOPHASES UNDER DIFFERENT GROWING ENVIRONMENT IN HISAR

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To study thermal time requirement in Indian mustard varieties at various phenophases under different growing environment conditions, experiments were conducted in 2013-14, 2014-15 & 2015-16 at Department of Agricultural Meteorology, CCSHAU, Hisar. The main



plot treatments consisted three date of sowing (D₁-First fortnight of October, D₂-Second fortnight of October and D₃-First fortnight of November) and sub plot treatments consisted three varieties (V₁- Kranti, V₂-RH 406 and V₃-RH 0749) using split plot design. The results revealed that pooled data analysis of GDD, HTU, PTU, RUE, TUE, Hydrothermal use efficiency (HYTUE), Photothermal use efficiency (PTUE), Phototemperature (Tp), Nyctotemperature (Tn), Humid thermal ratio (HTR), Phenothermal index (PTI) requirement were more efficient in early sown crop (First fortnight of October) followed by delayed sown crop. In late sown crop, higher day and night temperature during reproductive phase leads to forced maturity and reduced the thermal time requirement therefore it reduced the length of phenophases in different environmental conditions. Among varieties, the total crop duration was longest in RH 0749 followed by RH 406 and Kranti. The crop sown on first fortnight of October was best planting window and they are more efficient in thermal and radiation utilization in comparison with delayed sown crop.

Keywords: Indian mustard, phenophases variation, thermal indices.

EFFECT OF MICRONUTRIENTS ON YIELD, QUALITY AND STORAGE OF ONION (*ALLIUM CEPA* L.) IN NORTH BIHAR

Yadav, L. M., Prasad, S. S., Kumar, Jitendra and Singh, Yamuna Prasad

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A field experiment was conducted in 2014-15 and 2015-16 (*Rabi*) at Tirhut College of Agriculture, Dholi, Experimental Farm of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur) Bihar to evaluate the effect of micronutrients on yield, quality and storage of onion (*Allium cepa* L.) var. Agrifound Light Red in north Bihar. The experiment comprises of six treatments (T₁-Soil application of Zinc Sulphate @ 10.0 kg/ha (Zinc Sulphate), T₂-Foliar application of Zinc Sulphate @ 0.5% @ 30 and 45 DAP (Zinc Sulphate), T₃-Soil application of Boron @ 10.0 kg/ha (Borax), T₄-Foliar application of Boron @ 0.25% @ 30 and 45 DAP (Borax), T₅-Foliar application of micronutrient mixture @ 0.5% (Composition: Fe-2.5%, B-0.50%, Zn-3.0%, Cu-1.0 %, Mn-1.0 %) 30 and 45 DAP and T₆-Control replicated thrice in RBD. 15cm x 10cm spacing was maintained with standard package of practices. Fertilizer dose of N: P₂O₅: K₂O: S:: 120:80:100:40 were applied. Highest total bulb yield (29.12 t/ha), marketable bulb yield (26.88 t/ha), minimum double per cent (0.94 %), highest leave dry matter content (1.48 t/ha), total dry matter yield (28.16 t/ha), dry matter yield of bulbs (26.68 t/ha) and minimum storage loss (65.28 %) was recorded with T₅ followed by T₃ with total bulb yield (27.96 t/ha), marketable bulb yield (25.64 t/ha), total dry matter yield (26.54 t/ha), dry matter yield of bulbs (25.21 t/ha), and minimum storage loss (74.47 %). Overall impact of T₅ was superior one.

COST EFFECTIVE INDUSTRIAL AND MEDICLE MOLECULAR FARMING

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The use of agricultural plants for the production of useful molecules for non food, feed or fiber applications is known as molecular farming/ pharming or biopharming. Plants are already grown to produce valuable molecules, including many drugs. Biopharming is different because the plants are genetically engineered (GE) to produce the molecules we want them to. There are two categories of biopharming products based on their use- (i) Plant made industrial products (PMIP), (ii) Plant made pharmaceuticals (PMPCs). Use of plants for production of industrial products includes three main advantages i. e. low cost, stability and safety as compared to animal systems while use of plants for medicinal purposes dates back thousands of years but genetic engineering of plants to produce desired biopharmaceuticals is much more recent. As the demand for biopharmaceuticals is expected to increase, it would be wise to ensure that they will be available in significantly larger amounts, on a cost-effective basis. Currently, the cost of biopharmaceuticals limits their availability. Plant-derived biopharmaceuticals are cheap to produce and store, easy to scale up for mass production, and safer than those derived from animals. Idea of edible vaccines using edible fruits and vegetables for delivering vaccines is very attractive, although several plant-produced vaccines have been through Phase I clinical trials in humans but not commercialized yet. Industrial products like-proteins, enzymes, modified starches, fats, oils, waxes, plastics produced by using plant cell culture as a bioreactor system are the only successful examples of commercial biopharming products but era of cost effective industrial and medicine molecular farming yet have to come.

Keywords: Biopharming, GE, PMIP, PMPCs, Edible vaccines.

CHARACTERIZATION AND CLASSIFICATION OF ELITE GENOTYPES OF CHICKPEA (*CICERARIETINUM* L.) FOR MORPHOLOGICAL CHARACTERS USING DUS DESCRIPTORS

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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 MARKET WASTE AND ITS PROPER MANAGEMENT TOWARDS A SUSTAINABLE ENVIRONMENT.

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Vegetable wastes from market and homes are source of environmental pollution, global climatic changes and human health hazards. Methods of their disposal and management are not satisfactory. Earlier studies on waste management of fruits and vegetable waste in markets could not provide a simple and satisfactory method of waste recycling. Therefore, the study was taken up. In markets in India, normally vegetable waste and fruits waste are dump in open areas. Air does not act as natural environment for the growth and multiplication of air microflora but act as a very good medium for their dispersal. They causes the environment pollution, health hazards to the subsequent people of the area. More over the microorganism which are actually responsible for these, they also attack the fresh fruits and vegetables in markets, which causes a great loss to the dealer. Present paper is part of the aerobiological studies in vegetable and fruit market in Phagwara city. The freshly prepared petriplates containing SDA and PDA media were exposed to air for 10 minutes two times in a month at 15 days interval during a period of one year. The dominant fungal types were *Aspergillus*, *Cladosporium*, *Rhizopus*, followed by *Penicillium* and *Alternaria* in such type of environment. It was found that moderate temperature, high relative humidity favoured fungal growth. So a perfect management of the waste is needed in the market. Normally proper dump section of waste, biogas plant, making of vermicompost by the market waste can be easily done. We also studied about the sources of different market waste which are related to agriculture like fruits and vegetable market waste, fish market waste, poultry market waste, their causes of loss and how they can be properly use towards a sustainable management.

GENETIC TRANSFORMATION OF RICE: PROGRESS AND PROSPECTS

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Plant genetic engineering has become one of the most important molecular tools in the modern molecular breeding of crops. Transgenes are delivered into plants to confer novel traits such as improving nutritional qualities, resistance to pests. Over the last few decades, a significant progress has been made in the development of new and efficient transformation methods. Despite a variety of available DNA delivery methods, *Agrobacterium* and Biolistic mediated transformation remain two predominantly applied approaches. Rice (*Oryza sativa* L.) is an important food crop and requires larger amount of water throughout its life cycle as compared to other crops. Rice is a strategic crop in the Asian region especially Malaysia and it is essential to maintain a domestic production level for food security reasons. The new rice variety has been developed by transferring a gene from a common plant, *Arabidopsis thaliana*, into a variety of Indian rice called *samba mahsuri*. This gene is known to be involved in pathways controlling growth and development. *Arabidopsis thaliana* is a flowering plant widely used for research purposes but it has no agronomic value as such. Putting the *thaliana* gene into rice increased its height, length of the panicle that encloses the grain, efficiency of photosynthesis, chlorophyll content, and water use efficiency. Under water scarce conditions created in laboratory, the transgenic rice performed better than their unmodified counterparts.

INTEGRATED NUTRIENT MANAGEMENT (INM) FOR SUSTAINING PULSE CROP PRODUCTIVITY AND REDUCING ENVIRONMENTAL IMPACT: A REVIEW

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Pulses are one of the second most important segments of Indian Agriculture after cereals. It provides protein rich food, firewood and income for resource poor small farmers. Pulses are least preferred by farmers because of high risk and less remunerative than cereals. Consequently, the production of the pulses is sufficiently low. Modern agriculture depends on the application of fossil fuel based inputs like chemical fertilizers, pesticides and herbicides. The high cost of chemical fertilizers, the low purchasing power of small and marginal farmers and their adverse effect on environment has led to look for some alternative strategies. Continuous use of only chemical fertilizers in intensive cropping system is leading to imbalance of nutrients in soil, which has an adverse effect on soil health and also on crop yields. Excess and imbalanced use of nutrients has caused nutrient mining from the soil, deteriorated crop productivity and ultimately soil health. One such approach is the use of different integrated nutrient management systems, which can save the soil, environment and farmers limited resources. Balanced and efficient fertilizer application, combining inorganic and organic and biofertilizers are essential in realizing the higher yield, reducing cost of production, improve or maintain the soil physical and chemical properties, and provide crop nutrition packages which are technically sound, economically attractive, practically feasible and environmentally safe. Different agricultural practices through nitrogen (N) losses and GHG (greenhouse gas) emissions are reduced substantially under advanced INM practices.



EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON PLANT GROWTH AND YIELD OF TOMATO (*SOLANUM LYCOPERSICON* L.) C.V. PKM-1**Rajya Laxmi P and Sanjana R.Y. Dr. P.D.K.V. Akola.**

An experiment entitled “Effect of Organic manures and Inorganic fertilizers on plant growth and yield of Tomato (*Solanum lycopersicon* L.) C.V. PKM-1”, was conducted in Department of Horticulture, SHIATS, Allahabad, U.P. during 2013-14. The experiment was laid out in RBD design with 13 treatments replicated thrice. The treatments consisted of different combinations of Organic manures i.e, FYM, Poultry manure and Vermicompost and Inorganic fertilizers. Among thirteen treatments under study, treatment T₇ (50% RDF + 50% FYM) recorded maximum plant height (133.53 cm), minimum days to first flowering (29.47), maximum number of flower clusters per plant (8.67), maximum number of flowers per cluster (7.27), maximum number of fruits per cluster (5.67), maximum number of fruits per plant (36.72), maximum average fruit weight (41.67g), maximum fruit yield per plant (849 g), maximum fruit yield per plot (13.50 kg) and maximum fruit yield per ha (33.77 t) followed by the treatment T₈ (50% RDF + 50% Poultry manure). Maximum gross returns (Rs.3, 37,700 ha-1), net returns (Rs.2, 14,925 ha-1) and B:C ratio (2.75:1) was found with T₇ (50% RDF + 50% FYM).

Key words : Tomato, PKM-1, FYM, Poultry Manure, Vermicompost, RDF

UTILIZATION OF GENETICALLY DIVERSE GENOTYPES OF INDIAN MUSTARD IN ISOLATION OF HETEROTIC CROSSES FOR YIELD AND YIELD RELATED TRAITS**Sneha Adhikari*, Usha pant and Ram Bhajan**

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Variability is essential for a success of any breeding programme of any crop. Hybridization among genetically diverse parent is one of the most important method to create variability. Sometimes that results in development of recombinants and provides opportunity for maintaining huge biodiversity and can also be utilized directly in improvement of that crop. Half diallel analysis is carried out involving 10 genetically diverse genotypes with diverse origin of Indian mustard (*Brassicajuncea* L.), out of which two genotypes suitable for early sown (PRE-2011-15, PM-2), six for timely sown (Divya-55, Maya, DRMR-675-39, RRN-778, RB-57 and RMM-09-4) and two for late sown (PRL-2012-13, NRC-HB-101) situations. Crosses were made between these genotypes in all possible combinations excluding reciprocals during rabi 2014-15. The parents and their 45 F₁'s along with one standard variety (Kranti) were evaluated in a randomized block design with three replications during rabi 2015-16 at N. E. B. C. R. C., GBPUA& T, Pantnagar. Ten parents and 45 F₁'s were evaluated for 13 yield and yield contributing characters. These diverse genotypes were crossed to test magnitudes of relative, better parent and economic heterosis among all 45 F₁'s. All three type of heterosis (relative heterobeltiosis and economic heterosis) were observed significant in desirable direction for all the characters except plant height and glucosinolate content. The evaluation of heterosis revealed that crosses Divya-55×PM-25, PRL-2012-13×PRE-2011-15, NRCHB-101×PRE-2011-15 for days to flowering, RRN-778×Maya, RRN-778×Maya and RB-57×Maya for early maturity, DRMR-675-39×Maya, PRL-2012-13×RB-57, PRE-2011-15×PM-25 for seeds per silique Maya×RMM-09-4, RB-57×PM-25 and PRL-2012-13×DRMR-675-39 for seed yield, PRL-2012-13×RRN-778, PRL-2012-13×RRN-778 and DRMR-675-39×Maya for oil content were most promising heterotic crosses for mid parent heterosis, better parent and economic heterosis respectively whereas, for plant height Divya-55×Maya was most promising cross for mid parent heterosis. These promising heterotic crosses can be utilized for improvement of respective character through heterosis breeding methodology.

IMPACT OF FRONT LINE DEMONSTRATION ON YIELD AND ECONOMICS OF WHEAT**Ashok Kumar¹, Govind Kumar², Maya Kumari³, Nidhi Sinha⁴ and Anil Kumar⁵**

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Front Line Demonstration (FLD) is considered one of the most powerful tools for transfer of technology, as it establishes production potential of various crops and enterprises on farmers field through “Learning by doing and Seeing is believing”. Keeping in view of an effective extension approach of FLD for dissemination of wheat technology, the present investigation was done by krishi Vigyan Kendra, Manpur, Gaya in its 5 adopted villages (Bersima, Nawada, Mahmadpur, Sikahar and Sanaut) to know the Yield Gap, Economic Return, Extent of farmer's satisfaction and Constraints faced by the farmers. In this study, 100 respondents selected were all those farmers on whose field FLD was conducted during the years 2015-16 and 2016-17. The plot size was 0.4ha for both Demonstration and Local check. Before conducting FLD, the respondents were made abreast with the latest recommended package of practices of wheat. The demonstrated technologies under FLD resulted in an increase in yield by 19.15 percent over Local Check. It was also observed that there was technology gap (TG), extension gap (EG) and technology index (TI) of 9.11q/ha, 4.96 q/ha and 22.76 percent respectively. The economic performance of wheat under FLD showed an additional return of Rs.8085.5 / ha and additional cost of cultivation of Rs. 1525/ha with BC ratio of 1.91 for demonstration and 1.70 for Local Check. The respondent satisfaction index (RSI) revealed that majority of respondent farmers expressed high (57.33percent) level of satisfaction about Front Line Demonstration followed by medium (33.33 percent) and least under low category (9.33 percent). Unavailability of improved seed varieties of wheat in relation to climate change was found to be most confronting constraint as perceived by them and ranked I which was followed by Low technical knowledge about recommended package of practices (II), Lack of irrigation facility (III) and Use of higher seed rate was identified as least important constraint and ranked as X in their priority list. Thus, it could be inferred that with the use of suitable improved seeds and other recommended package of practices of wheat, yield and return can be increased substantially. However, the yield of demonstration was found higher than the local check but still lagging behind its potential yield. Thus, the yield could further be increased through effective extension methods like training demonstration.



TILLING: A TRADITIONAL MUTAGENESIS FOR FUNCTIONAL GENOMICS AND CROP IMPROVEMENT**Ashok Singamsetti* and Mounika Korada**

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In TILLING (for Targeting Induced Local Lesions in Genomes), traditional chemical mutagenesis is followed by high-throughput screening for point mutations. TILLING extends the long-established practice of using existing variation for functional genetic discovery. Its dependence on technology that discovers sequence variation means that forthcoming advances in SNP detection and in DNA sequencing can enhance TILLING. TILLING is no different from traditional mutation breeding as far as the organism is concerned, so genetically modified organism issues do not arise. This makes TILLING an attractive strategy not only for functional genomics, but also for agricultural applications. TILLING is a reverse genetic approach, currently being used for inducing and identifying genetic variation in several plant and animal species. TILLING searches the genomes of mutagenized organisms for mutations in a chosen gene, typically single base-pair substitutions. Its advantages over other reverse genetic techniques includes its applicability to virtually any organism, its facility for high-throughput and its independence of genome size reproductive or generation time. TILLING used as a SNP discovery tool to examine DNA variation in natural populations is called EcoTILLING. Germplasm accessions are used instead of mutants and haplotyping of different loci is possible with EcoTILLING. Under specific circumstances, where conventional methods may be found to be inadequate, the mutational approach could become crucial to further success in breeding of many crop species. For producing phenotypic variants without introducing foreign DNA into plant's genome and for identifying DNA polymorphisms TILLING method is best suited where other options are limited. This chapter covers practical aspects of the technology, ranging from building the mutagenized population to mutation discovery, and discusses possible improvements to current protocols, TILLING Informatics and the impact of new genomic methods for mutation discovery in relation to the future of the TILLING approach.

Keywords: TILLING, Mutagenesis, SNPs, EcoTILLING, Genomics**EFFECT OF CHEMICAL FERTILIZERS AND VARIOUS BIOFERTILIZERS ON PHENOLOGY IN BARLEY****Priti Malik, Meena Sewhag, Karmal Malik and Shweta**

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An experiment was done during Rabi 2015-16 and 2016-17 at the Research Area of Agronomy Section, Chaudhary Charan Singh 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. Experiment was done with the various fertilizer levels (50 per cent RDF, 75 per cent RDF and 100 per cent RDF) and different combination of biofertilizers (uninoculated, *Azotobacter*, *Azospirillum*, PSB, biomix i.e *Azotobacter*+*Azospirillum*+PSB, *Azotobacter*+PSB and *Azospirillum* +PSB) showed that chemical fertilizers have pronounced effect on duration for phenological stages of barley. Days taken to emergence were not significantly affected by various doses of chemical fertilizers. 50 % tillering was increased significantly with increase in the dose of chemical fertilizers. 50% heading took significantly higher days in case of 100% RDF following 75% RDF and 50% RDF. Days for 50% anthesis and days taken to maturity were also increased with the dose of chemical fertilizers.

Days to emergence and 50% tillering were found non significant due to application of biofertilizers. Biomix showed maximum effect on 50% heading, it doesn't differ significantly from *Azotobacter* + PSB but was significantly higher than *Azospirillum* +PSB in both years. Uninoculated experiment showed least days to 50% heading, 50% anthesis and days taken for maturity.

REGENERATION OF PLANTLETS THROUGH TISSUE CULTURE IN SUGARCANE CULTIVAR COSE 93232**Kumar*, V.K. Srivastava¹, S.P. Yadav¹, Sonia Yadav¹ and B.L. Sharma²**

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Sugarcane cultivar CoSe 93232 was a high yielding and high sugared and good ratooner variety for Uttar Pradesh, but after release of 6-7 years, the variety was found highly susceptible to red rot disease. It was thought, therefore, to standardize tissue culture system within the variety for creating genetic variability with in variety. The experiment was conducted at G.S. Sugarcane Breeding & Research Institute, Seorahi Kushinagar (U.P.). The experiment was conducted to standardize protocol for callus initiation, regeneration and root formation of plantlets in CoSe 93232, with a view to create somaclonal variation and screening of disease resistant clones. The material of this experiment was CoSe 93232, tops were collected from the field and spindles were surface sterilized with 0.1% HgCl₂ under sterile conditions. After rinsing the spindles thrice with in sterile water, leaves were removed and then the innermost leaf whorls were cut obliquely in small pieces of about 0.5 cm. These pieces were used as explants, which were put on medium in the conical flask or MS (1962) medium supplemented with different levels of 2, 4-D in the medium. The maximum callus mass was found in 5 mg /L 2, 4-D present in the medium. In order to induce somatic embryogenesis in calli. These were transferred on different concentrations of BAP and 3 mg/L of 2, 4-D with MS media. The highest frequency was observed on MS + 2, 4-D (3 mg/L) + BAP (0.30 mg/L) + Proline (560 mg/L). The embryogenic greenish callus mass was transferred on MS liquid medium on cotton bridge containing only cytokinin viz. BAP and Kn (Lacking of 2, 4-D) for plant regeneration. It was more rapid on BAP (0.5 mg/L) as compared to Kn (0.5 mg/L). Profuse roots with good root length were obtained in the ½ MS medium containing IBA (0.5 mg/L) and NAA (1.50 mg/L).

Keywords: Sugarcane, Tissue culture, Genetic variability, Somatic embryogenesis**HARMFUL EFFECTS OF MICROCYSTIN ON FISHES****Ashvani Kumar Srivastav***

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Microcystin is a toxic substance produced by different species of cyanobacteria namely *Microcystis*, *Anabaena* and *Oscillatoria*. They are dominant phytoplanktonic group of in freshwater bodies. Morphologically, cyanobacteria ranges from unicells to small colonies of cells to simple and branched filamentous forms. Cyanobacteria are producing two kinds of toxins, hepatotoxin and neurotoxin. Both forms of toxins are harmful for fishes. The study reports the hematological, biochemical, histological, carbohydrate metabolism, behavior changes in freshwater fishes due to toxicity of microcystin. Toxic effects were observed in red blood corpuscles (RBC), white blood corpuscles (WBC), clotting time (CT), mean corpuscles volume (MCV), mean corpuscles hemoglobin (MCH), mean corpuscles hemoglobin concentration (MCHC), packed cell volume (PCV), hemoglobin(Hb), bilirubin, SGOT, SGPT, liver, kidney, gills, gonads, liver glycogen, muscle glycogen and glucose. The toxic effects were also observed in the behavior of fish. It is suggested that microcystin concentration should be monitored in the drinking water and the public awareness should be created.

Key-words: Fish, Microcystin, Toxicity.

CYTOGENETIC CHANGES ON *VICIA FABA* BY SODIUM AZIDE

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Vicia faba seeds were treated with various concentrations of sodium azide (0.2, 0.4 and 0.8%) at 25 °C for 8 h and the changes in mitotic index is evaluated. Sodium azide is helpful in decreasing the seed germination percentage, mitotic index, increase in the aberrations in chromosomes. The root tip of *Vicia* is treated with sodium azide. *Vicia* seeds showed an increased percentages of chromosome stickiness, lagging chromosomes. Maximum abnormality was recorded in 0.8% sodium azide treated group which was very much times higher than in the control that is 22.11. After treating with Sodium azide some chromosomes fragments were observed. The study revealed that in *Vicia faba* treated root tip cells, the metaphase stage was the most affected stage with the different chemical concentrations treatment. The total percentage of abnormalities was higher than those at other normal mitotic stages. The findings are also corroborated with the contributions of other workers where chemicals transformed organic nutrient into inorganic and increased the microbial population by enormously and absorbed easily by plants roots. The total percentage of abnormalities in the other mitotic stages followed in the order first the prophase then other stages such as anaphase, telophase the next for all treatments. The findings provide the evidence for the chemical cytotoxicity in plant cells and also confirms the efficiency of the plant cytogenetic assays on monitoring the cytotoxicity. Increase in sodium azide concentration decreases decline in the mitotic index. Sodium azide showed reducing effects on mitotic index 19.98, 18.16, 17.89 that is after 4, 6, 8 hrs exposure period respectively while mitotic index in control was 22.11. The higher concentrations of insecticide showed the genotoxic and cytotoxic effects and damage the chromosomal activity.

Keywords: Chromosomal activity, mitotic index, Seed germination, Sodium azide;

EFFECT OF PLANE OF NUTRITION ON GROWTH OF FEMALE BUFFALO CALVES.

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The present experiment conducted at dairy farm during year 2016-17 at C.S.A. University of agricultural and technology Kanpur. The growth rate of female buffalo calves is major problem at dairy farm. Twelve female buffalo calves were selected for digestibility that on nutrition. Slid samples contains 86.5% DM, 20.1% CP, 2% EE, 15.5% CF, 52.7% NFE, and 9.5% ash. The average DM intake per 100kg body weight was (4.01, 4.04, and 4.04 kg) the digestibility coefficient of DM were Recorded (60.21, 60.71, 60.48) and digestibility coefficient of CP (64.34, 64.35, 62.34) and digestibility coefficient of EE (60.83, 60.65, 61.59) and digestibility coefficient of CF. (57.67, 57.58, 56.27) and digestibility coefficient of NEE (64.46, 61.44, 63.12). The average live Weight, Length, and heart girth, in female buffalo calves were increased (176.40, 186.65, and 215.40) gm per day. (1.25, 1.32 and 1.48) cm per week (0.83, 0.94, And 1.14) cm per week in T1, T2, and T3 group respectively, the parameters growth which studied were statistically non significant. The group T3, was shown better performance in respect of Growth parameters in other groups T1 and T2 from the present study, it was Apparent that the extra concentrate to be added in diet for proper development of growing calves T3 group were higher in growth than T1 and T2 groups. Digestibility coefficient of DM, CF, and NFE, were also higher in group T3.

RESPONSE OF DIFFERENT PAPAYA VARIETIES UNDER PROTECTED CONDITIONS

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Papaya (*Carica papaya* L.) is an important tropical fruit crop. The leading papaya producing states are Andhra Pradesh, Gujarat and Karnataka. The cultivation of papaya is also practised in north Indian plains. But, the existence of widespread constraints such as temperature extremes, seasonal frost incidences and viral infections adversely affect the quality fruit production in this region. These problems can be curbed to some extent by raising plants under protected conditions. The protected cultivation technology provides an optimum environment for the uniform growth and development of plants. In line with this, the present study was carried to screen the performance of five papaya varieties (i.e. Red Lady 786, Surya, Arka Prabhat, Pusa Dwarf and Surya) under poly net house condition at Fruit Research Farm, Punjab Agricultural University, Ludhiana. Nine plants of each cultivar were raised at a spacing of 6 ft × 6 ft. The yield and fruit quality response of different varieties was analysed. The results indicated significant variations in terms of fruit number, yield, fruit length, fruit weight, total soluble solids and total sugars. But insignificant variations were observed for fruit breadth, firmness and titratable acidity. The variety Red Lady 786 observed best quality in terms of maximum fruit number, yield, fruit weight, fruit size, T.S.S and total sugars. The present study thus, showed that plants of Red Lady 786 can be grown successfully under poly net houses in the plains of North India.



Major Theme Area: Biodiversity (Plant/Animal) Resources and their Conservation

ELUCIDATING GENETIC DIVERSITY IN 180 GERMPLASM LINES OF BREAD WHEAT FOR DIFFERENT YIELD AND COMPONENT CHARACTERS

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Knowledge about diversity and genetic relationships of available crop germplasm is very important for planning crop improvement strategies as well as genetic resource conservation. Precise information on the nature and degree of genetic diversity helps the plant breeders in choosing the diverse parents for purposeful hybridization. The more genetic diverse parents, there are greater chances of obtaining higher heterotic expression in F_1 's and broad spectrum of variability in segregating population. Incorporation of more divergent parents in hybridization can enhance the chances of attaining better heterosis and provide broad spectrum of genetic variability in segregating generation. The experimental materials for the present investigation comprised of 180 germplasm accessions and four checks. These genotypes were evaluated in augmented block design and observations were recorded for 16 different characters. The genotypes were grouped into 10 different clusters by non-hierarchical Euclidean cluster analysis. Cluster I, II, III, IV, V, VI, VII, VIII, IX, X had 24, 22, 4, 15, 41, 8, 18, 35, 11 and 6 genotypes, respectively. The maximum intra cluster distance was observed in cluster X (69.43) which revealed maximum genetic diversity among its constituents. Inter cluster distance was found maximum between cluster VI and cluster X (526.53) followed by cluster IX and cluster X (489.87), cluster IV and cluster X (455.32) and cluster III and cluster X (454.46). This indicates that the genotypes of cluster VI and cluster X, genotypes of cluster IX and cluster X are distinctly related to each other. The greater distance between clusters indicated that the genotypes included in these clusters revealed broad spectrum of genetic diversity and may be used in hybridization programme for wheat improvement. The hybrids developed from the selected genotypes within the limits of compatibility of these clusters may produce desirable transgressive segregants.

SUSPENDED SEDIMENT LOAD SIMULATION BASED ON GAMMA TEST, HEURISTIC AND SEDIMENT RATING CURVE TECHNIQUES

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The assessment of suspended sediment load from watershed is of utmost importance in the soil and water conservation practices in the watershed and in relation to several engineering topics, such as erosion around structures, backfilling of dredged channels, pollution, channel navigability reservoir filling, hydroelectric-equipment longevity, fish habitat, river aesthetics and scientific interests. In the present study, four different heuristic techniques viz. artificial neural network (ANN) and adaptive neuro-fuzzy inference system (ANFIS) and sediment rating curve (SRC) have been the efficient techniques for suspended sediment simulation. Gamma test (GT) is one of the non-linear modelling tools whereby an appropriate combination from input parameters can be investigated for modelling the output data as well as establishing a smooth model. This study was undertaken to develop and evaluate the applicability of the ANN, ANFIS and SRC models by way of training and testing of developed models during monsoon period (June to September) for Anandpur and Champua watersheds of Baitarani basin in the Keonjhar District, Orissa state of India. The best input combination of discharge and sediment were identified using the Gamma Test for the simulation of sediment yield, respectively. The predicted sediment concentration using ANN and ANFIS models were found to be the best performing models for Anandpur and Champua watersheds. It was clearly evident that SRC models fit very poorly for the dataset under study.

Keyword: Artificial Neural Network, Adaptive Neuro-Fuzzy Inference System, sediment rating curve and Gamma test.

PHENOTYPIC AND MICROSATELLITE MARKER ANALYSIS OF SELECTED LINES OF AEROBIC RICE UNDER WATER LIMITED CONDITIONS

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A field experiment was conducted at Chaudhary Charan Singh Haryana Agricultural University, Hisar, India during the *Kharif* season of 2014 to evaluate segregating F_3 aerobic $\times$ lowland progenies of cross MAS25 $\times$ PAU201, MAS26 $\times$ PAU201 and MASARB25 $\times$ PAU201 for various physio-morphological, root traits and SSR markers linked to the traits promoting aerobic adaptation. In all populations, enormous variation was observed for plant height, panicle length, effective number of tillers per plant, root length, root thickness, fresh and dry root weight, 1000 grains weight, number of grains per panicle, grain length/breadth ratio and grain yield per plant. In these populations, significant positive correlation was observed between yield per plant with plant height, effective number of tillers per plant, length/breadth ratio, 1000 grains weight, root length and/or root biomass. In SSR marker analysis most of the selected plants were found to have desirable alleles for the markers reported earlier to be linked with the aerobic adaptation traits.

Keywords: Aerobic, SSR markers, Grain yield, Rice.

AGRICULTURAL BIODIVERSITY CONSERVATION, DEVELOPMENT IN SUSTAINABLE AGRICULTURE

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The late twentieth century model of land is used for biodiversity conservation. The Millennium Ecosystem Assessment state about agriculture that has dramatically increased its ecological dysfunctions. Mostly Rural communities depend on main components of biodiversity and sustainable agriculture. Fortunately, many conservation practices are use for managing to host wild biodiversity of many types, either neutral or even artificial methods. The Convention on Biological Diversity (CBD), which was adopted at the 1992 UNCED Earth Summit and to which Germany and most other countries of the world are signatories. We highlighted some evidence for the importance of soil biodiversity to sustaining (agro) ecosystem functioning and explore directions for future research. Many studies showed that soil biodiversity supports several ecosystem functions simultaneously, underpinning its crucial role in ecosystems worldwide. There is evidence for soil biodiversity stability to stress and disturbance, but until now the mechanism is not yet fully understood. We assess the potentials and limitations for successful conservation of biodiversity in productive agricultural landscapes, the feasibility of making such approaches financially viable, and the organizational, governance and policy frameworks needed to enable eco agriculture planning and implementation at a globally significant scale. We conclude that effectively conserving wild biodiversity in agricultural landscapes will require increased research, policy coordination and strategic support to agricultural communities and conservationists. The Earth's biological diversity has suffered massive losses in recent decades, putting the resources vital to life on the planet at great risk.

Keywords: eco agriculture, landscape, biodiversity conservation, agricultural production, underpinning

NANOTECHNOLOGY : A NEW FRONTIER IN AGRICULTURE

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Nanotechnology is recognised by the European Commission as one of its six “Key Enabling Technologies” 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. The development of nanodevices as smart delivery systems to target specific sites and nanocarriers for controlled chemical release is discussed. Some nanotechnologies can improve existing crop management techniques in the short to medium term. Nanocapsules would help to avoid phytotoxicity on the crop by using systemic herbicides against parasitic weeds. Nanoencapsulation can also improve herbicide application, providing better penetration through cuticles and tissues, and allowing slow and constant release of the active substances. Nanotechnologic intervention in farming has bright prospects for improving the efficiency of nutrient use through nanoformulations of fertilizers, breaking yield barriers through bionanotechnology, surveillance and control of pests and diseases, understanding mechanisms of host-parasite interactions at the molecular level, development of new-generation pesticides and their carriers, preservation and packaging of food and food additives, strengthening of natural fibers, removal of contaminants from soil and water, improving the shelf-life of vegetables and flowers, clay-based nanoresources for precision water management, reclamation of salt-affected soils, and stabilization of erosion-prone surfaces.

Keywords: Nanotechnology, Agriculture, Innovation, Bioeconomy, Regulation, Consumer perception

MAIZE RESPONSE TO SOWING TIME AND VALIDATION WITH CERES MAIZE MODEL

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A field experiment was conducted during kharif season, 2016 at S.V. Agricultural college, Tirupathi to study the Maize response to sowing time and validation with CERES maize model. Three maize hybrids D.S 900M, Pinnacle and CP818 were sown at four dates of kharif season (June II FN, July I FN, July II FN and August I FN). Yield validation study was performed by CERES Maize model. CERES maize model serves as tool for determining the sowing time. Optimum sowing window for rainfed maize was June II FN could potentially assist resource poor farmers in Andhra Pradesh by providing alternate management. The results showed that grain yield of maize varied from 3748 kg ha⁻¹ (June II FN, D.S900M) to 1626 kg ha⁻¹ (August I FN, CP818) while the model simulated grain yield ranged from 3769 kg ha⁻¹ (July I FN, Pinnacle) to 1407 kg ha⁻¹ (August I FN, CP818). The CERES maize model validation was excellent. Yield reduction was less which clearly suggested that D S 900 M, June II FN sowing of maize found most beneficial compared to other dates of sowing.

Keywords: Dates of sowing, grain yield, CERES model

THE ANALYSIS OF CLIMATIC VARIABILITY/WEATHER TRENDS (PAST AND FUTURE) IN EASTERN U.P.

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Annual rainfall of Eastern U.P gradually declined over the normal (1000 mm) in recent years to come. South–West monsoon and Post monsoon rainfall of Eastern U.P declined over the normal in recent years. While trend of rainfall during winter and summer seasons found increased over the normal in recent years to come. In general, the rate of increase of maximum temperature in eastern U.P. will be higher during 2050 to 2080 (2–4°C) as compared to 2020–2050 (1–2°C). Similar observations were recorded for variations in minimum temperature too with greater magnitude ranging between 3–5°C in later part of century as compared to early part (2–3°C). Future prediction of maximum temperature and minimum temperature scenario on monthly basis predicts that month of December and January will be hotter as compared to November



contrary to the normal trend. Trend analysis of temperature (maximum and minimum) shows the increasing trend. The model predicts that rice yield may decrease 1.5-2% due to increase in maximum temperature alone by the end of 2080. Similarly, the range of sensitivity of minimum temperature in yield prediction is 1-2% with respect to average yield in eastern U.P. The maximum temperature is likely to increase between 0.5°C and 3.0°C in eastern U.P. while minimum temperature between 1.0 and 4.5°C during ensuing decades by 2080. A slight increase in rainfall is likely over eastern U.P. by 2080. Future rainfall scenario of eastern U.P. showed much varying trends in monthly rainfall and was observed that in eastern U.P. rainfall will increase during south west monsoon period up to 2080 but the month of August will face sharp decline in rainfall.

VARIETAL CANE IMPROVEMENT PROGRAMME FOR HIGH ECONOMICAL YIELD IN BIHAR

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The north zone of sub-tropical area, occupies 64 per cent of total cane area of the country. However, only 58 per cent of this area contributes to total cane production while only 48 per cent to sugar production of the country. The lower cane productivity and sugar recovery in sub-tropical north zone are the major problems of sugarcane sector. Variation between the sugarcane zones may be one of the reasons for it. In respect to northern zone of cane producing area, especially Bihar, which is bestowed with good soil for agricultural purposes, massive increase in yield, has been achieved by breeding varieties for higher yield as well as for higher tolerance/resistance towards biotic as well as abiotic stresses. The reason behind the increase in cane production as well as sugar recovery of Bihar is varietal cane improvement and selection programme which is being used in the state tremendously. The use of this varietal cane improvement programme in Bihar in turn shows a positive impact on genetic gains for yield as well as quality. With the usage of this programme in Bihar in last year, farmers were able to improve their ratoon crop yield by using varieties suitable for Bihar as ratoonnability especially during winter months is one of the major problems in sub-tropical India, particularly in northern zone. This programme has shown the breakage of the static poor sugar yield of Bihar and other parts of India by utilising the clones as a breeding material from related genera. Furthermore, the biotechnological approaches used in selecting the right cane variety also helps in rapid multiplication of disease free seed material that not only produces a healthy plant but also shows higher yield and recovery. Though large amount of success has been achieved through this programme, however, there are still some prevailing and new emerging challenges like higher incidence of existing diseases (red rot, pokkah boeng, etc.), climate change scenario, higher bio-ethanol production and even production of good quality of jaggery which need to be looked up for the upcoming years.

PERFORMANCE RELATIONSHIPS BETWEEN NIGHT SATELLITE AND OCO-2 SIGNATURE- IN THE CASE OF DELHI (INDIA)

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KEYWORDS: XCO₂; OCO-2; DMSP-OLS night satellite, Delhi (India).

DMSP-OLS is a special night-time imageries source that offers capabilities to represent human activities on the Earth's surface through the observation of artificial lighting at night. Temporal night-time DMSP-OLS satellite data was used over the Indian region in the current study to detect urban footprints with emphasis on Delhi. This paper analyses nightlight of the earth at night derived from the DMSP-OLS data, and explores performance of OCO-2 XCO₂ signature (level 2 data of column averaged CO₂ concentration that were collected from orbiting carbon observatory) in investigating causal relationship between them. The objective of this paper is to predict the relationships between the nightlights and CO₂ emissions, through geographically weighted regression (GWR). The higher value of pixel (0-63) represents the more urban and built-up areas which generally show higher XCO₂ mean concentration. The higher pixel value shows highest local R² while lowest local R² is generated from lower pixel values. The adjusted R² (0.6) were statistically significant on nightlight. This study could provide useful insights that improved spatial resolution of OCO-2 could explain co relationship between CO₂ and nightlights for specific area.

SODIUM FLUORIDE EFFECT ON LINSEED AT ON GERMINATION LEVEL

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Fluoride a toxic substance is present in air, water and soil. Industrial growth as well as human activities are responsible for increasing environmental pollution. Even at lower ambient fluoride concentrations, a number of physiological changes may be initiated in plant without the appearance of visible injury symptoms, levels of Sodium Fluoride (NaF) exhibited a marked reduction in growth parameters i.e. seedling germination percentage, length of root, length of shoot, plant height, number of leaves, size of leaf, number of flower per plant. Toxicity is a great cause of fluoride ion at high concentrations is known to cause several health hazards to human population and live stock including dental and skeletal fluorosis. The main source of Fluoride is groundwater, soil and air but among them groundwater is the most common source of fluoride pollution. Fluoride in groundwater is geological and the fluoride enrichment mechanism is controlled by presence of fluoride bearing minerals in rocks or soils, the degree of weathering as well as amount of leachable fluoride in a terrain. Fluoride presents in soil, water, air and plants in varying concentrations but is not co. Due to this high concentration of fluoride, it results in the necrosis and chlorosis in the plant, reduction in growth of shoot and root and ultimately reduced the yield of linseed. Bioaccumulation of fluoride in wheat grains creates secondary source of fluoride to human population resulting in food-borne fluorosis, primary considered essential for the normal growth of plants.



INTEGRATED NUTRIENT MANAGEMENT IN FRUITS

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India's horticulture production has increased by 30 per cent in the last five years. This has placed India among the foremost countries in horticulture production, just behind China. During 2012-13, its contribution in the world production of fruits was 12.6 %. Total production of fruits during 2012-13 was 81.2 million tonnes. Though production of fruits has increased manifold over the last decade but there exists a gap between the demand and supply of fruits. The present fruit production in India meets only the 46% of the total demand. The continuous use or excess supply of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing economic inefficiency, damage to the environment and in certain situations, harm the plants themselves and also to human being who consume them. On the other hand, increase in productivity of horticultural produce removes large amounts of essential nutrients from the soil. Without proper management, continuous production of crops reduces nutrient reserves in the soil. Another issue of great concern is the sustainability of soil productivity, as land began to be intensively exhausted to produce higher yields. Overtime, cumulative depletion decreases production, yield and soil fertility and lead to soil degradation. Thus there is strong need to increase the production and productivity through crop diversification and use of best horticultural techniques among which Integrated Nutrient Management (INM) is the one.

Integrated Nutrient Management is a system that helps to restore and sustain crop productivity and also assists in checking the emerging micro-nutrient deficiencies. Integrated plant nutrient management can also be referred to as maintenance of soil fertility and plant nutrient supply to optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. It envisages the use of chemical fertilizers in conjunction with organic manures, green manures, crop residues, and legumes in a cropping system and locally available resources with objectives of sustaining high yield and ensuring environmental safety.

MICROPROPAGATION OF GERBERA JAMESONII -AN ORNAMENTAL PLANT.

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Gerbera jamesonii L. (Family-Asteraceae) commonly known as Trans-daisy. It was named in the honour of a German naturalist Traugott Gerber. It is a perennial ornamental plant. It is most commercial flower in World and occupies the fifth place among cut flowers. *In-vitro* propagation of *G. jamesonii* was done by using nodal segments as explants. The explants were washed with liquid detergent under running tap water to remove dust particles. The explants were then treated with 0.1% (w/v) mercuric chloride for 3-5 minutes under aseptic conditions. After this, these explants were thoroughly washed 4-5 times with sterilized double distilled water to remove the traces of mercuric chloride. The nodal segments after trimming the ends were finally inoculated on Murashige & Skoog media containing 30 g/l sucrose and 8 g/l agar, supplemented with different concentration of BAP (0.5 - 1.5 mg/l) individually and in combination with IBA and NAA. The culture were incubated under 16 hours of light and 8 hours dark period at 25±2°C. The Maximum numbers of shoots per explants (38.30) were obtained on media containing BAP (0.75 mg/l) + (0.030 mg/l) IBA+NAA. Best shoot length (3.05 cm) followed by MS medium with 0.75 mg/l BAP+ 0.030 mg/l IBA+ 0.025 mg/l NAA (29.90 and 2.48 cm) followed by MS medium with 0.75 mg/l BAP+ 0.030 mg/l IBA+ 0.025 mg/l NAA (29.90 and 2.48 cm). However the treatment that gave least number of shoots per explants (17.97) minimal shoot length of (2.12 cm) was observed with 0.5 mg/l BAP+0.030 mg/l IBA+0.025 mg/l NAA. For rooting response, half MS media various combination fortified IBA (0.1-2.0 mg/l). Most efficient rooting response (95.28%) with average length (1.48±0.3 cm) and number of roots (5.40±0.25) was observed on half MS media supplemented with (0.4 mg/l). Minimum response for rooting was found on half MS medium with 0.1 mg/l IBA (73.33%). The rooting percentage was differed. The regenerated plantlets were successfully transferred to pots containing sterilized soil and sand mixture (3:1) and acclimatized with more than 70% survival rate in the field conditions.

Keywords: *In-vitro*, *Gerbera jamesonii*, BAP, IBA, NAA.

CHARACTERIZATION OF *BACILLUS THURINGIENSIS* STRAINS FOR THEIR TOXICITY AGAINST GRAM POD BORER (*HELICOVERPA ARMIGERA*, LEPIDOPTERA: NOCTUIDAE)

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Insects are responsible for major damage to crop plant eventually led to heavy economic loss to agriculture. The legume pod borer *Helicoverpa armigera* is a polyphagous pest that attacks more than 300 plant species; is widely distributed. Chemical pesticides used in agriculture has led to several problems, including environmental pollution, increases in human health effects. *Bacillus thuringiensis* (Bt) is a Gram positive, rod shaped, spore forming soil bacterium that produces crystalline proteins also referred as Bt toxin or δ -endotoxins, during sporulation process and used as biopesticide. The present study revealed isolation and molecular characterization of *B. thuringiensis*, isolated from soil. These isolates were further characterized by total protein analysis, PCR based detection of *cry1* genes followed by toxicity bioassay against *H. armigera* and application of best performing *B. thuringiensis* isolate to chick pea crop under field conditions. A total of 112 pure cultures were isolated from the soil collected from two different location, Aligarh and Mathura. Out of 112, 32 cultures showed *Bacillus* like morphology on penicillin amended medium and 17 were identified as *B. thuringiensis* on the basis of parasporal crystal, and the shape of crystal was confirmed by SEM analysis and presence of spherical crystals. PCR based detection of *cry1* gene was performed, two of the isolates showed the presence of *cry1* gene as observed by the amplification of 1500 bp product on agarose gel electrophoresis. The presence of 130 kDa and 65 kDa protein bands on SDS-PAGE analysis strongly supported the presence of Cry1 protein in the selected isolates. Toxicity of *B. thuringiensis* strains was checked against



2nd and 3rd instar larvae of *H. armigera*, showing 100% mortality at higher concentration (200 µg ml⁻¹). The most promising *Bt* strains were used to make insecticidal formulation and its efficacy was tested on the chick pea crop in the fields.

GASTROPROTECTIVE EFFECT OF FORMONONETIN, A METHOXYLATED ISOFLAVONE AGAINST ETHANOL-INDUCED GASTRIC ULCERATION IN RATS VIA AUGMENTATION OF CYTOPROTECTIVE MARKERS AND CURTAILING APOPTOTIC GENE EXPRESSION.

Formononetin (FMN), one of the major isoflavones in red clover has been shown to possess antioxidant, anti-inflammatory, antitumor, neuroprotective and cytoprotective activities. However, there is no report on the gastro protective effect of FMN against ethanol-induced gastric ulcer. Excessive alcohol consumption can lead to gastric ulcer and the purpose of the present study was to examine the protective effect of FMN on mucosal lesions induced by ethanol. Fasted rats were orally administered with FMN (25mg/kg, 50mg/kg and 100mg/kg), Omeprazole (20mg/kg) followed by the intragastrically ingestion of ethanol (5ml/kg) after one hour and sacrificed after four hours of exposure. Gross microscopic and macroscopic, biochemical and immunochemical alterations were scrutinized. Compared with ethanol, FMN pre-treatment showed a significant increase in gastric levels of reduced glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT) while decreased the malondialdehyde (MDA) content remarkably. FMN pre-treatment also bestowed the cytoprotective efficacy against ethanol induced ulceration by re-establishing the decreased level of nitric oxide (NO) and prostaglandin E₂ (PGE₂). Furthermore, FMN upsurged the alleviated level of interleukin-6 (IL-6) and decreased the ameliorated inflammatory cytokines, tumor-necrosis factor- α (TNF- α), interleukin-10 (IL-10) and myeloperoxidase (MPO) in gastric tissue. In histopathological sections, reduced pathological changes of gastric lesions were markedly observed in the FMN pre-treated groups compared with those in the ethanol group. Immunohistochemistry and western blot analysis showed upregulation of HSP-70 and Bcl₂ while downregulation of Bax in FMN pre-treated gastric tissue of rats. FMN regenerates ulcerated tissue, and prevents hemorrhagic injury of gastric mucosa. These results indicate that FMN exerts gastroprotective effects through the anti-oxidative, anti-inflammatory, anti-apoptotic and mucin-secretagogue mechanisms that are probably mediated by enhanced PGE₂ release, suggesting its therapeutic use to treat gastric ulceration by preserving mucosal glycoproteins and diminishing oxidative stress.

INTERNATIONAL CONFERENCE ON ADVANCES IN AGRICULTURAL AND BIODIVERSITY APILARNIL (A PRODUCT OF MALE HONEY BEE): IMPORTANCE IN HUMAN WELFARE

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Bees are some of the hardest working creatures on the planet because of their laborious work ethic especially pollution. Now besides the production of honey all bee keepers diverting their concentration towards the other bee products such as Royal jelly, Propolis, Bee venom and Bee pollen due to transformation of marketing strategy. Along with these products another product of bee is also there called "Apilarnil". It is a homogenous and milky substances, with yellowish grey colour and sour taste derived from 7 days old drone brood with its comb. Physico-chemical composition is similar to royal jelly, but yet different. It was reported that Apilarnil contains 25-35% dry matter, 9-12% proteins, 6-10% carbohydrates, 5-8 % lipids, 2% ash and 3% unidentified substances. Also in the chemical composition of Apilarnil we found vitamins (A vitamin, beta-carotene, B1, B6, PP and choline), minerals (calcium, phosphorous, sodium, zinc, manganese, iron, copper and potassium). The main chemical content of Apilarnil is the "Apilarnin" which possess the main role of anti-viral property as like royal jelly. The drone larvae contain testosterone, progesterone, prolactin and estradiol. Recent studies showed both estrogenic and androgenic like effect of drone food. The androgenic like effect seems to be related to the methyl palmitate and methyl oleate as active compounds found in the drone food. This fat-soluble molecule is involved in cellular energy production and antioxidant mechanisms. Apilarnil is used as a biostimulating product. It is suggested that apilarnil is a natural anabolism stimulator in males and also helps to get rid of gastro-intestinal diseases. Though it have such kind of good properties now a days the essentiality of this product are demolished beside the other top listed bee products.

COMPETITIVE ABILITY OF RICE VARIETIES AGAINST WEED UNDER AEROBIC CONDITION

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Sustainable weed management strategy in aerobic rice cultivation system would be beneficial from both economic and environmental perspectives. Field experiments were conducted to evaluate competitive ability of six rice varieties, namely DRR DHAN 44, DRR DHAN 41, DRR DHAN 42, DRR DHAN 46, HUR 3022 and Sahabhazi dhan against weeds under aerobic rice cultivation systems to select suitable varieties for cultivation in India. Results revealed that DRR DHAN 44 had the lowest weed dry weight and weed density and the highest weed dry weight was recorded in DRR DHAN 46, in field trials. DRR DHAN 44 with characteristics of taller plant stature and short growth duration competed better with weed as compared to other varieties with shorter plant and longer growth duration. Weed competition had negative impact on rice plants. Lower weed dry weights and relative less yield loss was found in DRR DHAN 44 indicated its better weed suppressive and competitive ability against weeds. These results concluded that DRR DHAN 44 is the most competitive variety against weeds under aerobic rice cultivation systems.

Keywords: Aerobic, Weed density, Weed competition, plant stature.



INFLUENCE OF INDOLE-3-BUTYRIC ACID ON ROOTING EFFICACY IN DIFFERENT CARNATION (*DIANTHUS CARYOPHYLLUS* L.) GENOTYPES UNDER PROTECTED CONDITION

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A study was carried out at Centre for Quality Planting Material, RDS Seed Farm, CCS HAU, Hisar, Haryana during 2016-17, to study the effect of rooting hormone viz., Indole butyric acid on rooting success in different carnation genotypes. In the experiment, terminal cuttings of fifteen genotypes of carnation viz., Friday (T₁), Irene (T₂), Aicardii (T₃), Gaudina (T₄), Ambrose (T₅), White Liberty (T₆), Jureno (T₇), Baltico (T₈), Bizet (T₉), Tasmon (T₁₀), Gwen (T₁₁), Harvey (T₁₂), Golem (T₁₃), Eskino (T₁₄) and IIHR (T₁₅) were treated with 200 ppm and 500 ppm IBA (Indole butyric acid) and were recorded for their rooting success. The experiment was laid out in Completely Randomized Design, with three replications. The study revealed that among the fifteen genotypes experimented, the highest per cent of rooting was recorded in the genotype Gaudina (91.33 %) whereas, the lowest rooting per cent was recorded in the genotype IIHR (44.66 %). As for the concentration of IBA used, 500 ppm resulted in the maximum rooting percentage (72.48%) as compare to that in 200 ppm concentration. Similar tendency of superiority was observed for days for root initiation, number of roots per cutting and length of roots, wherein the genotype Baltico took the least number of days for root initiation (15.83 days) and highest number of roots (18.01) per cutting followed by Golem (16.87).

Keywords: Carnation, genotype, Indole-3-butyric acid, rooting per cent, root length

EFFECT OF DROUGHT STRESS IN WHEAT AND ASSOCIATED REGULATORY TRANSCRIPTION FACTOR

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Wheat (*Triticum aestivum* L.) member of Poaceae family is an important cereal crop after rice to meet the food requirements and considered as staple food which provides more calories and protein than other crops. Wheat occupies 17% of the total cultivated area of the world and 13% of total cultivated land in India. Plants respond to various abiotic stresses in environment. Among all abiotic stresses drought is most common and important limiting factor for wheat production in arid and semiarid regions of the world that affect growth and development, leading to reduced yields. Moderate to severe water stress drastically affects various morpho-physiological traits and changes at biochemical and molecular level, such as root length, number of tillers, test weight, relative water content, membrane stability and chlorophyll content. At molecular level complex network of transcriptional regulation orchestrates the response of plants to environmental changes. Transcription factors (TFs) families (DREB/CBF, AREB, bZip, NAC, zinc finger protein, MYB and MYC) played important role as master regulators of many stress-responsive genes expression and provides a complex control mechanism to plants by modulating developmental processes and their over expression can lead to either up-regulation or down-regulation of a whole array of genes under their control. The expression of many genes is induced by drought, and their gene products function directly in stress tolerance and signal transduction in stress responses. Stress-responsive gene (Srg6) is a potential transcriptional regulatory hydrophobic protein with a helix-loop-helix DNA-binding domain induced by various abiotic stresses and similar TaSrg6 protein found in wheat played an important role in water stress tolerance. Therefore, understanding abiotic stress responses have vital significance for crop improvement regarding drought tolerance and for other abiotic stresses.

Keywords: Wheat, Abiotic stress, Drought and Transcription factor

EPIGENOMICS PROJECTS ON CROP PLANTS

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Epigenomics is the study of the all the epigenetic modifications on the genetic material of a cell, known as the epigenome. Epigenetic modifications viz chromatin modifications, DNA methylation, RNAs (coding and noncoding) etc. are reversible modifications on a cell's DNA or histones that affect gene expression without altering the DNA sequence. Epigenomic maintenance is a continuous process and plays an important role in stability of eukaryotic genomes by taking part in crucial biological mechanisms. Epigenomics research in plants emerged after discovery of impact of epigenetic events in plant physiology viz vernalization, DNA repair, response to abiotic and biotic stresses etc. Various epigenomics studies have been done on crop plants to improve abiotic and biotic stress resistance. Currently, various research projects are in progress worldwide; to better understand the plant epigenomics, so that it can be applied for crop improvement programs in near future. Plant epigenomics is still in its budding state and needs high throughput research and development for its application in crop improvement programs. Most of the currently ongoing epigenomics projects are contributed towards understanding all the possible epigenetic events that occur in plant genome. Various researchers have encouraged the development of epigenomics databases like pENCODE, Esembl, EPIC and many others; to enhance collaboration and collect the information of various epigenomics projects being conducted worldwide. With the availability of plant genome information and recent technologies, the future of epigenomics is promising to apply this area of research for the crop improvement programs.

Keywords: Epigenetics, epigenomics, plant genome annotation, DNA methylation, Histone modifications.



HUMAN-TIGER CONFLICT: IN PERSPECTIVE OF PILIBHIT TIGER RESERVE

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Pilibhit Tiger Reserve is located in Pilibhit, Lakhimpur Kheri and Bahraich district of Uttar Pradesh in India. It lies along the India-Nepal border in the foothills of the Himalayas and the plains of the 'terai' in Uttar Pradesh. Pilibhit Tiger Reserve is home to a large number of rare and threatened species, which include Bengal tiger, Indian leopard, swamp deer, hispid hare and Bengal floricans. Since its designation as a tiger reserve in June 2014 various instances of human tiger conflict have been reported. During the year 2016-17, 11 people and various domestic animals have been killed by the big cats. Pilibhit is among the narrowest tiger reserve in India and tiger population has doubled since its designation as a reserve. In many area of reserve, crop field along the edge merge almost seamlessly with the forest. A tiger can not differentiate between sugar field and a forest, for him it's all the same. Predators and herbivores are known to use these fields as part of their habitat. The presence of prey lures tigers to these fields which in turn prove deadly for human working in these fields. Arrangement of solar and nylon fencing along with solar light may provide a solution. Moreover People should also be needed to make aware about preventive, mitigating and reactive measures before and after the attack of tigers. Education should also be an integral part of programme to improve livestock management, compensation, insurance and incentive programme which not only will change human behaviour but also help to save tigers. Present paper provides a review of the impact of human tiger conflict in Pilibhit tiger reserve and stress the need for development and implementation of comprehensive plan to reduce human tiger conflict.

Key Word: Human, Tiger, Pilibhit, Conflict, Conservation

INTELLECTUAL PROPERTY RIGHTS IN INDIA

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IPRs refer to the legal ownership by a person or business of an invention/discovery attached to particular product or processes which protects the owner against unauthorized copying or imitation (Source: Business Guide to Uruguay Round, WTO, 1995). It's a broad term which encompasses patents, copyright, trademark, industrial designs, geographical indications, protection of layout design of integrated circuits and protection of undisclosed information (trade secrets). India is a WTO member therefore it is obliged to follow the IPR laws. Though India has a robust IPR laws but still there are many loopholes in it, which ultimately makes it ineffective. It lacks proper implementation of the IPR laws; officials and judiciary system do not take matters of IP seriously. There is no national IP policy in India, which adversely affects development of IP culture here. We need to have our own IP policy for the creation of a strong socio-economic foundation and deep international trust. Initiatives should be taken in field of formulation of Comprehensive IPR Policies for various sectors and academic institutions training of personnel to manage IPR, provide access and training to use Patent information databases and creation of a consortium of IPR professionals to offer professional services for IPR work, to make IPR successful in India. Now thinking about the negative side of IPR, it encourages monopolies, adversely affect biological diversity and ecological balance and it also adversely affect the livelihood of the poor in developing countries. IPR is a means to protect innovativeness and novelty, it gives hopes to inventors and creators that there is protected under laws and any illegal advantage taken of inventions and creations is punishable offence under IPR policy.

Keywords: intellectual property rights, IPR policies, WTO

EFFECT OF SEED TREATMENTS AND PACKAGING MATERIALS ON SEED QUALITY PARAMETERS IN COWPEA (*VIGNA UNGUICULATA*) DURING STORAGE

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The laboratory experiment was conducted at Post Graduate Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Uttar Pradesh during 2015 - 2016 with cowpea variety Kashi unnati to assess the effects of seed quality parameters during storage of 6 months. The seed treatments used were viz., ferrous sulphate, *Trichoderma viridae*, mancozeb, neem oil along with control (untreated seeds). After treatment, seeds were stored in plastic container and cloth bag for evaluation of protein and carbohydrate content of seeds by Lowry method and Anthrone method respectively. The data was analysed by factorial completely randomized design. The results revealed that T₇(ferrous sulphate + mancozeb + polymer coat + neem oil + trichoderma) recorded high protein (24.54%) and carbohydrate content (80.17%) by the end of storage period. Also the seeds stored in plastic container was very effective for extending the seed longevity and maintaining the storability than the cloth bag.

Keywords: carbohydrate, cloth bag, plastic container, polymer, protein, storage

WATER CONSERVATION BY TRADITIONAL PRACTICES

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Earth and every living organism on this planet require water for survival and without water there would be no life. Drinking water should be clean that means it should be free for micro-organism, harmful chemical and other pollutants. Water conservation encompasses the policies, strategies and to protect the water environment and to meet current and future human demand. Activities to manage fresh water as a



sustainable resource. Water conservation refers to reducing the usage of water and recycling of waste water for different purposes like domestic usage, industries, agriculture etc. Over the year rising populations growing industrialization, and expanding agricultural have pushed up the demand for water. Efforts have been made to collect water by buildings dams reservoirs and digging well. Some countries have to also try to recycle and desalinate sea water. Water conservation has become the need of the day. In the forest water seeps gently into the ground due to vegetation cover. This ground water in term feeds wells, lakes and rivers. Protecting forests means protecting water catchment. In ancient India people worshipped Nature and one of them was water. Rain water harvesting as method of utilizing rain water for domestic and agricultural use. Some traditional practices are: To use leak proof water supply in houses. Always monitor our water meter for zero water leaking process. Do not use miscellaneous bucket in toilet.

Keywords: Earth, Water conservation, Sea water, Forest, Rain water harvesting etc.

KRISHI VIGYAN KENDRA PLAY KEY ROLE IN EVERGREEN REVALUATION

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Krishi Vigyan Kendra educating of farmers through training programme is a crucial input for the rapid transfer and adoption of agricultural technology. The agricultural production can be increased if the production development programmes focusing more and on transferring the new technologies from research institutes to the farmers fields and make them more result oriented. KVK is an innovative institution providing for (i) effective linkage among researchers, farmers and extension workers (ii) practical approach to training through “Learning by doing” (iii) flexible syllabi based on a survey and needs of farmers and location specific requirements. The Krishi Vigyan Kendras (KVK) is of national importance which would help in accelerating the agricultural production and also in improving the socio-economic conditions of the farming community. Need based training programmes are being conducted by the KVK in various disciplines such as crop production, seed production, horticulture, soil science, women in agriculture, agricultural engineering and others. Survey method by personal interview was used for collecting the required information on component wise crop production technology transferred, extent of adoption of technology, discipline wise training organized by KVK and farmers response towards training, costs and benefit of crop production. It was concluded that KVK playing a vital role in disseminating the improved crop production technology and helps in increasing the crop yield. Further research need to be focused on the problems and constraint for adoption of the technology. Krishi Vigyan Kendra provides inspiration, constructive and constant advice to the people of that area to start new entrepreneurship for their livelihood and show them proper way when need actual help as the light house help the sailor in the sea. So this is the role of Krishi Vigyan Kendra in Evergreen revaluation. the KVKs are playing a pro active role in transferring new technology at field level or agriculture renewal.

ROLE OF TECHNOLOGY ADOPTION ON PADDY PRODUCTIVITY THROUGH FRONT LINE DEMONSTRATION

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Front line demonstration is an applied approach to demonstrate recommended technologies among the farmers. Krishi Vigyan Kendra, Saharanpur (U.P) conducted 35 demonstrations on paddy during 2015, 2016 and 2017 in three consecutive years. The critical inputs were identified in existing production technology through farmers meetings and group discussion with farmers. The average three years data reveals that the average yield of demonstration plot was obtained 47.62 q/ha over local check 33.65 q/ha with an additional yield of 13.97q/ha and the increase average paddy productivity 32.58 percent. From the above findings, it can be concluded that the use of scientific method of paddy cultivation increased productivity of paddy in the district. Moreover, extension agencies in the district need to provide proper technological support to the farmers through different educational and extension methods to reduce the extension gap for better paddy production.

POPULARIZATION OF SUGARCANE VARIETY Co.0238 IN WESTERN U.P.

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Sugarcane is one of the most important crop grown in U.P. The yield of sugarcane effected many reasons. Suitable variety is one of them. Keeping in mind selection of suitable varieties of Sugarcane for western U.P. demonstration were under taken to popularization the sugarcane variety Co.0238 the total number of demonstration 125 were conducted during 2014-15, 2015-16 and 2016-17 at farmers field in collaboration with sugarcane deptt. of saharanpur. Standard package of practice were followed for treated plots and farmers practice was referred as control 41% increase in yield was recorded in case of recommended practice than farmers practice with B:C ratio of 3.14 and 2.15 respectively. The growth and yield contributing parameters showed superior values for recommended practice than farmers practice. The demonstration yield was 1190.60 qt/ha and control yield was 705.85 qt./ha respectively. The increase in yield net profit in demonstration (Rs.252180/ha) and control Rs. 106755/ha shows significant high than control plot.



HIGH FREQUENCY AXILLARY SHOOT PROLIFERATION THROUGH *IN VIVO* DERIVED EXPLANTS IN *GYMNOEMA SYLVESTRE* COUPLED WITH HISTOLOGICAL, BIOCHEMICAL AND PHYSIOLOGICAL STUDIES

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G. sylvestre is a large, more or less pubescent perennial, woody climber of Asclepiadaceae family. It is highly antidiabetic liana due to which it is popularly known as gudmar (gud = jaggery; mar = kills). Anti-atherosclerotic, antimicrobial, antieurogenic, hepatoprotective, larvicidal are other properties of therapeutic repute. Threatened status and constrained conventional propagation due to poor seed viability, reduced germination rates as well as difficulty in rooting necessitate the need of employing micropropagation system for large scale multiplication and conservation of gudmar. The present study focussed on *in vitro* regeneration studies of *G. sylvestre* using shoot tip and nodal segments collected from mature *in vivo* plant. *In vivo* derived shoot tip and nodal segments were inoculated on MS medium supplemented with single cytokinins (BA, Kn and TDZ), cytokinin-auxins (BA-IAA/IBA/NAA) as well as cytokinin-antiauxin (BA-TIBA) combinations in order to explore the optimal hormonal milieu for enhanced axillary shoot proliferation. The effect of two different additives such as Adenine sulphate (AdS) and glutamine (Glu) in optimised medium were explored for improved and quality *in vitro* response. Microshoots were transferred to half and full strength MS medium alone or supplemented with three different auxins viz. IBA, IAA and NAA for *in vitro* root induction. Histological studies of regenerating tissues were conducted to confirm the direct mode of *in vitro* organogenic route. Physiological and biochemical studies were also conducted during different stages of acclimatisation.

CONCEPT OF INTEGRATED PEST MANAGEMENT TO SUPPRESS PEST POPULATION

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Integrated pest management is an approach for economic control of pests. It aims to suppress pest populations below the economic injury level. Entomologists and ecologists have urged the adoption of IPM pest control since the 1970s. IPM system is designed around five basic components. It includes cultural, mechanical, genetic, regulatory, and biological practices. The emphasis is on *control*, not *eradication*. Cultural practices by selecting varieties best for local growing conditions. Plant quarantine and cultural techniques such as crop sanitation, e.g., removal of diseased plants. Mechanical controls have hand-picking, barriers, traps and tillage to disrupt breeding. Monitoring include regular observation which is critically important. Biological control of insect pests and diseases through biological means is most important component of IPM. Parasitoids (*Trichogramma*, *Apanteles*, *Bracon*, *Chelonus*, *Brachemeria* etc.), Predators (Spiders, dragon flies, lady bird beetles, *Chrysopa* species etc.), Pathogens- These are micro-organisms which cause diseases in their hosts. Major groups of pathogens are fungi, viruses and bacteria. Fungi- *Beauveria* and *Metarhizium*, Virus- Nuclear polyhedrosis virus and granulosis viruses and in Bacteria- *Bacillus thuringiensis* and *B. popillae* are common. Biocontrol practices includes- Introduction, augmentation and conservation- the most important component of biological control is conservation and plays a major role in pest suppression. In this process, natural enemies present in the nature are protected from being killed. Some practices are required to protect them are as the use of broad spectrum pesticides should be avoided, growing trap crop on the borders of main fields before the actual sowing of crop to trap pest and develop natural enemies, crop rotation and inter-cropping also help in conservation of natural enemies. Use of pesticides should be need based, judicious, based on pest surveillance with recommended doses and at economic threshold level.

INVASIVE ALIEN SPECIES: A THREAT TO NATIVE BIODIVERSITY

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Invasive alien species are those whose presence in a region is attributable to human actions that enabled them to overcome fundamental biogeographical barriers. Of these, a subset spread, or have the capacity to spread, over substantial distances from introduction sites. Invasive species are a major element of global change and are contributing to biodiversity loss, ecosystem degradation, and impairment of ecosystem services worldwide. The harmful effects of invasions are now widely recognized, and multiscale programmes are organised in place in many parts of the world to reduce current and future impacts. Among the activities that are receiving the most attention and that have the most promise for reducing problems are risk assessment, pathway and vector management, early detection, rapid response, and new approaches to mitigation and restoration. In the context of invasion ecology, risk assessment was undertaken to evaluate risks associated with a species being introduced to a given region, establishing itself, negotiating barriers in the naturalization invasion continuum and having notable impacts. Rapid development of new technologies has improved our ability to assess, monitor, and plan control operations, and integrated strategies are starting to be implemented to reduce current and future impacts of invasive species. Every effort should be made to keep representative areas, such as protected areas, free of alien species. Biosecurity policies and strategies are being implemented for prevention, risk assessment and risk management of these invasive species. Management needs to focus on early stages of the invasion process for which recent developments in risk assessment, pathway and vector management, and early detection and rapid response provide a solid foundation; prevention is more effective than mitigation and restoration after invasion has taken place.



INTEGRATED PEST MANAGEMENT: PREREQUISITE FOR SUSTAINABLE NATURE**Surbhi Garg**

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Integrated Pest Management (IPM) is used to control the pest with various methods of chemical, biological and physical by reducing the use of pesticide. The severity of pest is determined by monitoring the pest populations, beneficial parasite and predator populations. IPM might reduce pesticide use by 50%, if used properly and extensively and at the same time improves the pest control. IPM coordinates environmentally acceptable methods of pest control with judicious and minimal use of toxic pesticides, ultimately minimizing environmental problems. To determine the best method of pest control, biology of pest species and soil quality would be identified. It includes introduction of beneficial insects that eat harmful species. Many pests that are attached to crop residues can be eliminated by ploughing. Simple paper or plastic barriers placed around fruit trees deter the insects. Weeds can be controlled by spreading crop residue, grass, leaf, or black plastic mulch. Insect pests such as the European corn borer and the Japanese beetle have been controlled by introducing their predators and parasites. Wasps that prey on fruit-boring insect larvae are now being commercially bred and released in California orchards. The many hundreds of species of viruses, bacteria, protozoa, fungi, nematodes, pest insects and weeds are used as selective control agents. Release of sterilized male insects and use of sex pheromone are effective for luring and trapping insects. IPM controls more pest control than pesticides. Hence, IPM helps to achieve a better future for coming generation with sustainable environment.

Keywords: Beneficial parasite and predator, IPM, Pest species**ROLE OF SYSTEMIC ACQUIRED RESISTANCE IN PLANT DEFENCE****Ishan Raheja, Adesh Kumar, Vipul Kumar, Kabrabam Suraj Jackson, Mohit Kumar, Baby Wangkhem, Dilpreet Singh and Jagraj Singh**

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Systemic acquired resistance (SAR) is a process of induction of defence against the broad spectrum plant pathogenic microorganisms such as viruses, fungi, bacteria and Oomycetes. Its role is to provide plants a long lasting protection to defend themselves against pathogens. A signal molecule such as salicylic acid (SA) turns on the SAR, which in turn starts the synthesis of pathogenesis-related proteins (PR proteins) and thus this systemic resistance provides protection to plants. SAR turns on the innate defence of plants and provides protection to almost all the plant pathogens for a longer period of time and does not affect environment. The activation of SAR is indicated by the formation of necrotic lesions such as disease symptoms or hypersensitive response. Apart from salicylic acid, a lipid based molecule signal has also been found recently, which is also responsible for the activation of SAR in plants.

INDIGENOUS TECHNOLOGY KNOWLEDGE: A NEED OF PRESENT ERA**Nitika Kumari, Vijayshree Gahlot, Komal Kathuria and Rajaram Bunker**

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Now is the high time to coordinate modern tools of farming with traditional tools so that cultivation can be done in a more sustainable manner. ITK are of great significance to farmers since the very start of cultivating a crop i.e. from sowing till harvesting. Indigenous Technology Knowledge refers to the unique knowledge invented by women and men indigenous to a particular geographical area. In other words we can say that it is local knowledge based on the experience over the passage of time. Indian farmers have learnt to grow food and to survive in difficult environments due to their own set of basic practices. From times farmers have used their past experiences for predicting forecast of rains by observing the direction of wind/clouds, practices to maintain seed viability as well as to prevent it from outside damage by not separating the outer shell of seed, storing seeds along with the leaves of neem (*Azadirachta indica*), pungam (*Pongamia pinnata*) etc, following shallow sowing in dry lands, dragging the thorny branches with weight over them for covering seeds sown on dry lands are some of indigenous practices used by farmers. Indigenous storage techniques which are eco-friendly, cheaper and locally available such as Kulumai are used for storing various food grains, especially paddy grains (*Oryza sativa*). It protects the grains from pests and diseases and even from rats and rodents. Channampoo (*Cycas circinalis*) flowers are cut in to pieces and placed in many places whose bad odour drives away the rats. Indigenous technology knowledge has not only helped farmers to overcome obstacles but it will also decrease the dependence on chemicals and expensive equipments thus curbing some of the constraints associated with the use of these hazardous chemicals.

Keywords: Modern tools, ITK'S, Unique traditional knowledge, overcome obstacles.**INTEGRATED WEED MANAGEMENT IN VEGETABLE CROPS****Nisha Jangre¹, Anjit Jangre², Pappu Lal Bairwa¹, Bhanupratap Jangde¹.**¹Department of Vegetable Science, COA, IGKV, Raipur – 492012 (C.G.) India.²Department of Agronomy, COA, IGKV, Raipur – 492012 (C.G.) India

Weed is a plant growing where it is not desired (Buchholz, 1967). They are ubiquitous. The vegetable fields are usually infested by a wide spectrum of broad and grassy weeds. Weeds compete with the crops for water, soil, nutrients, light, space and thus reduce crop yields up to 37 per cent (Varshney, 2007). The vegetable as well as agricultural crops are infested with a variety of weeds. Out of over 800 weeds documented in India, 80 are considered as serious and nearly 200 as major weeds. Reduction in economic yield of vegetables has been reported to be 6-82 per cent in potato, 25-30 per cent in peas, 70-80 per cent in carrot, 67 per cent in onion, 42-71 per cent in tomato and 61 per cent in cauliflower (Singh, 1980). Farmers usually have a variety of methods for weed control and their choice of control measures is closely controlled by



economics. Although, herbicides were introduced to horticultural crops in India in 1960, hand tools and animal drawn equipment still remain important methods of weed control in vegetable crops. Conventional methods of weed control have become an expensive input in the cultivation of vegetable crops. Owing to high cost and non-availability of labour, in time and no single method of weed control is adequate or cost effective. Integrated weed management is a systematic approach to minimize weed impacts and optimize the land use, by the use of different weed management practices (Aldrich, 1984).

OPTIMIZATION OF CULTURE CONDITIONS FOR ENHANCED PHYTASE PRODUCTION BY *ASPERGILLUS TERREUS*

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Aim: -The aim of the present study was the optimization of culture conditions for enhanced phytase production by *Aspergillus terreus*.

Methods and Results: - Different physical parameters were tested included incubation period, inoculum size, incubation temperature and pH and ca-phytate concentration. Maximum phytase production was found on the 4th day of incubation at 55 °C with 0.1% ca-phytate. Under optimized culture conditions of inoculum size (1.5 ml), metal ions (5mM) (Mg^{++} increase enzyme production however, the metal ions Zn^{++} , Cu^{++} , Co^{++} , Mn^{++} and Fe^{++} have inhibitory effect), the fungal isolate (*Aspergillus terreus*) showed maximum phytase activity (15.8 U/ml). The findings indicate that phytase activity increased from 11.80 U/ml (under un-optimized conditions) to 15.80 U/ml after optimization. The phytase activity after optimization of culture conditions was enhanced by 1.18-fold.

Implication: - Phytase production by fungus *Aspergillus terreus* influenced by various physical and nutritional parameters. The results revealed that optimization studies resulted into 1.18-fold increase in phytase titres. Further studies will be conducted to characterize the phytase for its application in industrial processes.

Keywords: *Aspergillus terreus*, phytase, phytate, optimization, ca-phytate

EVALUATION OF POINTED GOURD FOR FRUIT YIELD UNDER TARA CONDITION OF UTTARAKHAND

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The pointed gourd (*Trichosanthes dioica* Roxb.), is a highly nutritious cross pollinated cucurbit vegetable and coveted in markets of our country particularly during summer and rainy seasons. It is locally known as 'patal', 'parval' or 'green potato'. Pointed gourd is morphologically distinct from other cucurbitaceous species due to its perennial nature, well established dioecism and vegetative means of propagation. In India, vegetable production is not uniformly distributed round the year due to climate and other factors and most of the vegetables are produced in winter. So, there is a scarcity of vegetables during summer and rainy season and only small amount of vegetables are produced during the months of April to October. Among these, pointed gourd contributes a significant portion of vegetable production during lean period in summer and rainy season in India. Pointed gourd has higher nutrient content than other cucurbits; its fruits are rich in vitamin A (153 IU), protein (2%), vitamin C (2%), fat (0.3%), P (40 mg), Ca (30 mg), Na (2.6 mg), Mg (9 mg), K (83 mg), Cu (1.1 mg), S (17 mg), Cl (4 mg) and also provides 20 kcal energy per 100 g of edible portion. It has also some medicinal value being diuretic, easily digestible and laxative, invigorates the heart and brain and is useful in the disorder of the blood circulatory system. To know the performance of different genotypes of pointed gourd under *tara* condition of Uttarakhand, for fruit yield and its components an experiment was conducted involving 36 genotypes collected from different parts of the country. The experiment was conducted at Vegetable Research Centre of the G.B. Pant University of Agriculture and Technology, Pantnagar during summer-rainy season, 2015. The experiment was laid out in Augmented Block Design II with three checks (Kashi Alankar, Swarna Rekha and Rajendra Parwal-1) which were arranged in six blocks, each block possess six genotypes and three checks. Appreciable performances were recorded for ten horticultural traits. Analysis of variance revealed significant difference for all of the character. Among the 36 genotypes, three genotypes namely PPG-12 (31.22 t), PPG-16 (28.32 t), PPG-1 (28.22 t) were found most promising for fruit yield per hectare over the best check i.e. Kashi Alankar (26.80 t). The high fruit yield recorded in these three genotypes, has been directly attributed to increased number of fruits per plant. Therefore, it recommended that such genotypes/varieties can be grown for commercial cultivation on farmer's field under *tara* condition of Uttarakhand for enhancing profitability of small and marginal farmers.

GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (*ORYZA SATIVA* L.)

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Rice (*Oryza sativa* L.) is one of the most important staple foods in the world's population. These QTL alleles of yield related traits make a significant contribution of high yielding rice breeding program. The QTL as a genetic locus where functionally different alleles segregate and cause significant effects on a quantitative trait of advent molecular marker technology, QTL mapping on chromosome linkage maps has become a standard procedure in quantitative genetics. They can be used to identify the QTLs with dominance effects in the whole rice genome. Thousand-grain weight (TGW), grain number per panicle (GPP) and panicle number per plant are the three yield components traits. However, TGW and GPP were often focused in the past QTL mapping studies due to their direct contribution to yield. The molecular markers developed for QTL analysis of enhancing breeding efficiency by marker assisted selection (MAS) for particular agronomic traits. Plant Breeders have focused on improving plant architecture as effective to increase yield potential in rice production. The demand of high yielding rice production for increasing greater stability to human population and changing global climate. In this study, we are using different kinds of rice germplasm and QTL



information including its genome position and genetic effect. We mainly focus on the genetic action of major QTLs and phenotypic traits for improvement in rice breeding programme.

Keywords:-QTL, MAS, TGW, GPP, Rice and Yield

SEED GERMINATION OF GUAVA (*PSIDIUM GUAJAVA* L.) AS AFFECTED BY DIFFERENT SCARIFICATION TREATMENTS

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Seed germination studies depends on seed viability and dormancy aspects, besides essential requirements and factors for the same. Of the various factors involved in seed germination, dormancy plays a significant role. In guava, seed dormancy is more of physical nature (due to hard seed coat) than being physiological. A field experiment was conducted to study influence of scarification treatments on seed germination of guava (*Psidium guajava* L.). The objective of the study was to get maximum germination of guava seeds. Three scarification methods were used i.e. water soaking (for 24, 48 and 72 hours), hot water soaking (at 70, 80, 90 and 100°C) and sulphuric acid soaking (at 10, 20, 30, 40 and 50 % dilution). Duration for hot water soaking and sulphuric acid soaking was kept as quick dip (5 seconds), 1 minute and 3 minutes. All these treatments significantly decreased days to emergence of seedling over control (25 days). Among the scarification methods and durations used, treatment of guava seeds with 20 per cent sulphuric acid for 3 minutes was judged best with maximum germination per cent (51.7 %), minimum days to emergence (11.7 days) and girth of seedlings (3.50 mm after 150 days of sowing). Seeds without any scarification treatment also showed poor germination (24.7 %). On the basis of the findings, it can be concluded that the scarification of guava seeds with 20% sulphuric acid would result in better seedling emergence and further development.

KEYWORDS: Guava, scarification, seed germination, sulphuric acid, hot water soaking.

LET STUBBLE NOT TO BE A TROUBLE

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Stubble burning is the burning of the plant material (straw) left after the crops have been harvested by the farmers which leads to a serious threat to the environment. What makes farmers burn the stubble?, how it affects environment? and what role government played? In India it has been reported that around 500-550 Million tons of crop residues are produced per year, but the surplus residues i.e., remained after utilization for various purposes, are typically burnt on farm. The data produced in the report of IARI shows that Uttar Pradesh, Punjab and Haryana topped the list respectively. This results in the smoke and soot particles, emission of green house gases, affecting human health, damaging the physical and chemical properties from upper crust of the soil resulting in loss and imbalance of nutrients and mortality of active beneficial soil microbes. The main reasons of stubble burning has been observed due to certain limitations such as timely sowing of next crop, unavailability of human labor, use of combines for harvesting and high cost in the removal of crop residues through conventional methods. The crop residues effectively can be used for composting, power generation, livestock feed, mushroom cultivation, biofuel production etc. Though the government imposing fines on farmers to curb the stubble burning and gives subsidies but seems not effective since farmers are protesting against the stubble ban. Therefore this is necessary for the government of India to come up with new technologies in bringing the alternatives to the farmers to overcome this all.

ROLE OF BIO AGENTS IN PLANT DISEASES MANAGEMENT

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It is estimated that diseases, insects and weeds together annually interfere with the production and destroy 36.5 % crop production. Annually 14.1 % losses caused due to plant diseases. The terms “biological control” and its abbreviated synonym “biocontrol” have been used in different fields of biology, most notably entomology and plant pathology. Biological disease control is an attractive alternative strategy for the control of plant diseases. Meanwhile, it also provides practices compatible with the goal of a sustainable agricultural system. Insofar as we know, the mechanisms of biocontrol may involve and be divided into (i) antibiosis, (ii) competition, (iii) mycoparasitism, (iv) cell wall degrading enzymes, and (v) induced resistance. However, these mechanisms of biological control are probably never mutually exclusive. BCAs are play an important role in controlling plant pathogens, especially soil borne fungal pathogens. The use of BCAs based products is not only safe for the farmers and consumers but it is also good for the environment. However, much more work needs to be done to develop stable, cost effective, easy to produce and easy to apply formulations. Effective biological control strategies in the future, critical to carry out more research studies on some less developed aspects of biocontrol, including development of novel formulations, understanding the impact of environmental factors on biocontrol agents, mass production of biocontrol microorganisms and the use of biotechnology and nano-technology in improvement of biocontrol mechanisms and strategies. Future outlooks of biocontrol of plant diseases is bright and promising and with the growing demand for biocontrol products among the growers, it is possible to use the biological control as an effective strategy to manage plant diseases, increase yield, protect the environment and biological resources and approach a sustainable agricultural system.



BODY TEMPERATURE, CLOACAL PROTUBERANCE, GONADAL SIZE AND NUPTIAL COLOURATION IN MATING SUCCESSION IN BLACKHEADED MUNIA (*LONCHURA MALACCA*)**Kumar P, Pandey RK, Chhabra R and Bhardwaj SK***

Chronobiology lab, Department of Zoology, Chaudhary Charan Singh University Meerut

Variation in colouration has been related to sexual selection in most of avian fauna, even though such a relationship has been proven for many other vertebrate taxa. Male and female blackheaded munia (*Lonchura malacca*) juveniles have a uniform pale brown upperparts, lack the dark head and have white to pale buff under parts, but adults have a stubby pale grey-blue bill, shiny black head, and brown body, with a brick red patch on the lower back, visible only when it flies. The adult develops body molt and molt primaries a conspicuous nuptial colouration during the pre-reproductive season. To investigate the possibility that colouration plays a role in sexual selection in this species, in month of January three groups of juvenile blackheaded munia birds exposed 12L: 12D photoperiods, each group has 30 juveniles and third group added extra 5 adult male birds. In the first group temporal variation in pale brown of upperparts change shiny black colouration on head in five juveniles, in second group all non-colouration juveniles were present and in third group, five adult male (which has shiny black head) put with juveniles, determined this shiny blackness affected gonadal size, cloacal protuberance or body temperature of birds and investigated if shiny blackness of males could be related to their mating success. Results confirmed previous observations that females start to develop follicles, body temperature and cloacal protuberance in first and third groups for a very few time points. Colouration group first and third exhibiting higher in follicular size, body temperatures and cloacal protuberance size of were somewhat than non-colouration second group birds with lower body temperatures, follicles, and cloacal protuberance. Finally, mating success was positively related to juvenile birds, whereas in non colour of birds no such relationship was detected. While our results align with the hypothesis that the shiny black colouration of birds in a group may be a target of sexual selection, alternative explanations are also discussed.

Keywords: blackheaded munia, photoperiods, juveniles, cloacal protuberance, Follicular diameter, reproduction, sexual selection.

STUDY OF TOTAL SEED STORAGE PROTEIN PATTERN OF RICE (*Oryza Sativa* L.) GENOTYPES USING SDS-PAGE**Shende Rajendra¹, Sheilendra Pandey², Kanchan S. Bhan³,**

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The present investigation, 170 genotypes of rice (*Oryza sativa* L.), were characterized based on the total seed protein and analyzed through protein Bradford assay and biochemical characters (sodium dodecyl sulfate polyacrylamide gel electrophoresis, SDS-PAGE). The study revealed that all the genotypes of rice were identified on the basis of total seed protein content. Highest protein content was found in Badagadakhurta (8.27 %) followed by Kalokuchi (8.05 %) and NunkiGurmatia (7.20 %).

Based on jaccard's distances and similarity coefficients obtained from SDS-PAGE of rice genotypes and it ranges 65 to 100%. Cluster I had two subgroup Kalamkati and G-21 similar and Rajeshwari, IR 87728-367-B-B and Uri are some differences between genotypes. Cluster II (a) 15 genotypes and three subgroup and Moroberekan genetically different to the other. Cluster II (b), the largest one with 114 genotypes this cluster three genotypes Poornima, Basmati, and E 2526 are different diversity than other.

Overall on the cluster Rajeshwari, IR-87728-267 and Uri genotypes are different. Thus, it is also most likely that the protein marker would then be able to estimate the amount of genetic diversity in the genus and perhaps obtain an indication as to the origin of the rice genotypes. On the basis of cluster analysis the genotypes, Rajeshwari, IR-87728-267 and Uri for protein marker and Badagadakhurta and ARC 10376 for protein content seems to be different and further would be used to enhancement of nutritional quality of rice.

Keywords: Seed storage protein, Bradford assay, SDS-PAGE, genetic diversity, Polymorphism, varietal identification.

IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD AND PRODUCTIVITY OF MUSTERED CROP**Rhit Kumar ^a, Akhila Nand Dubey^{b*} and Manish Singh ^b**^aDepartment of Agricultural Chemistry & Soil Science, Udai Pratap Autonomous College, Varanasi^bDepartment of Soil Science & Agricultural Chemistry, Banaras Hindu University, Varanasi^cDepartment of Horticulture, Banaras Hindu University, Varanasi

A field experiment was conducted at experimental farm of Udai Pratap College, Varanasi during 2016-17 to assess the possibility of improving soil properties and productivity of mustered under integrated application of NPK through inorganic sources and FYM with seven treatment i.e. T₁ (Control), T₂ (50% NPKS), T₃ (50% NPKS+10 t Vermicompost/ha), T₄ (100 % NPKS), T₅ (100% NPKS+10 t Vermicompost/ha), T₆ (150 % NPKS) and T₇ (200% NPKS). Application of K through chemical fertilizer plus FYM -N significantly improved the organic carbon, available N, P, K and S contents over chemical fertilizer alone. Application of K through inorganic source with FYM significantly increased total porosity and reduced the bulk density at all level of fertilizer. The use of organic manure decreased soil pH and EC as compared to chemical fertilizer alone. Significantly higher plant height (137.50 cm), number of silique (86), number of grain in per silique (15), grain yield (15.25) and total NPKS uptake (210, 16.03, 190, 11 Kg/ha⁻¹, respectively) with the application of K + FYM. Thus integrated application of inorganic and organic source (K + FYM) maximized yield of mustered and improved the soil fertility.



INFLUENCE OF PANCHAGAVYA WITH DIFFERENT LEAF EXTRACTS FOLIAR SPRAY ON GROWTH AND YIELD OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)**KM Choudhary, K G Vyas, SK Kakraliya and M K Man**

Department of Agronomy, S.D. Agricultural University, Sardarkrushinagar-385 506

Panchagavya is an organic formulation, which in Sanskrit means the blend of five products obtained from cow i.e. milk, ghee, curd, dung and urine. Panchagavya is an organic product having the potential to play the role of promoting growth and providing immunity in plant system. A field experiment was conducted

Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, S.K. Nagar during kharif season 2010.

to Study the

effect of foliar applied neem (*Azadiracta indica*), oak

(*Callotropis gigantea*), glyricidia (*Glyricidia sepium*), custard apple (*Annona squamosa*) leaf extracts in 1:1 combination with panchagavya on growth, yield of groundnut. The field experiment was laid out in a factorial randomized block design (FRBD) with 18 treatments of foliar spray combinations in the experiment comprised of six sources of foliar application and 3 stages of application. Six sources of foliar application viz., - Control, Panchagavya, Panchagavya + neem, Panchagavya + oak, Panchagavya + glyricidia, panchagavya + custard apple and 3 stages viz., - Branching, Flowering and Branching + flowering were taken in this investigation. Foliar spraying of combination of panchagavya + neem leaf extract resulted in higher plant height and number of branches as compared to control. Pod yield kg ha^{-1} was also recorded significantly increase with application of panchagavya + neem extract as compared to other sources. So, panchagavya can be a effective organic growth-promoter for small and marginal farmers.

DISTRIBUTION AND DIVERSITY OF PHYTOPLANKTON IN SELECTED PONDS OF ALIGARH DISTRICT, U.P., NORTH INDIA

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The present study was carried out to evaluate the distribution and diversity of phytoplankton in selected ponds of Aligarh district in U.P., North India. Monthly sampling from all the three selected ponds in five replicates was made for a period of 12 months (July 2011–June 2012) at 9:00–11:00 h. A total of 16 species of phytoplankton belonging to 4 genera were found with the Bacillariophyceae and Chlorophyceae being the most abundant taxa. The Shannon–Wiener diversity index calculated for phytoplankton ranged from 2.04 to 2.61. The statistical relationships between water temperature, transparency, dissolved oxygen and free carbon dioxide and phytoplankton groups were also computed for assessing the impact of anthropogenic disturbances on phytoplankton diversity of selected ponds. *Anacystis* species, *Spirulina* species and *Navicula* species identified in the fresh water ponds reveals that the studied ponds are subjected to pollution.

UTILIZATION PATTERN OF MOBILE PHONE TECHNOLOGY (SMARTPHONE) AMONG THE FARMERS OF NAGOUR DISTRICT IN RAJASTHAN**Kailash, Om Prakash Mishra, Shani Kumar Singh and H.K. Verma**¹⁻³ Department of Extension Education, Institute of Agricultural Sciences, B.H.U, Varanasi, India- 221005⁴ Department of Extension Education, AAU, Anand, India- 388001

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 retailer than call to relative farmer (80%), internet user (29.09) and perceived as most information on weedicide, pesticide and disease control (89.09%) through mobile phones. The correlation studies indicated a significant association between education, with extension agency contact and mass media of the farmer. The analysis showed that the poor connectivity, economic problem, high cost internet services and lack of updated information were some of the problems reported by the respondents.

POPULATION IMPROVEMENT STRATEGIES FOR IMPROVING THE ALLOGAMOUS CROP PLANTS**Kailash Chandra*, Ravindra Prasad and Lal Chand Prasad**

Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005

The basic concept of population improvement originated out of necessity, not for the cultivation of population *per se* but for enhancing the scope of developing better-inbred lines required for the production of heterotic F_1 hybrids. It's well understood that cross-pollinated crops are highly heterozygous and heterogeneous. Consequently, they show varying degrees of inbreeding depression. It is therefore, inbreeding should be avoided or kept to be a minimum in cross-pollinated crops. Individual plants are heterozygous and their progeny would be heterogeneous and usually different from the parents, due to segregation and recombination gene(s) for desirable trait.

Thus, desirable genes can be seldom fixed through selection in cross-pollinated crops except for highly heritable qualitative characters. Hence, the breeder/researcher main aims of increasing the frequency of desirable alleles in the population. In cross-pollinated crops, the



genotype of the individual crop plants is generally has little importance, especially in population improvement programmes but, the frequency of desirable alleles or genes in the population as a whole is much more important. The common goal of improving open or cross-pollinated species is to changing the gene frequencies in the population towards fixation of favorable alleles for trait of target while the maintaining a high degree of heterozygosity as well. Mass selection and its modification, breeding method with progeny testing and its modification and recurrent selection along with taking the support of molecular technique is an important breeding approach employed to improve the populations of crop plants particularly for cross-pollinated species.

MOLECULAR CHARACTERIZATION OF *HETERORHABDITIS INDICA* DH₃ ISOLATE AND ITS REPRODUCTIVE POTENTIAL AGAINST *GALLERIA MELLONELLA*

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Nematology Laboratory, Department of Zoology, Ch. Charan Singh University, Meerut-250004, India

Entomopathogenic nematodes (EPNs) are soil dwelling; free living, parasitizing nematodes belong to the families Steinernematidae and Heterorhabditidae, with a variety of association with symbiotic bacteria *Xenorhabdus* and *Photorhabdus* respectively. The integrated approaches of morphological and molecular tools play an important role in identification of EPNs. Isolate DH₃ was genetically recognized by sequence length of ITS region (accession no. KY311812, length 739 bp), D2D3 region (accession no. KY311814, length 873 bp) morphological and their analyses showed the close resemblance (100% similarity with 0 nucleotide difference) with *Heterorhabditis indicata* than other described species. Isolate *H. indica* DH₃ isolate was tested in laboratory for their pathogenicity and reproductive potential against *Galleria mellonella* larvae infected with four different concentrations or 3rd stage infective juveniles viz. 25, 50, 100, 200 IJs/larva. Mortality was observed in all the concentrations of both insect larvae after 24h post infection period (PIP). Isolate DH₃ showed 20%, 30%, 40%, and 70% against *G. mellonella* larvae bioassay after 24h PIP. No mortality was recorded in control group. LC₅₀ value was calculated at three different time intervals viz. 24h, 36h, and 48h, and recorded as 40 IJ/larva, 13 IJ/larva and 8 IJ/larva respectively in *G. mellonella*. The highest IJs production was recorded in *G. mellonella* with $21.94 \pm 1.16 \times 10^4$ IJs/larva at 200 IJs/larva dose whereas it was highest in 50 IJs/larva.

Keywords: *Galleria mellonella*, *Heterorhabditis indica*, ITS, D2D3, pathogenicity and reproductive potential.

RESPONSE OF INM ON YIELD AND NUTRIENT UPTAKE OF SESAME (*SESAMUM INDICUM* L.)

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A field experiment entitled "Response of INM on yield and nutrient uptake of sesame (*Sesamum indicum* L.) Was conducted during *kharif* season of 2015 at Agronomy Farm, S.K.N. College of Agriculture, Jobner, Jaipur (Rajasthan). The experiment composed of 16 treatments combination comprising four levels of organic manures (control, FYM @ 10 t ha⁻¹, Vermicompost @ 5 t ha⁻¹ and FYM @ 5 t ha⁻¹ + Vermicompost @ 2.5 t ha⁻¹) and four levels of Mineral nutrients (control, S @ 20 kg ha⁻¹, S @ 20 kg ha⁻¹ + Fe @ 10 kg ha⁻¹ and S @ 20 kg ha⁻¹ + Fe @ 10 kg ha⁻¹ + Zn @ 5 kg ha⁻¹) was laid out in randomized block design and replicated thrice. Sesame variety RT-46 was taken as a test crop. Results showed that application of FYM @ 5 t ha⁻¹ + vermicompost @ 2.5 t ha⁻¹ was significantly increased crop yield and N, P, K, S, Fe and Zn uptake by the crop. Results increasing levels of the mineral nutrient treatments revealed that the application of S @ 20 kg ha⁻¹ + Fe @ 10 kg ha⁻¹ + Zn @ 5 kg ha⁻¹ significantly increased crop yield and uptake of N, P, K, S, Fe and Zn by the sesame crop.

APIS SPP. (HYMENOPTERA: APIDAE) AS POTENTIAL VISITOR OF INDIAN MUSTARD, *BRASSICA JUNCEA* (L.) CZERNJ. & COSSON

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Rapeseed (sarson and toria) and mustard (rai) are prominent oil producing crops being grown in India as well as in 52 other countries throughout the world. Among rapeseed-mustard, Indian mustard, *B. juncea* (L.) Czernj. & Cosson is predominantly cultivated in Haryana and adjoining states. The inflorescence of *B. juncea* is an elongated corymbose raceme, borne terminally on the main stem and branches, carrying bright yellow flower (Pua and Douglas, 2004) and is visited by a number of insect visitors. Chaudhary (2001) reported insects belonging to Apoidea (98.50% of total insects) as the major visitors of *B. juncea*. The present investigation was carried out on Indian mustard variety RH 0749 in the field of Oilseed Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during 2015-2016 Rabi season with the objective to record the abundance of insect visitors and pollinators on Indian mustard. Data on abundance (number of bees/m²/5 min) of various *Apis* spp. on the flowers of Indian mustard, *B. juncea* variety RH-0749 was recorded once a week at two hour intervals from 0600-1800 h during December, 2015 and January, 2016. There was no honey bee activity at 0600-0800 h throughout the investigation period due to low temperature in morning hours in different weeks of December and January. It was observed that *A. dorsata* was significantly the most abundant visitor with a mean population of 4.29 bees/m²/5 min followed by *A. cerana indica* (2.82 bees/m²/5 min), *A. mellifera* (2.33 bees/m²/5 min) and *A. florea* was least abundant (1.74 bees/m²/5 min) visitor of Indian mustard flowers. The abundance of major insect visitors/pollinators was low at the initiation of flowering of the crop. It was maximum at peak flowering time of the crop and was again low at the cessation of flowering of the crop. Abundance was maximum (5.86 bees/m²/5 min) at 1200-1400 h of the day followed by 1000-1200 h (5.05 bees/m²/5 min), 1400-1600 h (2.18 bees/m²/5 min), 0800-1000 h (0.73 bees/m²/5 min) and 1600-1800 h (0.14 bees/m²/5 min).



DIVERSITY OF INSECT VISITORS/POLLINATORS ON INDIAN MUSTARD(BRASSICA JUNCEA L.)FLOWERS**Kanika Nagpal¹, Sunita Yadav*² and Robin Singh¹**¹Department of Entomology, CCS Haryana Agricultural University, Hisar-125 004, Haryana, India²Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar-125 004, Haryana, India

Among rapeseed-mustard, Indian mustard, *B. juncea* (L.) Czernj. & Cosson is predominantly cultivated in Haryana and adjoining states. It is known as *rai*, *raya* or *laha*. The bowl shaped flower of mustard is a suitable place for the landing of insect pollinators, especially honey bees. Thus, the experiment was carried out on Indian mustard variety RH-0749 at Research Area of Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during 2015-2016 to study the diversity of insect visitors/pollinators. A total of sixteen insect species belonging to nine families of four different orders were recorded from the Indian mustard flowers. The Hymenopterans were the major floral visitors comprising of eight species from four families viz., Apidae (*A. mellifera* Linnaeus, *A. cerana indica* Fabricius, *A. dorsata* Fabricius, *A. florea* Fabricius and *Nomada* sp.), Andrenidae (*Andrena savigneyi* Spinola), Halictidae (*Lasioglossum* sp.) and Scoliididae (*Compsomeriella* sp.). They were followed in order of diversity by Dipterans (five species from three families) viz., Syrphidae (*Episyrphus* sp., *Eristalinus obscuritarsus* Meijere and *Eristalinus tabanoides* Jaennicke), Muscidae (*Musca domestica* Linnaeus), Calliphoridae (*Chrysomya rufifacies* Macquart). The least diversified orders were Lepidoptera (two species from one family) viz., Nymphalidae (*Danaus chrysippus* Linnaeus and *Venessa cardui* Linnaeus), and Hemiptera (one species) viz., Pentatomidae (*Bagrada hilaris* Burmeister). Among these insect visitors, *Apismellifera*, *A. cerana indica*, *A. dorsata* and *A. florea* were the most frequent visitors.

NUTRITION GARDEN AN INTERVENTION AGAINST MALNUTRITION: A CASE STUDY OF NICRA VILLAGE.**Sarita Joshi (mail id. saritajoshi156@yahoo.co.in)**

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Krishi Vigyan Kendra Baghpat, (S.V.P.U.A&T Modipuram Meerut.)

India is the second largest producer of fruits and vegetables, but their consumption is meagre especially among the rural population that leads to malnutrition. Malnutrition is a serious problem which affects the potentials of an individual. The sustainable solution to this problem lies in the improvement and diversification of household diets by growing kitchen garden. Vegetables are rich sources of nutritional bioactive compounds. They are important sources of protective nutrients like vitamins, minerals, antioxidants, folic acid and dietary fibres. The diversified and highly nutritive vegetables are affordable and cost effective solution to hidden hunger. Home gardening contributes to household food security also by providing direct access to healthy diet that can be harvested, prepared and fed to family members, often on a daily basis with adequate macro and micronutrients at doorstep. Keeping this view into consideration the present study was planned during 2015-16 as an intervention programme in NICRA village and finally twenty families were provided with mini seed kit for kitchen garden at frontyard / backyard of their house with an objective to investigate the role of kitchen gardens in Food supply and nutritional diversity. Result revealed that kitchen garden could not only help in mitigating malnutrition by providing fresh vegetables and fruits round the year but also enhanced income indirectly by saving, which otherwise incurred in purchasing of fruits and vegetables. Apart from that improvement in general health & comparatively less incidence of diseases like common cold, anemia was reported with annual reduction on family expenses on fruits & vegetables.

Key word: Kitchen garden, Malnutrition, Nutritional diversity, Intervention programme

EFFECT OF MICRONUTRIENT AND ORGANIC MANURE IN GRAIN YIELD OF RICE (NDR-359)**Sanjeev Kumar Singh¹ and Bikramaditya²**¹Kisan PG College Simbhaoli, Hapur²Department of Agronomy, C.S.S.S. (P.G.) College, Machhara, Meerut, U.P. India

A field experiment was conducted during kharif season of 2016 at farmers field in the village of Nabada, Hapur. Data revealed that different nutrients and micronutrient had significant effect on yield attributing characters viz No. of panicles/m² and panicles wt (g). Combine application of 10 t FYM+100% RDF (120:60:60 NPK/ha)+Zn (0.5% spray)+Fe (0.5% spray) produced significantly higher grain yield of rice (5.53 t/ha) than 100% NPK alone (4.54 t/ha). 100% NPK + 25 Kg Zn/ha produced significantly more grain yield of rice (4.82 t/ha) than 100% NPK alone. Combine application of 10 t FYM+100% NPK+Zn (0.5 spray) recorded significantly higher grain yield of rice (5.38 t/ha) than 100% NPK alone. The increase in rice grain yield with 10 t FYM+100% RDF+Zn (0.5%) + Fe (0.5% spray) was to the tune of 21.8%, 14.7% and 2.7% than 100% NPK alone, 100%, NPK+25 Kg Zn and 10 t FYM + 100% RDF + Zn (0.5%) spray.

IMPORTANCE OF ZINC BIOFORTIFICATION AND ITS APPLICATION AT DIFFERENT STAGES OF WHEAT ON THE BASIS OF ZADOK'S SCALE.**Pramod Lawate and S.K. Prasad**Dept. of Agronomy, Institute of Agril. Sciences,
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Micronutrient deficiency particularly Zn is the most widespread problem (Wuehler *et al.* 2005) covers about one half of Indian soils (Welch *et al.*, 1991) and varied from 54-60% in different states (Nayyar *et al.* 2001). The low zinc content in soil leads to decrease in grain Zn concentration and reduces its bioavailability in humans (Hussain *et al.* 2012). Zinc has been found useful in improving yield and yield



components of wheat and improve the water use efficiency of wheat (Bagci *et al.* 2007). Zinc involves many important physiological functions such as synthesis of auxin, catalyzes the photochemical reaction, stability of biological membranes, synthesis of nucleic acids, proteins and lipids, leads to improve wheat grain quality (Seilsepour, 2006). Zinc nutrition may affect plant water relations and alter stomatal conductance (Khan *et al.* 2003). Management of zinc fertilizer is to be most effective and profitable when applied at specific times during wheat development (phenological stage). The knowledge of timing of phenological events helps timely irrigation, fertilizer application and crop protection (Ruml and Vulić 2005). There are several scales or developmental codes for wheat that describe visible growth stages. However, Zadoks scale is the most comprehensive and easiest to describe the wheat development stage. Zadoks scale, a two-digit system and has 10 main growth stages, labelled 0 to 9, which describe the crop and each main growth stage can be further described using a second digit, labelled 0 to 9. Zhang *et al.* (2012) reported that foliar Zn application significantly increased the Zn concentration and bioavailability in both whole grain and flour of wheat.

EVALUATION OF BIO-AGENT POTENTIAL OF *TRICHODERMA* SP. AGAINST VASCULAR WILT OF LENTIL IN BUNDELKHAND REGION

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Lentil (*Lens culinaris*) is the most important pulse crops of Bundelkhand region. Lentil vascular wilt incited by *Fusarium oysporum* f. sp. *lenticis* is one of the most severe disease caused by heavy losses (20-100%) depending upon stage of infection and wilting. To test of ability of bio-agent *Trichoderma* sp. against *Fusarium oysporum* f. sp. *lenticis* reduce vascular wilt disease in lentil. *Trichoderma* sp. has been extensively used as a bio-agent for the management of a large number of seed and soil borne pathogen. In the experiment, 6 *Trichoderma* isolates were evaluated for their antagonistic ability against the test fungi followed by the *Trichoderma* isolates. *In-vivo* condition isolates 1 showed maximum plant growth promotion and low disease incidence. Isolate of 2, 3, and 5 were also showed average plant growth promotion and average less disease incidence. Isolate 6 was least effective bio-agent showed minimum plant growth promotion and highest disease intensity.

LAND USE PLANNING: A KEY TO SUSTAINABLE AGRICULTURE

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Sustainable use of the soil is a form of land management which retains the natural fertility of the soil and allows for the production of food and fiber supplies and renewable natural resources on a long-term basis. It implies that the natural environment should be treated and managed in such a way that the cycles and energy fluxes among the soil, bodies of water and atmosphere are considered, preserved or restored. To this respect, the term «sustainable land use» is more comprehensive than the term «sustainable soil use». Land, commonly, stands for a section of the earth's surface with all the physical, chemical and biological features that influence the use of the resource. It refers to soil, spatial variability of landscape, climate, hydrology, vegetation and fauna, and also includes improvements in land management, such as drainage schemes, terraces and other agro-biological and mechanical measures. The term «land use» encompasses not only land use for agricultural and forestry purposes, but also use of the land for settlements, industrial sites, roads and other human activities. Land use, in this meaning, can be termed sustainable only if it is achieved such a spatial distribution or configuration of the different uses, as to guarantee biodiversity and preserve the eco-balance of the whole system. Rational land use planning is fundamental to this process. With reference to the afore stated issues, the paper describes the main physical, social and economic features of land use planning projects, along with their environmental impacts and constraints to sustainable development. The importance and role of institutional strengthening, sound financial and managerial frameworks, availability of human resources involved, research thrust, technology transfer and networking improvement are also analyzed.

Keywords: - Land use planning Sustainable agriculture & Networking system.

LAND USE PLANNING: - OBJECTIVES AND STEPS

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Land use planning in the technical co-operation is an iterative process based on the dialogue amongst all participants. It is aimed at the definition of decisions on a sustainable form of land use in rural areas and the initiation of the appropriate measures for implementation and monitoring. Land conversion is detrimental to the agricultural system because it reduces the quantity of farmland available for production. It is most detrimental when the farmland lost is of high quality, as both production levels and crop diversity suffer. The Objectives of Land Use Planning to quantify the agro-ecology factors that defines the categories of land use and optimal cropping patterns, to integrate the economic market relationships of the input- output matrix that governs the acreage and production relations under the particular crop regime identified for the category of land use identified, as a tool for benchmarking farmers' managerial index and his capacity to absorb capital and technology and charting out ways and means of enhancing it, to identify the institutional infrastructure needs for promoting "brand equity" and usher in the commercial/industrial status to agriculture and to help in reorienting the departmental perspective from present top-to-bottom departmental (compartmentalized) approach to a bottom-up management process with the participation of all stakeholders in agricultural development. Steps in land-use planning: - Establish goals and terms of reference. Organize the work. Analyse the problems. Identify opportunities for change. Evaluate land suitability. Appraise the alternatives: environmental, economic and social analysis. Choose the best option. Prepare the land-use plan. Implement the plan. Monitor and revise the plan.



Keywords: Land use planning, Land use, Land use objectives and Steps, Land conversion, Agricultural system.

LAND-USE PLANNING FOR SUSTAINABLE DEVELOPMENT USING GEOINFORMATICS: POLICY IMPLICATIONS FOR DRYLANDS

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The land is the basic natural resource of the planet earth. Continuing population growth has definitely increased food, fuel and fodder demands, and this has put pressure on the judicious use of land resources. Therefore, proper and rational planning is essential to achieve long-term benefits from this resource. The proper planning for conservation, optimum utilization and management of these resources is not only vital for sustenance of life but also to meet the growing needs of agriculture, expanding urbanization, increasing industrialization and for overall socio-economic development of the country. The Agenda 21 ratified by over 170 nations at the Earth Summit in Rio de Janeiro in 1992 highlights that the land-use planning plays a key role in natural resource management. The science of sustainable development requires setting up of strategies based on the accurate assessment of the earth's carrying capacity. This requires an integrated approach towards harnessing land resources after taking into account the vulnerable environmental condition. In this study, a dry land part of middle Ganga plain, known as Son-Karnamasa interfluvies, in India is selected. Based on the results, alternative land-use systems and integration of livestock enterprises with the agriculture system have been suggested for land resources management. The objective of this chapter is to present a land-use plan to increase the productivity of land for sustainable development. The present study is likely to contribute required inputs to help policymakers to improve the socioeconomic and environmental conditions of the dry lands.

Keywords:-Drylands Geoinformatics, Land-use planning Policy, Sustainable development.

CROP GROWTH AND YIELD OF POTATO (*Solanum tuberosum* L.) AS AFFECTED BY DIFFERENT WEED MANAGEMENT PRACTICES

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Potato (*Solanum tuberosum* L.) is one of the most important vegetable crop and at present it is the 4th most important food crop of the world, widely cultivated after wheat, rice and maize. Apart from being used as a vegetable, it is used in preparation of various alcoholic beverages, chips, french fries, extraction of starch and other processed products are also made from potato. Under Indian conditions various field experiments had been conducted and the estimated yield reduction by weeds was found to be 10-80% in potato crop depending on type of weeds species and its intensity. The present study was conducted to evaluate the effects of weed management on growth and yield of potato at Vegetable Research Centre of G.B.P.U.A.&T., Pantnagar, (Uttarakhand) India. The experiment consisted of seven treatments i.e. weedy check, weed free, hand weeding at 30 days after planting (DAP), hand weeding at 40 DAP, hand weeding at 50 DAP, herbicide metribuzin @0.75 kg a.i./ha pre-emergence and herbicide metribuzin @0.75 kg a.i./ha post-emergence. At dehauling stage under the various weed control treatments, significant effect was found on fresh and dry weight of weeds, number of monocot and dicot weeds and plant height whereas, no significant effect was observed on number of haulms at dehauling stage. With the application of herbicide metribuzin @0.75 kg a.i./ha pre-emergence the maximum total tuber yield (308.95 q/ha) was observed with maximum net return and B:C ratio 1.93.

EFFECT OF CLIMATE CHANGE, GLOBAL WARMING AND ITS IMPACT ON HORTICULTURE CULTIVATION

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Climate change has a serious impact on the availability of various resources on the earth especially water, which sustains life on this planet. Changes in the biosphere, biodiversity and natural resources are adversely affecting human health and quality of life. Climate change has emerged as a serious global environmental issue having impact on all forms of life. It increases the green house gases like carbon dioxide, nitrous oxide, ozone and methane which may cause impact in terms of increased temperature, more demand for water and increase in biotic and abiotic stresses. It has direct impact on agriculture and horticulture. The global warming has caused loss of vigour, fruit bearing ability, reduction in size of fruits, less juice content, low colour, reduced shelf life and increasing attack of pests resulting in low production and quality of horticultural produce. The established commercial varieties of fruits, vegetables and flowers will perform poorly in an unpredictable manner due to aberration of climate. To sustain the productivity, modification of present horticultural practices and greater use of greenhouse technology are some of the solutions to minimize the effect of climate change. Development of new cultivars of horticultural crops tolerant to high temperature, resistant to pests and diseases, short duration and producing good yield under stress conditions, as well as adoption of hi-tech horticulture and judicious management of natural resources will be the main strategies to meet this challenge. These effects of climate change also influence the pest and disease occurrences, host-pathogen interactions, distribution and ecology of insects, time of appearance, migration to new places and their overwintering capacity, thereby becoming a major setback to vegetable cultivation.



STUDIES ON HERITABILITY FOR YIELD AND ITS COMPONENTS IN BITTERGOURD (*Mormordica charantia* L.)”**Leela Bhatt and S.P.Singh**Department of Horticulture
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Nine diverse parents were evaluated for studied on of bitter gourd in RBD design with three replications for eleven quantitative traits were carried out in summer and rainy seasons of 2015 at Horticulture farm, SKNAU, Jobner (Rajasthan). High heritability was observed for these characters namely as, fruit length, fruit weight, fruit diameter, yield per plant, days taken to opening of first female flower, days taken to first fruit set, Number of node at which female flower appeared, vine length at harvest, male:female ratio, days to fruit harvest (84.3%, 65.2%, 32.9%, 56.5%, 74.2%, 6.82%, 14.1%, 23.25%, 51.2% and 52.6% respectively) indicates predominance additive. Thus, there is ample scope for improving these characters through direct selection.

MECHANISM OF *TRICHODERMA HARZIANUM* AS A BIOCONTROL AGENT IN DISEASE MANAGEMENT**Vinay Kumar Kardam¹, Deepak Kumar², Chandni Kumari³**¹Department of Plant Pathology, Dr Y S Parmar University of Horticulture and Forestry- Nauni, Solan (H.P.), India²Assistant Professor, Jagannath University, Jaipur (Raj.), India³Maharani Shri Jaya Government College, Bharatpur (Raj.), India

Fungal species belonging to the genus *Trichoderma* are worldwide in occurrence and easily isolated from soil, one of the most interesting aspects of the science of biological control is the study of the mechanisms employed by biocontrol agents to effect disease control, this biocontrol agent have the potential of nonchemical property. Mycoparasitism and Antibiotic (Toxin) Production, *Trichoderma* know that one of the most salient characteristics of the group is their ability to parasitize other fungi i.e. *R. solani* and *P. ultimum*. Competition and Rhizosphere Competence, Rhizosphere competence is important because a biocontrol agent cannot compete for space and nutrients if it is unable to grow in the rhizosphere. *Trichoderma* species, either added to the soil or applied as seed treatments, grow readily along with the developing root system of the treated plant. Enzymes, such as chitinases, amylase and glucanases produced by the *T. harzianum* and these are responsible for suppression of the plant pathogens. *T. harzianum* also effective against *Botrytis cinerea* on bean leaves. It is also concluded that hyphae of the biocontrol fungus penetrated the epidermis and upper cortex of the plant root. Metabolism of Germination Stimulants, pathogen propagules were induced to germinate by artificial means.

Keywords: Mycoparasitism, Antibiotic, Competition, Enzymes, Germination Stimulants.

BIOLOGICAL CONTROL SYSTEMS OF WILT DISEASES**Dr. Archana Srivastava & Shenu Sankhwar**

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Biological control systems with an eco-friendly approach are one among the alternative methods to control wilt diseases. The potential role of biological control agent such as antagonistic fungi. Use of such biological control agent is a harmless method in controlling wilt diseases thereby reducing hazardous pesticides use and environmental pollution. Consequently, more efficient *antagonistic fungi operative proper inhibitory effect against wilt diseases under laboratory and green house effect*. Such control agents have also shown direct beneficial for plant growth development and stimulating defence against diseases. The efficient high capabilities bioagent are successful prevented of wilt diseases. In this well planned has sufficient equitable of its academic content in the eco-friendly bio control of wilt diseases. The biological control system techniques for enhance survivability of these antagonists in different organic substrates and develop effective biological formulations are becoming priority research for most of the agricultural scientists associated with biological management of wilt diseases. Biological control system is one of these environmentally friendly.

Keywords: Biological control system, wilt disease,

PATHOGENECITY OF *HETERORHABDITIS* SPP. ISOLATE CH18 AGAINST *GALLERIA MELLONELLA***LOVELY BHARTI* AND A.K. CHAUBEY****Nematology Laboratory, Department of Zoology,
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Heterorhabditis indica isolate CH18 isolated from the soil of Meerut District, Uttar Pradesh. To calculate the pathogenicity of the collected isolate, six well plates bioassay was carried out at different inoculums against the pet of the honey comb, *Galleria mellonella*. Four concentrations of IJ viz. 25, 50, 100 and 200 were prepared in 300 µl double distilled water using fresh emerged IJs. Mortality in insect larvae was recorded in all concentrations of isolate after 24 hour post infection period (PIP). At 48 hour post infection period, 90% mortality was observed. No mortality was recorded in control group. LC_{50} and LT_{50} values were also calculated to judge the pathogenicity of isolate by probit analysis at three different post infection periods viz. 24, 36 and 48 hours at different concentrations viz. 25, 50, 100 and 200 IJs/Larva. Higher LC_{50} value was recorded at 24 hour PIP which was about 96 IJ/larva confirming the high pathogenicity of present isolate. On the basis of LT_{50} , the present isolate was also found to be highly virulent showing LT_{50} values of 24.94, 24.02, 22.31 and 20.18 IJs/Larva at 25, 50, 100 and 200 IJs/Larva respectively at 24 hour exposure. Thus the present isolate caused 100% mortality with all lethal concentrations within 36 hour. Thus the *Heterorhabditis indica* isolate CH18 can be used in IPM against the *Galleria mellonella*.

Keywords: *Heterorhabditis*, *Galleria mellonella*, pathogenicity, LC_{50} , LT_{50} 

ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM SUGARCANE**BY KOLLURI RAMU¹, AMIT KUMAR² AND SHASHANK GUPTA³**DEPARTMENT OF PLANT PHYSIOLOGY, INSTITUTE OF AGRICULTURAL SCIENCE, BANARAS HINDU UNIVERSITY, VARANASI.
ABSTRACT

Use of plant growth promoting rhizobacteria (PGPR) gaining more importance in future aspects of agriculture. PGPR acceptance by world gives us future trend. It is the important tool to increase the yield potential of different crops. Sugarcane is the important commercial crop in Indian agriculture. Sugarcane is majorly cultivated for producing products like sugar, jaggery, ethanol, molasses, baggase, press mud etc. There is wide need of increasing the yield of sugarcane. This can be achieved by identifying the potential PGPR for particular sugarcane varieties and specific PGPR strains. PGPR identification and isolation can be reported by using parameters like indole acetic acid (IAA) production, phosphorus solubilisation, siderophore production and antagonistic against the pathogen especially *Colletotrichum fulcatum*, which cause red rot disease in sugarcane *in vitro*, pyrroloquinoline quinone activity (PQQ), Extracellular polymeric substances (EPS). The identified potential PGPR can be conserved by sub culturing using suitable media (nutrient agar media) or sent to microorganism banks. Conservation of important microbial diversity in field level is very much emphasised to increase the yield of crops.

Keywords: PGPR, IAA, phosphorous solubilisation, siderophore production, antagonistic, PQQ, EPS.

EFFECT OF POST HARVEST APPLICATION ON VASE LIFE OF FLOWER**Lyang B. Sangama** and A. K. Chaurasiya***

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Keeping quality and length of vase life are important factors for evaluation of cut flowers quality, for both domestic and export markets. Studying the effect of post-harvest gibberellic acid and benzyl adenine applications on keeping quality and vase life of cut gerbera flowers during vase period is the approach taken. The cut flowers were harvested and were kept in vase solutions containing gibberellic acid and benzyl adenine (with distilled water). Sucrose at 4% was added to all treatments as a base solution. The changes in relative fresh weight, water uptake, water loss, acceptability, scape bending, vase life at 50% fading and biochemical changes were estimated during vase period. The results showed that the relative fresh weight, water uptake, water loss and vase life decreased significantly during experiment for all treatments. A significant difference between gibberellic acid, benzyl adenine and control treatments in all measured parameters is observed. During vase period, the gibberellic acid treatments maintained significantly a more favourable relative fresh weight, water uptake, water loss, as compared to control treatment. Also, the results showed that the using gibberellic acid increased significantly the vase life cut gerbera flowers, over control. The highest values of measured parameters were found when plants were treated post-harvest application of gibberellic acid at 50 ppm. The result revealed that the quality attributes and vase life of cut gerbera flowers were improved by the use of gibberellic acid treatment.

MANAGE OF SEED QUALITY FOR BETTER PRODUCTION OF SUGARCANE CROP IN BIHAR AND UTTAR PRADESH**Mukesh Kumar, Varucha Misra, A. K. Mall*, B. D. Singh and A. D. Pathak**

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Sugarcane is an important crop of India grown for multiple purposes wherein Uttar Pradesh, Bihar, West Bengal, Maharashtra, Gujarat, Tamil Nadu, Karnataka, Andhra Pradesh, Haryana and Punjab are the major sugarcane producing states occupying an area of 49.53 lakh ha of the total area allocated to sugarcane cultivation in the country in the year 2015-16. However, sugarcane production and productivity under small holder farming system are constrained by biotic, abiotic and socio-economic factors. This results in deterioration in cane yields along with poor quality of cane seed.

Production of good quality seed cane is an important criterion for raising and producing an economically good sugarcane crop. Globally sugarcane breeders develop better adapted and high yielding varieties to meet the requirement of the sugar industry. But inadequate availability of quality seed of new sugarcane varieties and poor seed replacement rate adversely affect the realization of potential cane yield of varieties. It is well known that commercially this crop is propagated by vegetative means using cane setts (Three budded/two budded or single budded), seedlings, bud chips, micro-propagation and rayungans as planting material and it is apparent that planting material has substantial influence on sprouting of sugarcane. Thus, the selection of proper and suitable planting material is the most important factor among the various agronomic practices which require due attention. Temperature, seed, soil, use of resistance variety, fertilizers, weed, insect, disease, cultural practices, genetic and physical purity, planting methods and tissue culture etc. all affecting factors are discussed in this review article.

MANAGEMENT OF INSECT PESTS USING NANOTECHNOLOGY**D. Vamsi Chandrasekhar Reddy, Abhishek Yadav and Tara Yadav**

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Nanotechnology is the art and science of manipulating matter at the atomic or molecular scale and holds the promise of providing significant improvements in technologies for protecting the environment. Nanotechnology has the potential to revolutionize the existing technologies used in various sectors including agriculture. Insect pests are the major biotic factor responsible for crop losses. The major problem with synthetic insecticides is development of resurgence, resistance and residue problem. To combat this in this present decade several new formulations of



ecofriendly pesticides should be developed. But our main intention is to control the pest as early as possible. For that the most thrilling insecticides are nanopesticides.

Nanopesticides can be used as a better alternative to conventional pesticides. Nanopesticides have several advantages, unlike conventional pesticides these “Killer Spices” do not require extensive regulatory approval and are readily available. An additional advantage is that insects are less likely to evolve resistance – the ability to shrug off once effective toxins; they are also safer for farm workers, who are at high risk for pesticide exposure. But natural pesticides like botanicals and microbials tend to evaporate quickly & degrade rapidly in sunlight farmer need to apply pesticides to crops more frequently than conventional pesticides. Therefore new ways of making natural pesticides longer – lasting & more potent has been found. Nanoparticle-mediated gene transfer would be useful for the development of new insect resistant varieties. Use of nanoparticles for delivery of anti-microbiological or drug molecules will be at its helm in near future for therapy of all pathological sufferings of plant. Nanomaterials in different forms can be used for efficient management of insect pests and production of different formulations of potential pesticides. Therefore, it can be concluded that nanotechnology can provide green and eco-friendly alternatives for insect pest management without harming the nature.

MANAGEMENT OF STORED INSECTS IN RELATION TO CLIMATE CHANGE

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In the past, the effects of climate change were projected in connection with alterations in land and in the evolution of different forms of life. Changing climate trends have also shown direct and indirect relationships to agriculture and global food production. Numerous mitigation strategies are being developed to handle the crisis. Safe food grain storages by themselves are considered as a measure to adapt to the changing global climates and as a channel to food security. Stored grain is a man-made ecosystem undergoing incessant interactions between several abiotic (for example temperature, relative humidity, inter-granular CO₂ levels and moisture content) and biotic factors (such as insect pests, fungi, mites and rodents). Changing seasonal patterns would promote favourable conditions for the growth and multiplication of insect pests in new geographical regions. In general, delayed winters and rising seasonal temperatures would permit shorter periods for pests to complete their developmental cycles, thereby resulting in a much rapid built up in their populations. With respect to the insect type, different stages of its life cycle will show different levels of tolerance to climate change. For instance, eggs of *Tribolium confusum* are the most sensitive to increasing temperature and those of *Sitotroga cerealella* to CO₂. However, it is the larvae stage in case of *Oryzaphyllus surinamensis* and the adult stage in case of *Lesioderma serricorne* and *S. paniceum* that are the least tolerant to increasing levels of CO₂.

MANAGEMENT STRATEGIES FOR CONSERVATION OF NATURAL RESOURCES IN AGRICULTURE

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This paper suggests a holistic framework for assessment and improvement of management strategies for conservation of natural resources in agriculture. First, it incorporates an interdisciplinary approach (combining Economics, Organization, Law, Sociology, Ecology, Technology, Behavioral and Political Sciences) and presents a modern framework for assessing environmental management and strategies in agriculture including: specification of specific “managerial needs” and spectrum of feasible governance modes (institutional environment; private, collective, market, and public modes) of natural resources conservation at different level of decision-making (individual, farm, eco-system, local, regional, national, transnational, and global); specification of critical socio-economic, natural, technological, behavioral etc. factors of managerial choice, and feasible spectrum of (private, collective, public, international) managerial strategies; assessment of efficiency of diverse management strategies in terms of their potential to protect diverse eco-rights and investments, assure socially desirable level of environmental protection and improvement, minimize overall (implementing, third-party, transaction etc.) costs, coordinate and stimulate eco-activities, meet preferences and reconcile conflicts of individuals etc. Finally, it suggests recommendations for improvement of public policies, strategies and modes of intervention, and private and collective strategies and actions for effective environmental protection.

Keywords: - Environmental and Natural resources, governance and strategies.

ASSESSMENT OF GENETIC VARIABILITY IN *NIGELLA SATIVA* L. INDUCED BY CHEMICAL MUTAGEN (EMS)

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Black cumin (*Nigella sativa* L.) is an important annual medicinal plant, has been considered as cure for all diseases as well as a good source of spice in the family ranunculaceae, having very narrow range of genetic variability. For the genetic improvement of black cumin, induced mutagenesis techniques have the best recommended approach. Therefore, a study was undertaken to know the effect of EMS in black cumin to create genetic variability. With this view, the seeds of *Nigella sativa* L. were treated with different doses of EMS (0.1, 0.2, 0.3, 0.4, 0.5 and 0.6%), to induce variability of black cumin (*Nigella sativa* L.) and the untreated seeds were taken as control. The observations were made on the cytological, physiological and morphological parameters of *Nigella sativa* L. in M1 generation to establish the mutagenic potency of the treatments and selection of desirable plants for further propagation. It was found that the cytological and physiological abnormalities were increased with increased in strength of concentration of EMS and lower concentrations generated few variants for future generation. Overall, the sensitivity was found to be more in higher concentrations as compare to lower concentrations of EMS.

Keywords: Genetic variability, Induced mutagenesis, EMS, *Nigella sativa* L.



A COMPARATIVE STUDY OF GENETIC DIVERSITY USING MORPHOLOGICAL AND MOLECULAR DESCRIPTORS AMONG TROPICAL AND SUBTROPICAL MAIZE INBRED LINES (*ZEA MAYS* L.)

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The present investigation was conducted to understand the genetic relationship among twenty four tropical and subtropical elite maize inbred lines (DM-RIL-47, NAI-147, CM-142-393-1, MGU-138-3053, CM-212-3142, CML-152-3058, SE-547-3037, BLSB-RIL-92, VQL-1, HKI-193-1, CM-152, HKI-209, HKI-287, SC-7-2-1-2-6-1, CML-119, HKI-1025, HKI-1105, HKI-335, HKI-323-8, CML-147, CML-150, CML-395, HKI-162, CML-421-CML-170) using eleven morphological parameters (both qualitative and quantitative) viz., 50% silk, 50% tassel, 75% maturity, plant height, ear height, ear length, ear diameter, number of kernel rows per ear, number of kernels per row, 100 kernels weight and grain yield per plant and 42 Simple Sequence Repeats at molecular level. The findings of the study depicted existence of considerable amount of variability among the test inbred lines using both morphological and molecular descriptors. The dendrogram created using D² analysis grouped these twenty four inbreds into five major clusters with minor sub grouping within the major clusters. The intra cluster distances ranged from 82.47 to 29.76. Similarly, cluster dendrogram produced on the basis of SSRs using NTSYSpc programme separated inbreds into six main clusters with sub clusters based on genetic similarity. A total of 107 alleles with an average of 2.55 alleles per locus were detected. The polymorphism information content (PIC) values of 42 SSRs loci ranged from 0.08 (UMC1428) to 0.68 (UMC2189 and UMC2332) with the overall calculated PIC mean value of 0.44, whereas the discrimination rate (DR) value for SSR markers ranged from 0.09 (UMC2089) to 0.42 (UMC1311) with the average DR value of 0.26 representing the existence of adequate amount of genetic divergence among the genotypes. Cluster analysis of morphological and molecular markers distances did not show the same population grouping. Since the morphological characters are influenced by the environmental and several other factors, Whereas, Molecular markers were found free from such limitations and capable to providing more precise information on genetic diversity. Thus, the assessment of genetic diversity could facilitate a reliable selection of parents for hybridization as well as assessment of the genetic variations present in the germplasm. Further, this information could be helpful for biodiversity conservation programmes related to maize crop and for sustainable agricultural development in the present global scenario which is threatening by several issues like global warming, food security etc to the mankind.

TILLING: A TRADITIONAL MUTAGENESIS FOR FUNCTIONAL GENOMICS AND CROP IMPROVEMENT

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In TILLING (for Targeting Induced Local Lesions in Genomes), traditional chemical mutagenesis is followed by high-throughput screening for point mutations. TILLING extends the long-established practice of using existing variation for functional genetic discovery. Its dependence on technology that discovers sequence variation means that forthcoming advances in SNP detection and in DNA sequencing can enhance TILLING. TILLING is no different from traditional mutation breeding as far as the organism is concerned, so genetically modified organism issues do not arise. This makes TILLING an attractive strategy not only for functional genomics, but also for agricultural applications. TILLING is a reverse genetic approach, currently being used for inducing and identifying genetic variation in several plant and animal species. TILLING searches the genomes of mutagenized organisms for mutations in a chosen gene, typically single base-pair substitutions. Its advantages over other reverse genetic techniques includes its applicability to virtually any organism, its facility for high-throughput and its independence of genome size reproductive or generation time. TILLING used as a SNP discovery tool to examine DNA variation in natural populations is called EcoTILLING. Germplasm accessions are used instead of mutants and haplotyping of different loci is possible with EcoTILLING. Under specific circumstances, where conventional methods may be found to be inadequate, the mutational approach could become crucial to further success in breeding of many crop species. For producing phenotypic variants without introducing foreign DNA into plant's genome and for identifying DNA polymorphisms TILLING method is best suited where other options are limited. This chapter covers practical aspects of the technology, ranging from building the mutagenized population to mutation discovery, and discusses possible improvement. Review Article scols, TILLING Informatics and the impact of new genomic methods for mutation discovery in relation to the future of the T

Keywords: TILLING, Mutagenesis, SNPs, EcoTILLING, Genomics

GENOMICS-ASSISTED BREEDING FOR DROUGHT TOLERANCE IN MAIZE

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Maize (*Zea mays* L.) is the world's most widely grown cereal and is the primary staple food in many developing countries. Drought is a worldwide phenomenon and is a major production constraint, reducing crop yields. In India the previous conditions in agricultural sector were not favourable, added to that severe droughts were enough to shake India's GDP. India has already faced three droughts between 2000 and 2009. Parts of Rajasthan and Andhra's Anantapur and Chittoor districts see two droughts in five years. Each degree day spent above 30 C reduced the final yield of maize by 1% under optimal rain-fed conditions, and by 1.7% under drought conditions. The complex nature of drought resistance requires a multi-pronged approach to breed new varieties with stable and enhanced yield under drought stress conditions. High throughput genomics allow marker-assisted selection (MAS) and genomic selection (GS) which offer rapid and targeted improvement of populations and identification of parents for rapid genetic gains and improved drought-resistant varieties through genome assisted breeding. Marker-assisted breeding and genome selection will gradually evolve into genomics-assisted breeding for crop improvement.

Keywords: Maize, Drought, Marker assisted selection and Genomic selection.



EFFECT OF GLUCOSE CONCENTRATION ON GROWTH OF BACTERIAL ISOLATES UNDER ALUMINIUM STRESS**Priyanka Arora^{1*}, Geeta Singh² and Archana Tiwari¹**¹School of Sciences, Noida International University, G.B Nagar, Greater Noida, U.P²Division of Microbiology, Indian Agriculture Research Institute (IARI), New Delhi

Aluminium is one of the most abundant metals. This metal is responsible for inhibiting growth and productivity of many cultures thereby affecting the metabolism of most of the microbes. The current study is aimed at examining the effect of glucose addition on bacterial growth under aluminium stressed conditions. For this purpose, nutrient broth was supplemented with different concentration of aluminium viz. 0mM, 20mM, 60mM and 80mM. In addition to above heavy metal supplementation, the nutrient broth was additionally provided with varying concentration of glucose (0.25%, 0.5% and 1% glucose). The *Bacillus* and *Burkholderia* cultures were allowed to grow in all possible combinations of provided aluminium and glucose concentrations. In case of *Bacillus* culture, when media was supplemented with 0.5% glucose, the culture growth was increased upto 2-folds in 20mM aluminium toxic conditions whereas growth of *Burkholderia* strains increased upto 2-folds, 11-folds and 5-folds in case of 20mM, 60mM and 80mM aluminium stressed conditions respectively. The results conclude that under aluminium toxic conditions, 0.5% glucose supplementations could prove to be beneficial for bacterial optimal growth.

CHEMICAL MUTAGEN INDUCED HIGH YIELDING AND HIGH PROTEIN MUTANTS OF COWPEA (*VIGNA UNGUICULATA* L.)**Aamir Raina, Samiullah Khan**

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Mutation induction in plant breeding supplements the existing germplasm and can be directed to improving specific traits. The induction of mutations has been used to enhance the yield, better nutritional quality and wider adaptability of world's most important crops such as wheat, rice, pulses, millets and oilseeds. Cowpea (*Vigna unguiculata* L.) is one of the famous legume crops used as food and fodder, however, the seed yield is affected by various biotic and abiotic stresses. Keeping this constraint to yield in view we took an induced mutations programme with the primary objective of developing some high yielding and high protein mutants. Dry, dormant and healthy seeds of cowpea var. Gomti vu-89 were treated with different doses of sodium azide (0.01% to 0.04%) to raise the M₁ and M₂ generation. Seeds harvested from high yielding M₂ mutants were analyzed for total seed protein and the protein profile using Lowry method and SDS-PAGE respectively. The mean seed protein content of the mutants showed a slight but significant improvement over the controls. SDS-PAGE analysis of the seed storage proteins of the high yielding mutants of chickpea revealed the polymorphic changes in polypeptide chains, in terms of variation in the number and intensity of bands, from the control as well as amongst themselves. Protein profiling through SDS-PAGE analysis may be helpful in determining the response of any mutant genotype towards the abiotic and biotic stresses. Induced mutagenesis, through chemical mutagens, is an important method to enhance seed yield and protein content in cowpea and it also offers a promising technique to combat the food security issues. Mutant seeds can serve in a future as a hope for overcoming malnutrition problem throughout the world.

Keywords: cowpea, sodium azide, protein content, induced mutants.**EFFECT OF BASIC FUCHSIN DYES ON SOIL MYCOBIOTA****Permod Kumar¹ Raj Singh¹, Anju Rani¹ and Pradip Kumar²**¹ Department of Botany, K.V. Faculty of Science, Swami Vivekanand Subharti University Meerut, UP, India.² Department of Biotechnology, C. C.S. University Meerut, UP, India.

Soil samples treated with basic fuchsin dye (1000 ppm, 1500 ppm and 2000 ppm) for 90 days analyzed for basic fuchsin –tolerant fungal species using dilution plate method, after 30, 60 and 90 days of treatment. In all, 15 species of fungi were isolated. Slightly lower number of fungal species were obtained and 8 species could not be isolated, from control soil (treated with water only) after 30, 60 and 90 days as compared to that, from initial soil sample. However, treatment with basic fuchsin led to substantial decrease in the number of species isolated. Only three species viz., *Aspergillus niger*, *Aspergillus flavus* and *Aspergillus fumigatus* were found to be highly tolerant to higher concentration (2000 ppm) of basic fuchsin for 90 days. *Aspergillus niger* and *Aspergillus fumigatus* appear to be quite resistant to dye as these survive to a significant extent after treatment with basic fuchsin solution for 90 days.

BIOCHEMICAL BASIS OF STARCH BIOSYNTHESIS TO IMPROVE QUALITY ASSOCIATED WITH NUTRITION**Vivek Chandra Verma and Sanjeev Agrawal**

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The present investigation will be focussed on biochemical basis of starch biosynthesis in cereals like wheat rice and millets. Starch properties determine the key functional properties such as cooking, temperature and influence human health through its contribution to the glycemic index and levels of resistant starch. High amylose cultivars usually have more resistant starch and lower estimated glycemic index. The variation in the size and shape of starch granules is attributed to the biological origin. The granular structures of wheat, rice and millets starches show significant variations in size and shape when viewed by SEM. The rice starch granules are pentagonal; foxtail millet starch granules are polygonal. The size of the starch granule in barnyard millet ranged from 1.2-10µm slightly bigger than the other millet starches granules. Amylose content has been determined in the wheat and millets. The relative weight percentages of amylose and amylopectin range between 72 and 82%



amylopectin, and 18 and 33% amylose in cereal endosperm starches. Starch biosynthesis in the cereal endosperm requires the coordinated activities of three enzymes, including ADP-glucose pyrophosphorylase, starch synthase viz. granule-bound starch synthase, soluble starch synthase and starch debranching enzyme will be estimated in cereals. Enhanced starch biosynthesis greatly influences the grain yield of cereals. The properties of starch granules in cereals influence the eating and cooking qualities of grains. Thus, a better understanding of the processes underlying starch biosynthesis is essential for improving grain yield and quality in cereals through biotechnology approach. In order to review study it was found that the enzymes activity changes and the expression levels of genes SSS, GBSS and SBE had some correlation with the rates of starch synthesis. Keeping all the factors in mind it is important to ascertain the biochemical basis of starch biosynthesis in cereals attributing towards resistant starch.

Keywords: Starch, Amylose, Amylopectin, ADPG, SBE, GBSS, SSS

MOLECULAR CHARACTERIZATION OF SIKKIM GOATS

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Genetic characterization of these animals was carried out using a battery of twenty three microsatellite markers. Microsatellite markers provided 203 alleles. The average observed and effective numbers of alleles were 8.826 ± 0.621 and 3.388 ± 0.308 respectively. All the loci studied were polymorphic in nature. A polymorphic Information Content (PIC) value varies from 0.363 to 0.892 with an overall mean of 0.662 ± 0.33 . Overall mean observed (H_o) and expected (H_e) heterozygosity were 0.471 ± 0.038 and 0.646 ± 0.032 this population was in Hardy-Weinberg equilibrium at most of the loci studied. The overall mean within-population inbreeding estimate (F_{IS}) was 0.275 ± 0.042 showed moderate level of inbreeding. The population was stable with respect to size and was non-bottlenecked. The observed normal L-shaped curve indicated no mode shift in the population.

Keywords: Genetic characterization, PIC, heterozygosity, bottleneck

CHANGES IN HEMOCYTE POPULATION OF *G. MELLONELLA* AGAINST *HETERORHABDITIS* ISOLATE CH2

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The present investigation was carried to study the effects of *Heterorhabditis indica* CH2 on hemocytes of the *Galleria mellonella*. 19 IJs/larva doses were used for hematological studies and total hemocyte count (THC) and differential hemocyte count (DHC) were observed after every 6 hours till 24 hours Post Infection Period (PIP). Different hemocytes including prohemocytes, plasmocytes, granulocytes, spherulocytes, oenocytoids and adepohemocytes were seen during study and were distinguished based on morphological parameters. Initially the THC showed elevated profile and increased to 53.3% at 6 hours PIP but after 12 hours, there was sharp decrease (24.1%) and consequently followed the descending pattern after 18 and 24 hours PIP when compared with control group. In control group, THC showed fluctuating profile during this study period. The fluctuations were noticed during DHC after 6 hours till 24hours PIP. Prohemocytes initially showed an elevated profile after 6 hours PIP, however, after 12, 18 and 24 hours PIP showed reduction. The most prominent cells viz. plasmocytes decreased just after 6 hrs PIP and increased after 12 hrs but 18 and 24 hours production of these cells declined as compared to control group. Spherulocytes increased after 6, 12, 18 and 24 hours PIP but enormous increment was observed only after 24 hours PIP. Fat droplets serving as reserve food for growing larvae also showed increment and decrement in their percentage values during these PIP. Further detailed study is required on this line of research.

Keywords: Hemocytes, THC, DHC, morphological, Post Infection Period

IMPROVING DROUGHT TOLERANCE IN PEARL MILLET THROUGH MARKER ASSISTED BREEDING

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is an annual, diploid, highly allogamous cereal crop with seven chromosome pairs. It is an important forage and food crop in arid and semiarid regions of India and Africa. Globally, it ranks fifth among most important cereals in terms of area cultivated after rice, wheat, maize and sorghum. Drought stress during the terminal stages leads to heavy reduction in yield and hence making stress tolerance a crucial attribute of pearl millet improvement. Marker assisted breeding is an effective tool for achieving these objectives. Major QTL associated with drought tolerance are present at Linkage group 2 and 5. The pearl millet hybrid HHB226 was used for improvement against terminal drought stress, where QTLs identified for drought tolerance were introgressed from PRLT2/863B (donor parents) to HBL11 (recipient parent), one of the parents in HHB 226. SSR markers were used to carry out molecular analysis between donor and recurrent parent and 4 SSR markers out of 11 were found polymorphic. The F_1 plants were raised and backcrossed with recurrent parent till BC_4F_1 generation which was then selfed to produce BC_4F_2 generation. The plants were selected in each generation using polymorphic SSR markers. In BC_3F_1 generation a total of 90 plants were analyzed for the presence of drought tolerance QTL and 21 plants were found positive for both the crosses. The selected plants were used for the background selection to select the plants with maximum recurrent parent genome recovery. Background selection is in progress for BC_4F_2 generation.

Keywords: Pearl millet, SSR, QTL's, MAS, linkage group.



COMPUTATIONAL MODELING AND ANALYSIS OF VARIETAL EFFECTS ON GROWTH AND YIELD OF RICE USING IFSS VER. 1.1 MODEL IN WESTERN PLAIN ZONE OF UTTAR PRADESH

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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 rice of cultivars. The objectives of the field experiment were to simulate the various parameters of growth and grain yields of crop to find out best cultivar that resulted into highest yield on the basis of validation of the model performance and also to calibrate the genetic coefficients of various cultivars of crop rice for IFSS Ver.1.1 model.

The highest grain yield (5839 kg/ha) was recorded in crops 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 (Normal) and T₃ (Control). In general higher grain yield of rice 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. However during *kharif* 2014, test weight was higher over to *kharif* 2013. Result of phonological observations showed that the highest days taken to panicle initiation (49.3 days), days to flowering (63.7days) and days taken to achieve the dough stage (81.7days) 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 milking stage by the crop were 71.1days in T₂, 61.2days in T₃ and 60.7days in T₁. The highest days taken to milking stages were found similar in year *kharif* 2013 and 2014.

Out of seven parameters related to grain yield of rice viz, test weight, panicle initiation, flowering, milking stage, dough stage and physiological maturity significantly contributed in the determination of grain yield. The coefficient of determination R²=0.938 was calculated following the stepwise regression analysis. The regression equation {Grain Yield (kg/ha) = 809.7+71.3*(test weight) +160*(PI)-100.3*(Flowering)-21.5*(Milking Stage) +16*(Dough Stage) +7.6*(Physiological Maturity)} was fitted in the model for development of the soft ware (IFSS ver.1.1) for decision support systems as a rice component/module.

MUTATION BREEDING, USE OF IRRADIATED POLLEN FOR IMPROVEMENT OF HORTICULTURAL CROPS

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Existence of natural variation is of utmost importance for improvement of horticultural crops, but in absence of the same it would be impossible. In this view, major aim of mutation-based breeding is to develop and improve well-adapted plant varieties by modifying one or two major traits for increasing productivity and quality on a positive side. An advantage of mutation breeding is that the cultivars developed through this approach generally do not face the regulatory, intellectual property, and economic challenges which generally limit the cultivation of transgenic horticultural plants. Till date, more than 16-18 horticultural crops have been screened for natural or induced allelic diversity for many candidate genes. Mutation have made improvement over commercial traits like virus-resistance (peppers, tomato), improved starch quality (potato), longer shelf-life (tomato, melon) and many more. Another important use of Mutation breeding is in fruit breeding. Demand of seed less fruit in a short duration is high enough and for achieving this, use of irradiated pollen is an advance mutation based technique which induce parthenogenesis and haploid production in fruit crops. Doubled haploids (DHs) are then obtained by the spontaneous or induced doubling of their chromosome numbers which is an efficient system to increase the range of applications of mutation techniques, facilitating the screening for both recessive and dominant mutants, avoiding chimerism and shortening the time taken up by breeding programmes. Production of haploids *via* irradiated pollen induced parthenogenesis is based on the 'Hertwig effect'. Among all the types of radiation available for mutagenesis X-rays and most preferably gamma rays, have been used, particularly for fruit trees viz., kiwi, citrus, apple, pear plum and cherry etc. Though substantial progress has been made but future demand calls for a more use of these techniques for better improvement of horticultural crops.

Keywords: Mutation Breeding, horticultural crops, irradiated pollen, Parthenogenesis, Haploids.

CONSTRAINTS PERCEIVED BY GOAT KEEPERS IN ADOPTION OF GOAT HUSBANDRY IN WESTERN U.P.

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The present study was undertaken to investigate the constraints faced by Goat farmers in Western U.P. The data collected from 250 households during 2013-2014 revealed that marketing management was the main constraints faced by 89.50 % goat farmers followed by breeding management, health care and feeding management by 89.33, 86.40 and 84.80 % farmers respectively. The main constraints regarding feeding management was lack of knowledge about balance feeding, high cost of feeds and fodder, lack of irrigation facilities non availability of green fodder. Lack of knowledge about importance of mineral mixture and shrinking grazing land. Regarding breeding, main constraints were inadequate availability of breeding buck, lack of knowledge about breeding practices and indiscriminate breeding practice with respect to health care the major constraints were lack of veterinary services in village, high cost of treatment, ignorance about importance of de-



worming, lack of knowledge about common disease and vaccination programme not carried out by any agency. With respect of marketing the main constraints were lack of marketing infrastructure, middleman not fetching remunerative price to male kids, unorganized goat owners and not even a single agency help in marketing. Considering above facts, it is suggested that appropriate strategy might be formulated for the development of the goat farming and also for the goat farmers

EFFICACY OF CHEMICALS AND BOTANICALS ON *VARROA DESTRUCTOR*, AN ECTOPARASITE ON *APIS MELLIFERA*

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Among various pests, the serious ectoparasitic mite, *Varroa destructor* Anderson & Trueman is a subject of concern to beekeepers worldwide as it feeds on haemolymph of brood and adult bees causing colony collapse disorder, weakness, decrease in brood and deformation of bees. Present investigations on these aspects were carried out during 2016-17 at Faculty of Agriculture, Wadura SKUAST-Kashmir. Evaluation of chemicals (Formic acid, Oxalic acid and Taufluvalinate) and botanicals (*Artemesia annua*, *Matricaria chamomilla*, *Juglans regia* and mixture *A. annua* + *M. chamomilla* + *J. regia*) was carried out under Complete Randomised Block Design (RCBD) for management of *V. destructor*. The studies revealed that among chemicals Taufluvalinate (2 strips per colony) was found highly effective (78.93 %) against the *V. destructor* mite followed by Formic acid 85 % @ 2 ml per colony with efficacy of 74.83 per cent. However, in case of botanicals green leaf extract mixture @ 150ml/colony was found highly effective against *Varroa* mite followed by *M. chamomilla*. The order of efficacy of treatments was Taufluvalinate (78.93 %) > Formic acid (74.83%) > Oxalic acid (72.16 %) > GLE mixture (67.10 %) > *M. chamomilla* (63.83 %) > *A. annua* (61.87 %) > *J. regia* (58.34 %). Based on the present studies, relying solely on single treatment with a chemical or botanical is not sufficient to maintain *Varroa* mite population below the economic injury level.

CONSERVATION EFFORTS IN WHEAT GENETIC RESOURCES AT THE NATIONAL GENE BANK, ICAR- NBPGR

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The National Genebank located at Indian Council of Agricultural Research- National Bureau of Plant Genetic Resources is one among the largest genebanks in the world, with a germplasm holding of 4, 32,787 accessions belonging to 37 crops represented by more than 1500 species. The genebank conserves a very large collection of wheat germplasm, comprising of 33,429 accessions of both indigenous and exotic origin. This wheat germplasm collection is a gold mine of genetic diversity that has been collected and conserved over a period of more than 30 years. The wheat collection has accessions representing the entire species diversity (55 species). The total wild wheat germplasm collection is around 2300 accessions. Among the cultivated genotypes (*Triticum aestivum*, *T. durum* and *T. dicoccum*), there are more than 300 genetic stocks having economically important traits and around 400 varieties released and notified by the central variety release committee. Among the exotic accessions, the major imports have been received from CIMMYT, Mexico, followed by the United States Department of Agriculture (USDA) and ICARDA, Syria. The entire conserved germplasm of cultivated wheat (around 22,000) was subjected to characterization and evaluation at multi-location sites, and this mega programme was cited in the Limca Book of Records. The major outcome of this effort was (i) development of a core set of wheat germplasm comprising 2760 accessions representing the total genetic diversity, (ii) identification of sources of rust and spot blotch resistance and (iii) development of a reference set for terminal heat stress tolerance in wheat germplasm. The germplasm accessions are also utilized by wheat breeders across the country in their research programmes.

GENETIC ANALYSIS OF SEGREGATING POPULATION IN RICE (*ORYZA SATIVA* L.) DERIVED FROM CROSS BETWEEN BASMATI AND *INDICA* (SALT TOLERANT)

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Rice (*Oryza sativa* L.), is one of the important food crop for over half of the world's population and supplies 20 percent of daily calorie intake. But its production is affected by many biotic and abiotic factors. Salinity, a major abiotic stress adversely affects crop productivity and quality. Rice is found to be sensitive to salinity especially at seedling stage and at reproductive stage. There is about 12 percent reduction in grain yield per degree increase in electrical conductivity (EC) beyond the threshold value of 3.0dSm⁻¹. Soil salinity is a major problem which is further increasing because of the consistent use of water for irrigation which is of reduced quality. Soil reclamation and improving salt tolerance in target crops are two methods by which we can overcome the reduction in yield due to salt stress. The selection process for the target trait can be increased by the use of molecular markers which can tag quantitative trait loci (QTL). The identified QTL associated with the phenotypic effect can further be used in the marker assisted breeding approach. Microsatellite markers (SSRs) being highly polymorphic and co-dominant have been extensively used for genotyping and diversity analysis in rice. Pusa1121 x CSR10 F₂, F₃ and F₄ plants have been used in the present study. The seedlings have been treated with 40mM of NaCl and seedlings showing resistance towards salt stress have been raised up to maturity and molecular analysis have been done using SSR markers. BAD2 aroma locus has also been tested for the selected plants.

Keywords: Electrical conductivity (EC), Quantitative trait loci (QTL), SSR



ROLE OF NANOTECHNOLOGY IN INSECT-PEST MANAGEMENT

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Research and technology development at the atomic, molecular and macromolecular level at the scale of approximately 0.1-100 nanometer range, to provide a fundamental understanding of phenomena and materials at the nanoscale and to create and use structures, devices and systems that have novel properties and functions" (National Nanotechnology Initiative (NNI), USA). The potential uses and benefits of nanotechnology are enormous. It is used to make products smaller, cheaper, faster and better by "scaling" them down (Electronics, catalysts, water purification, solar cells, coatings, life-science, etc. It introduces new physical phenomena for science and technology. In agriculture, the use of nanoparticles that encapsulate pesticides can improve delivery systems and therefore limit undesirable impacts. Nanocapsules are already being incorporated in the development and formulation of agrochemicals. In insect it is used for marking insects, in detecting and tracking of biological molecules and detection of mode of action of chemicals. 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. This art is focused on traditional strategies used for the management of insect pests and potential of nanomaterials in insect pest control as modern approaches of nanotechnology

EFFECT OF NANOCHITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION

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Nanoparticles are materials with a particle size of 1- 100 nm. Nanotechnology have led to the creation of various chitosan based nanoparticles. Chitosan is a bio-compatible, biodegradable, non-toxic material and could be an alternative to synthetic agrochemicals applied in agriculture. Nanochitosan will have essential role in the controlled release of agrochemicals for protection against pests and pathogens, soil fortification, drought tolerance and plant growth. Nanochitosan can also efficiently enhances photosynthesis, promotes plant growth, increases nutrient uptake and seed germination rate. In this study, effect of Nanochitosan was evaluated on plant growth parameters and soil bacterial population. It was observed that Nanochitosan not only enhanced rate of seed germination upto 24 percent over control but all other parameters like root length, shoot length, fresh weight and dry weight, chlorophyll content and protein content of plants were also showing hike by two fold over control. For the soil health assessment Colony Forming Unit was done on Nutrient Agar and Aleksandrow Agar media which showed two fold increase, whereas soil protein was enhanced by 1.5 fold over the control. The above results suggests important applications of Nanochitosan in agriculture which was found to be not only beneficial for the crop productivity but also maintain soil health.

CROP IMPROVEMENT THROUGH RNA MEDIATED GENE SILENCING APPROACHES

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Crop improvement against all the challenges is the key strategy for well-being of the farmer. Altering the crops for their enhanced performance involving modern technology approaches is underway. Achievements in transgenic plants are impacting crop improvements in unparalleled ways. In this view, significant achievement has been made through reverse genetic approaches over the last two to three decades by silencing the genes and their incorporation into different crop plants to get desired characteristics. Since then several gene silencing technologies have been proven promising for crop improvement. Among these RNA interference and Antisense RNA technologies are provides the wide range of scope for upgrading of crops. During the last thirty years molecular biology has transcended the conventional approaches. This was achieved by cloning of gene and expression of that gene for desired trait. Such a technology though offers numerous advantages but some limitations are linked to these approaches. With the advent of technologies in molecular field and better understanding regarding nucleic acids has facilitated desirable alterations within a crop plant genome itself. In Antisense technology, synthetically produced complementary molecules seek out and bind to messenger RNA (mRNA), blocking the final step of protein production. The antisense RNA technology involves the cloning of a particular gene in reverse orientation with strong promoter while in RNA interference, silencing of a gene is a consequence of degradation of RNA into short RNAs that activate ribonucleases to target homologous mRNA, thus stopping production of protein. Both of post transcriptional gene silencing approaches has been used successfully in plants to enhance the nutrition, shelf life, reduced alkaloids and polyphenol production, improved resistance against stresses etc.

Keywords: Reverse genetic approach, Gene silencing, RNA interference and Antisense RNA

GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (*ORYZA SATIVA* L.)

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Rice (*Oryza sativa* L.) is one of the most important staple foods in the world's population. These QTL alleles of yield related traits make a significant contribution of high yielding rice breeding program. The QTL as a genetic locus where functionally different alleles segregate and cause significant effects on a quantitative trait of advent molecular marker technology, QTL mapping on chromosome linkage maps has



become a standard procedure in quantitative genetics. They can be used to identify the QTLs with dominance effects in the whole rice genome. Thousand-grain weight (TGW), grain number per panicle (GPP) and panicle number per plant are the three yield components traits. However, TGW and GPP were often focused in the past QTL mapping studies due to their direct contribution to yield. The molecular markers developed for QTL analysis of enhancing breeding efficiency by marker assisted selection (MAS) for particular agronomic traits. Plant Breeders have focused on improving plant architecture as effective to increase yield potential in rice production. The demand of high yielding rice production for increasing greater stability to human population and changing global climate. In this study, we are using different kinds of rice germplasm and QTL information including its genome position and genetic effect. We mainly focus on the genetic action of major QTLs and phenotypic traits for improvement in rice breeding programme.

Keywords: QTL, MAS, TGW, GPP, Rice and Yield

ELUCIDATING GENETIC DIVERSITY IN 180 GERmplasm LINES OF BREAD WHEAT FOR DIFFERENT YIELD AND COMPONENT CHARACTERS

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Knowledge about diversity and genetic relationships of available crop germplasm is very important for planning crop improvement strategies as well as genetic resource conservation. Precise information on the nature and degree of genetic diversity helps the plant breeders in choosing the diverse parents for purposeful hybridization. The more genetic diverse parents, there are greater chances of obtaining higher heterotic expression in F_1 's and broad spectrum of variability in segregating population. Incorporation of more divergent parents in hybridization can enhance the chances of attaining better heterosis and provide broad spectrum of genetic variability in segregating generation. The experimental materials for the present investigation comprised of 180 germplasm accessions and four checks. These genotypes were evaluated in augmented block design and observations were recorded for 16 different characters. The genotypes were grouped into 10 different clusters by non-hierarchical Euclidean cluster analysis. Cluster I, II, III, IV, V, VI, VII, VIII, IX, X had 24, 22, 4, 15, 41, 8, 18, 35, 11 and 6 genotypes, respectively. The maximum intra cluster distance was observed in cluster X (69.43) which revealed maximum genetic diversity among its constituents. Inter cluster distance was found maximum between cluster VI and cluster X (526.53) followed by cluster IX and cluster X (489.87), cluster IV and cluster X (455.32) and cluster III and cluster X (454.46). This indicates that the genotypes of cluster VI and cluster X, genotypes of cluster IX and cluster X are distinctly related to each other. The greater distance between clusters indicated that the genotypes included in these clusters revealed broad spectrum of genetic diversity and may be used in hybridization programme for wheat improvement. The hybrids developed from the selected genotypes within the limits of compatibility of these clusters may produce desirable transgressive segregants.

EFFECT OF PLASMA SEED TREATMENT ON QUALITY OF OKRA [*ABELMOSCHUS ESCULENTUS* (L.) SEED CROP

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The effect of cold plasma treatment on quality of okra [*Abelmoschus esculentus* (L.) cultivar P-8] seed crop was studied at Department of Seed Science and Technology, Dr Y. S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh. The experiment comprising of seeds of two different age viz., 'A1' (One year old seed) and 'A2' (Two year old seed) and seven plasma treatments of seeds viz., 'P1' (only vacuum, no plasma treatment), 'P2' (3 minute), 'P3' (6 minute), 'P4' (9 minute), 'P5' (12 minute), 'P6' (15 minute) and 'P7' (Control –Without treatment). The seeds with different combination of treatments were evaluated for different quality parameters studied in laboratory. It was found that crop raised from one year old seeds resulted in higher germination percentage (92.39 %) in comparison with crop raised from two year old seeds (86.29 %) and the seed treated with treatment 'P5' shows highest germination percentage i.e. 91.75 %. This may be due to higher thousand seed weight resulted in bolder seed and have sufficient food reserve, obtaining good quality fruits which resulted in higher germination percentage. Similarly other characters like speed of germination, seedling length, seedling dry weight, SVI-I and SVI-II were found to be maximum (40.48, 26.90 cm, 23.06 mg, 2486.16 and 2138.61, respectively) in one year old seeds and minimum (35.09, 26.01 cm, 21.89 mg, 2244.96 and 1890.79, respectively) in two year old seed. The reduction in seed quality parameters could be attributed to difference in one year and two year old seed is due to ageing. Whereas in all the plasma treatments 'P5' shows highest speed of germination, seedling length, seedling dry weight, SVI-I and SVI-II. These results indicated that cold plasma treatment might promote the growth and modify the speed of germination.

DOUBLE HAPLOIDS FOR ACCELERATED BREEDING IN RICE

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Double haploids (DH) are cells/plants with identical homologous chromosomes produced by a technique called anther culture. Anther culture is a tissue culture process in which excised anthers are cultured for obtaining haploid plants which were further treated with colchicine which will induce chromosome doubling for double haploid plant generation. Anther culture technique provides excellent platform for various breeding programs in which F_1 or F_2 hybrids itself are used to develop new varieties, instead of going for F_7 to F_8 population for homozygosity as done in conventional plant breeding. Anther culture technique is used to develop homozygous lines in short period of time (1-2 years). Anther culture protocol was standardized for different crosses of Rice hybrid involving genotypes Safri 17, PR 122, RP Bio 226 and Dubraj in which RP Bio 226 resistant to BLB and PR122 for BLAST resistant in rice. The authors have taken anthers from F_3 generation crosses Safri 17 X RP Bio 226, Dubraj X RP Bio 226, Safri 17 X PR 122, Safri 17 X RP Bio 226 X Safri 17 X PR 122 and Dubraj X RP Bio 226 X Dubraj X PR 122.



Authors have developed several lines through anther culture are under screening in the field for BLB and BLAST resistance. Morphological characters are studied with DUS observations. Genotypic screening is going on using different SSR molecular markers to establish its homozygosity. The authors obtained some promising lines for BLB and BLAST resistance which are under multi location trials.

STUDY ON DNA QUANTIFICATION OF WILD AND CULTURED *LABEO ROHITA*(HAMILTON, 1822)

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The present study was conducted on the isolation of DNA and determination of DNA concentration of both male and female of wild and cultured *Labeorohita* using Nanophotometer. DNA isolation was done and extracted DNA was analyzed using nanophotometer to determine the concentration of DNA and its purity level. DNA content of fish tissues are considerable interest for their specificity in relation to food values of fish and evaluating their physiological needs at different periods of life, fish exhibit large variations in their biochemical content from species to species. Biochemical and DNA measurement can provide valuable tool for monitoring the health and condition of both wild and cultured fish. Several different methods have been employed in the quantification of nuclear DNA over the past 50 years. The ease of use of this technique not only makes it a feasible option for small volume analysis of DNA but also a practical alternative for spectrophotometric measurement. Significant progress was made to measure micro volume liquid samples (<1µl) in biotechnology & pharmaceutical applications. For the present study both male and female of wild *Labeorohita* (from middle Ganga Region) and cultured *Labeorohita* (from cultured ponds and/ hatchery) were taken. The value of DNA concentration in female of wild *Labeorohita* was in between 60 -64 ng/µl and of male was in between range of 66- 72 ng/µl. The value of DNA concentration in female of cultured *Labeorohita* was 59 - 68 ng/µl and of male 70- 74 ng/µl.

Keywords: DNA extraction, DNA quantification, nanophotometer, *Labeo rohita*.

GREEN SYNTHESIS OF HEMATITE (A-Fe₂O₃) NANOPARTICLES USING AQUEOUS ALOE VERA LEAF EXTRACT AND THEIR ANTIBACTERIAL AND ANTIBIOFILM ACTIVITIES

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Besides the exciting medicinal and cosmetics applications of *Aloe vera* (*Aloe barbadensis* Miller), such as immunomodulatory, antiinflammatory, UV protective, antiprotozoal, and burn-healer due to its 75 potentially active constituents: vitamins, enzymes, minerals, sugars, salicyclic acids, lignins, saponins, and amino acids etc., the extract of *Aloe vera* plant has also been successfully used to synthesize crystalline gold, silver, copper oxide and zinc oxide nanoparticles by allowing the extracts of *A. vera* (ALE) with aqueous solution of metal ions. This has prompted us to investigate the biosynthesis of iron oxide nanoparticles using ALE. In the present study, an in-house one pot protocol for *Aloe vera* leaf extract (ALE) mediated biosynthesis of hematite nanoparticles (ALE- α -Fe₂O₃NPs) was developed. The biogenesis of low cost, eco-friendly ALE functionalized ALE- α -Fe₂O₃NPs was achieved by adding ALE to 0.1 M ferric (III) chloride. After 3h of rigorous mixing at 80°C using magnetic stirrer, the color of reaction mixture changed from yellow to intense brown indicating the formation of iron- nanoparticles. The ALE- α -Fe₂O₃NPs were characterized by UV-visible spectroscopy, XRD, TEM, SEM-EDX, and FTIR analyses. The size of ALE- α -Fe₂O₃NPs were determined to be in range of 1.0 - 20.0 nm with 6.78 ± 2.1 nm average particles size. FTIR analysis exhibited the capping of ALE- α -Fe₂O₃NPs with the ALE constituents. The antimicrobial activity of ALE- α -Fe₂O₃NPs were assessed by growth and biofilm inhibition of extended spectrum β -lactamase (ESBL) producing *Pseudomonas aeruginosa*, *Escherichia coli* and methicillin-resistant *Staphylococcus aureus* (MRSA) bacterial isolates. Significant biofilm inhibition was observed in case of *S. aureus* and *P. aeruginosa*, respectively. Overall, the results elucidated, a cost-effective and convenient method for ALE- α -Fe₂O₃NPs synthesis, for possible applications as nanoantibiotics.

BIOTECHNOLOGY IN PLANT GENETIC RESOURCE (PGR) CHARACTERIZATION AND ITS MANAGEMENT

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Biotechnological tools and technique gradually replaced the biochemical characterization and in four different ways characterized the plant genetic resources (PGR): identification of genotypes including duplicate accession, analyzing genetic diversity in collections, fingerprinting of genotypes and assembling a core collection. Several techniques are available for characterization of germplasm, largely depend on the need, type and nature of the crop. The characterization may be for morphological traits, cytological features, histological traits, biochemical traits and molecular polymorphism. Isozymic genetic markers have been widely used in taxonomic, genetic and evolutionary studies. They are routinely used to check genetic seed purity and have occasionally been used to assist in selecting progeny during plant breeding. Evolution of transgenic for bio-safety clearance falls under the preview of environmental protection act 1986, for which the DBT is the nodal department. Seed production is governed by seed act, 1966, through which Department of Agriculture and Cooperation (DAC) control the commercial seed production of notified varieties. The scientist interested to work on recombinant technology has to seek permission from IBSC before starting the experiments. RCGM functions under the DBT and is empowered *inter alia* to monitor safety related aspects of ongoing research projects involving GMO.

Keywords: PGR, fingerprinting, gene, transgenic



CONSORTIUM EFFECTS OF AM FUNGI AND BACTERIA ON BIOCHEMISTRY OF CATHARANTHUS ROSEUS L.**ASHISH KUMAR* and NAVNITA SHARMA ***

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Catharanthus roseus L. a popular medicinal herb, member of Apocynaceae family has been cultivated as well as most extensively studied medicinal plant species due to its antitumor alkaloids vinblastine and vincristine, used in treatment of leukemia and Hodgkin's disease. Arbuscular mycorrhizae (AM) are beneficial symbionts for plant growth and development, and offer a possible substitute of high input agricultural technology employed for production of environmentally hazardous fertilizers. Therefore, the present investigation was focused to examine the impact of AM fungi (*Acaulospora laevis* Gerd. & Trappe and *Glomus mosseae* (Nicol.& Gerd.) Gerd.& Trappe) alone, and in combination with *Pseudomonas fluorescens*, on plant in a pot experiment with sterilized soil under polyhouse condition. AM inoculum and *P. fluorescens* showed significant increase in different biochemical parameters after 120 days of inoculation. All treatments showed positive influences of mycorrhization on biochemical parameters over the untreated control. Mycorrhization was assessed in term of root colonization and spore number. Infestation with consortium of *Glomus*+*Acaulospora*+*Pseudomonas* (GAP) was found to be most effective for root colonization, increasing chlorophyll content, phosphorous and phosphatase activities. GAP treatment was further followed by *Glomus* + *Pseudomonas* treatment for chlorophyll content and phosphorous content whereas phosphatase activity was found maximum in *Acaulospora*+*Pseudomonas* (AP) treatment. In single inoculation, *Glomus* was found to be most compatible with plant.

MARKER ASSISTED TRANSFER OF SPIKELET NUMBER QTL QSPP2.2 FROM O. LONGISTAMINATA DERIVED INTROGRATION LINE INTO PUNJAB BASMATI 3**Sadhan Debnath, Kuldeep Singh, Dharminder Bhatia, Kumari Neelam Singh, Kishore Sinha, Amanpreet Kaur, Neha**

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Basmati, the unique aromatic quality rice, is nature's gift to the Indian sub-continent. Punjab Basmati 3 (PB3), an improved version of traditional variety Basmati 386 is photoperiod sensitive, semi-dwarf, lodging tolerant and resistant to bacterial blight. Compared to *Indica* varieties, it is low yielding which is primarily due to lower number of grains (70 to 80) per panicle. Therefore, we planned to precisely transfer a QTL *qSPP2.2* introgressed from *O. longistaminata* into the background of *Indica* rice cvPR114 following Marker Assisted Selection. The introgression line (IL) designated, as LIL-RIL127 was crossed to PB3 and the F_1 backcrossed to PB3 to generate more than 2000 BC_1F_1 seeds. The QTL *qSPP2.2* was mapped in 176kb region on chromosome 2 flanked by very closely linked SSR marker. One of the polymorphic markers, RM6 was employed for foreground selection of the backcross progenies. Half of the BC_1F_1 seed was planted during off-season and 29 plants which had RM6 allele of the donor line, and *BADH1*, *BADH2*, *xa13*, *Xa21* and RM190 alleles of Basmati were identified and selfed to generate BC_1F_2 populations. Out of the 29 BC_1F_2 populations, two genetically and agronomically superior populations were again analyzed with RM6. As many as 40 desirable plants were backcrossed to PB3 to generate more than 1900 BC_1F_2 : BC_2F_1 seeds. Remaining BC_1F_1 seeds planted during main season, among them 700 plants were analyzed and 340 were positive for RM6. These plants were analyzed for background selection. Forty plants with desirable alleles and phenotype were selected and backcrossed to PB3 to recover the Basmati parent genome. Together, more than 4000 BC_2F_1 seeds were generated to ensure recovery of plants with higher grain number and with most of the Basmati traits. In order to understand the correlations between grain number per panicle and grain size, ~300 F_2 plants of the cross PB3/LIL-RIL127 were replicated and analyzed for all the yield component traits, but no significant correlation was observed between grain size and grain number/panicle, thereby indicating the scope of increasing grains per panicle and overall yield. The large BC_2F_1 progeny coupled with marker assisted selection for donor allele and background selection for the recipient alleles is expected to result into high yielding Basmati varieties which could benefit both farmers and consumers alike.

Keywords: *O. longistaminata*, SPP, *qSPP2.2*, Markers- Assisted Selection (MAS), Punjab Basmati 3**CYTOKININ REGIME FOR IN VITRO PROPAGATION AND ASSESSMENT OF ANTIOXIDANT ACTIVITIES DURING EX VITRO ESTABLISHMENT OF ANTI DIABETIC PLANT (TECOMA STANS L.).****Sheikh Altaf Hussain and Mohammad Anis***

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An efficient in vitro propagation system was developed for an antidiabetic plant (*Tecoma stans*) using nodal explants. Effect of cytokinins (BA or Kin) either alone or in combination with different concentrations (0.1 – 2.0 μ M) of auxins, NAA or IAA on regeneration and multiplication was evaluated. All tested concentrations facilitated shoot bud induction and best organogenic potential (89%), maximum mean shoot number (6.40 $\pm$ 0.92) with average mean shoot length (3.70 $\pm$ 0.20cm) per explant was achieved on (MS + 5 μ M BA + 0.5 μ M NAA) after 4 weeks of incubation. To stimulate the *in vitro* rhizogenesis healthy microshoots ($\geq$ 4cm) were excised and inoculated on root induction medium enriched with different (0.1- 2.0 μ M) concentration of IBA or NAA. Finally, 93% of the regenerated microshoots rooted with, mean root number (9.66 $\pm$ 0.88) and root length (2.66 $\pm$ 0.33cm) was achieved on MS medium supplemented with (1.0 μ M) IBA after 4 weeks of incubation. About 75% of the regenerated plantlets were acclimatized in culture room and successfully established in earthen pots containing garden soil and manure (2:1) and maintained in greenhouse with 90% survival rate. An attempt was made to obtain basic information on different antioxidant enzymatic activities such as Superoxide dismutase (SOD), Ascorbate peroxidase (APX), Catalase (CAT) and protein estimation during acclimatization process. Results obtained from the studies would be beneficial in the mass multiplication, sustainable development and in assessing the physiological parameters in *Tecoma stans*.



BIOTECHNOLOGICAL INVENTIONS IN PLANT GENETIC RESOURCE MANAGEMENT

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Plant Genetic Resources are the foundation on which agriculture sector around the world is based on. In the present global scenario of increasing population, climate change, declining natural resources ensuring food security is major challenge for agricultural scientist across the globe. The intensity of this challenge is amplified by increasing deforestation, urbanization, pollution, natural habitat destruction, spread of invasive alien species, changing life styles, globalization, over-grazing and changes in land-use pattern. Hence there is urgent need to conserve plant species are now in danger of becoming extinct. Recent advances in biotechnology mainly in field of *in vitro* culture, molecular biology, genomics are important tools in hand of plant breeders to address above challenges. Tissue culture help to multiply elite genotypes rapidly, meristem-tip culture and shoot-tip grafting help to get virus free plantlets. Seed bank, seedling bank, gene bank, pollen bank, cryopreservation of ovum, sperm or embryo, embryo micropropagation, somatic embryogenesis are ex situ germplasm conservation methods. Significant progress has been made for conserving endangered, rare, crop ornamental, medicinal and forest species, especially for non-orthodox seed and vegetatively propagated plants. Medium-term conservation by means of *in vitro* slow growth culture and Cryopreservation (liquid nitrogen, -196°C) for long term storage are effective means nowadays for germplasm conservation. DNA-based molecular markers are playing significant role in detecting the genetic variation available in germplasm collections and breeding lines and in identifying useful alleles in these gene pools and assist in their further introgression or incorporation in cultivated genotypes. Germplasm characterisation followed by bioinformatics software tools for storing, retrieving, organizing, analyzing, and visualizing biological data has simplified task of bio resource management. Comparative genomics together with bioinformatics tools reveals evolutionary divergence and genomic co-linearity among the cereals that may highlight significance of minor cereals, small millets from nutritional aspect. New high-throughput technologies like next-generation sequencing (NGS) is improving our knowledge of plant genetic resources for their conservation and effective use in crop improvement.

ROLE OF GENETICALLY MODIFIED CROPS IN PRESENT SCENARIO FOR THE WELFARE OF HUMAN BEING

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The term “genetic modified crop (GM)” is very advance technology use to achieve more benefits for both producers and consumers are accompanied by potential biomedical risks and environmental side effects. GM crops are highly demandable crop by farmer and producer because it has high yield and resistant to specific pest, are aimed at the short- and long-lasting health problems that may result from this advanced biotechnology. Complex studies have been carried out around the world independently to evaluate the advantages and disadvantages of GM crop. Genetic modification is a biological technique that effects alterations in the genetic machinery of all kinds of living organisms. An organism whose genetic characteristics have been altered by the insertion of a modified gene or a gene from another organism using techniques of genetic engineering. Genetic modified organism “GMO” is defined as follows by WHO (World Health Organization): “Organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination”. The definition seeks to distinguish the direct manipulation of genetic material from the millennial-old practice of improvement in the genetic stock of plants and animals by selective breeding. Similarly, the FAO (Food and Agriculture Organization of the United Nations) and the European Commission define a GMO as a product “not occur naturally by mating and/or natural recombination”. “GM foods” refer to foods produced from genetically modified plants or animals. In case of rice, “Golden Rice” expresses high levels of beta-carotene (a precursor of vitamin A) thanks to its modified genetic properties. After 25 years’ bench work in the laboratory, Golden Rice, designed as a cheap and effective way to deliver dietary source of vitamin A for developing areas of the world

Keywords: GM crops, WHO, Golden Rice, GM foods, Vitamin A

MARKER ASSISTED SELECTION IN FRUIT CROPS: A NEW HORIZON TO EXPLORE

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Conventional fruit breeding is primarily based on phenotypic selection of superior individuals among segregating progenies resulting from hybridization. It is often time consuming as breeding a new variety takes about 20 to 25 years and even then, the release of improved variety is not guaranteed. Hence, fruit breeders are extremely interested in new technologies that could make this procedure more efficient and worthy. Molecular marker-assisted selection, often simply referred to as marker-assisted selection (MAS) offers such a possibility by adopting a wide range of novel approaches to improving the selection strategies in horticultural crop breeding. Marker assisted selection is an indirect process of selection based on use of molecular markers and these markers are powerful research tools that make it possible to determine the genetic makeup of plants; they also serve as reference points to compare differences in DNA sequence and consequently, the allele composition between plants. Molecular markers used for MAS must possess the qualities like polymorphism, co-dominance and abundant in numbers. MAPS (Marker assisted parent selection) and MASS (Marker assisted seedling selection) are two essential component of Marker assisted selection. MAS is combination of conventional breeding and molecular biology that bring a systematic basis to traditional breeding, enhancing its precision and expediting the process. Therefore, genetic and genomic control of horticultural traits achieved through molecular markers can help to design more efficient breeding strategies and breeding perennial fruit crops through markers assisted selection is expected to lead to a high efficiency gain in near future.

Keywords: Marker assisted selection, Molecular markers



ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN OKRA GENOTYPES FOR YIELD AND YIELD RELATED CHARACTERS**Meenakshi Kumari^{1*}, S.S. Solankey², A.K.Dubey³ and Pallavi Neha⁴**^{1,4}Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh – 208 002, India.²Department of Horticulture (Vegetable & Floriculture), Bihar Agricultural University, Sabour (Bhagalpur), Bihar – 813 210, India³Division of Division of Post Harvest Technology & Agricultural Engineering, Indian Institute of Horticultural Research, Bengaluru- 560 089, Karnataka, India

Okra [*Abelmoschus esculentus* (L.) Moench.] is a fast growing annual which has captured a prominent position among the vegetables and is commonly known as okra or lady's finger in India and it belongs to the family Malvaceae. It is one of the most important vegetable crops cultivated in tropical, sub-tropical and warm temperate regions of the world. It is one of the oldest cultivated vegetable crops and presently grown in many countries and is widely distributed from Africa to Asia, southern Europe and America. Variability in a population with respect to characters, for which improvement is sought, is an indispensable pre-requisite for a successful breeding programme. In this context a study of genetic diversity in 20 okra genotypes for 22 morphological and agronomic traits (13 quantitative and 9 qualitative) was laid out in randomized block design with three replications during 2015-16. The phenotypic and genotypic variances, phenotypic (PCV) and genotypic coefficients of variation (GCV), heritability, genetic advance of the characters were studied. The genotypes demonstrated wide range of variability for all characters. In this study PCV value was higher than its corresponding GCV thus revealing the role of environmental factors. Higher heritability (h^2b) was recorded for all characters except days to first flowering which have moderate value. Genetic advance in per cent of mean was high for all the characters except moderate for first flowering node, fruit length, fruit diameter as well as low for days to first flowering and days to 50% flowering. The genotypes, viz. Kashi Kranti, Kashi Satdhari, VROB-159, Punjab-8 and Kashi Mohini were found promising for most of the yield contributing traits. These genotypes could be used further in hybrid breeding programme of okra.

The higher value of genetic advance indicates that selection of genotypes on the basis of these characters is desirable. Fruit yield showed positive and significant association with fruit diameter, number of fruits per plant, average fruit weight, number of seeds per pod, first flowering node.

Keywords: Genotypes, variability, heritability, character association, okra, yield

EVALUATION OF GROWTH PROMOTING AND IMMUNOSTIMULATORY EFFECTS OF FEED PROBIOTIC BIOSYN IN *LABEOROHITA*.**Iqra Nazir* and R. S. Chauhan**

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Aquaculture industry is facing challenge of meeting out growing demand in coming years which may be fulfilled by increasing the quality of aqua feeds through improving nutrient content as well as the digestibility of low quality feed by the use of efficient feed additives. Sustainable aquaculture depends on perfect balance between growth and health conditions of fish. Several drugs, synthetic chemicals and vaccination programmes have been in practice to prevent and control the diseases, but partial success has been achieved. An alternative approach has been the application of various compounds to boost or stimulate the immune system of fishes and shrimps. One among such alternatives is probiotic. Probiotics are "live microorganisms, which when administered in adequate amounts confer a health benefit on the host." Probiotics generally includes bacteria, cyanobacteria, micro algae, fungi, etc. The present study was carried out from February to May 2015 to evaluate the effects of dietary supplementation of commercial probiotic Biosyn in the fingerlings of Indian major carp (*Labeorohita*) on growth performances, haematological and biochemical parameters. Therefore, the fish with similar body weight (7.239 ± 0.232 g) were distributed randomly into four treatment groups T_0 , T_1 , T_2 and T_3 . Experimental diets were prepared by mixing rice bran, deoiled mustard oil cake, soybean cake and vitamin mineral mixture. The biomedicine Biosyn was incorporated in to diet D_1 @0.2%, D_2 @0.4%, D_3 @0.6%. In control diet D_0 , Biosyn was not incorporated in feed. The fishes of group T_0 were fed with diet D_0 , T_1 with D_1 , T_2 with D_2 and T_3 with D_3 @5% body weight per day for 90 days. Fingerlings fed with diet D_3 achieved better SGR (0.648%), FCR (3.255) and GCE (0.299) as compared to other treatments. T_3 group of fishes showed higher value of TLC ($35.114 \times 10^3/\mu\text{l}$), TEC ($3.35 \times 10^6/\mu\text{l}$), Hb concentration (10.2 g%), Total serum proteins (9.1g/dl), Albumin (1.695 g/dl) and Globulin (7.405 g/dl) as compared to control and other treatments. The obtained results indicated that T_3 was the best treatment which realized significant ($P < 0.05$) increase in all growth performance parameters, haematological and biochemical parameters. There were no adverse effects on water quality criteria among all the experimental treatments. Consequently, from the obtained results, it can be concluded that the inclusion of the commercial probiotic Biosyn @ 0.6% in diet of *Labeorohita* is useful to get the best fish performance with friendly effects on the environment.

Keywords: Probiotic, Aquaculture, Growth, Feed additives

ASSESSMENT OF GENETIC VARIABILITY IN TARO (*COLOCASIA ESCULENTA* (L.) SCHOTT VAR. *ANTIQUORUM*) GERMPLASM**Khushboo Kathayat*, M.L. Kushwaha¹ & Monisha Rawat²**

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The present investigation was conducted during March 2014-October 2014 and March 2015- October 2015, at Vegetable Research Centre and PG Laboratory, Department of Vegetable Science in G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The field experiment was laid out in Augmented Block Design having six blocks with forty two genotypes along with three checks with 60 cm × 30 cm spacing. Each single plot was of 1.8 m² having 1 row which were 3 m long. Observations were recorded on total 9 qualitative and 19



quantitative characters. Data were analyzed statistically for their mean, range, genetic variability, coefficient of variation, heritability, genetic advance as per cent of mean, character association, path coefficient analysis

The results revealed highly significant differences among the genotypes observed for most of characters except leaf length, leaf area index and number of cormels per plant. Genotypes, namely, PKS-1, NDC-18, Aryan CA-1, NDC-9 and NDC-68 recorded for maximum yield. Phenotypic coefficient of variation was higher than that of genotypic coefficient of variation for all the characters. Heritability in broad sense was found maximum for length of corms (98.14) and minimum for number of cormels per plant (28.12).

Pooled analysis of two year data revealed that width of cormels (66.02) had maximum genetic advance as percentage of mean. Yield tonne per hectare exhibited highly significant and positive phenotypic correlation with number of cormels per plant and weight of corm per plant and weight of cormels per plant. Path analysis revealed that number of cormels per plant had highest positive direct effect on yield followed by dry matter content and weight of corms per plant. So these are the important characters which should be preferred while making selection for improvement of yield.

PHALARIS MINOR RESISTANCE MECHANISM TO ISOPROTURON IN UTTARAKHAND

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Herbicide resistance is a serious problem which ultimately affects the productivity of crops. *Phalaris minor* is a major problematic weed of wheat in the rice –wheat cropping system of northern India. Isoproturona PS II inhibitor was recommended against *P. minor* in late 1980s which reduced huge yield losses in wheat and was largely accepted by the Indian farmers, due to its broad-spectrum weed control and its selectivity with crops. Extensive use of Isoproturon over many years has led to the evolution of resistance to this weed in north-west India and resulted total crop failure. However, in Uttarakhand, this weed was successfully controlled by the herbicide isoproturon, for a quite long period. But due to continuous use of the same herbicide has led to development of resistance in the weed. After reports of herbicide resistance in this weed from Haryana and Punjab, monitoring of the resistance development was undertaken in the state. Seeds of *P. minor* were collected from farmers fields in the Udham Singh Nagar and Nainital districts of Uttarakhand and adjoining areas of UP where the cropping system was predominantly rice-wheat. These seeds were sown in pots and treated with different doses of the herbicide. Plants from all the locations survived at recommended and double doses of the herbicide. There were differences in the survival rate in plants from different locations. Resistance was confirmed by further biochemical studies and the mechanism of resistance is suspected to be due to enhanced metabolism of the herbicide.

CHEMICAL ECOLOGY AND ITS USE IN HOST PLANT RESISTANCE

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Chemical ecology is a discipline that emerged during the past half century and is by definition an integrative research field. It is driven by the recognition that organisms of diverse kinds make use of chemical signals to interact. It promises an understanding of the molecular and genetic mechanisms of biological signal transduction in species interactions, which can help to ultimately understand the evolution of complex species interactions.

Plant chemicals which affect behaviour have also been classified into two main groups. There are those which the insect can utilize as nutrients as well as behavioural cues, and then there are those which have no apparent nutrient value but which serve only as sign stimuli, enabling the insect to select the appropriate food or host-plant. These are known as secondary plant chemicals.

Plant odours can attract or repel insects. In either case the volatile plant constituent affects the orientation of the insect with respect to the plant. It may influence larval or adult orientation or both. e.g. 3rd instar grass grubs are strongly attracted by the odour of fresh ryegrass root and that the odour of some legumes is even more attractive but the exact root volatiles involved was not identified.

GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (*ORYZASATIVA L.*)

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Rice (*OryzasativaL.*) is one of the most important staple foods in the world's population. These QTL alleles of yield related traits make a significant contribution of high yielding rice breeding program. The QTL as a genetic locus where functionally different alleles segregate and cause significant effects on a quantitative trait of advent molecular marker technology, QTL mapping on chromosome linkage maps has become a standard procedure in quantitative genetics. They can used to identify the QTLs with dominance effects in the whole rice genome. Thousand-grain weight (TGW), grain number per panicle (GPP) and panicle number per plant are the three yield components traits. However, TGW and GPP were often focused in the past QTL mapping studies due to their direct contribution to yield. The molecular markers developed for QTL analysis of enhancing breeding efficiency by marker assisted selection (MAS) for particular agronomic traits. Plant Breeders have focused on improving plant architecture as effective to increase yield potential in rice production. The demand of high yielding rice production for increasing greater stability to human population and changing global climate. In this study, we are using different kinds of rice germplasm and QTL information including its genome position and genetic effect. We mainly focus on the genetic action of major QTLs and phenotypic traits for improvement in rice breeding programme.



CONSERVATION OF NATURAL ENEMIES OF PESTS IN THE MOLECULAR ERA: NEW OPPORTUNITIES TO ADDRESS OLD CONSTRAINTS

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Biological control of insect pest is a core component and serve as a central pillar in integrated pest management programme (IPM). Natural enemy such as predators, parasitoids and pathogen are essential component of biological control programme and are very effective in managing various insect pests of economically important crops. Many obstacles will need to be overcome before biological control can reach its full potential. Abiotic stress including high temperature, rainfall as well as various anthropogenic activities such as excessive use of chemical pesticides affect the survival and efficacy of these beneficial organisms. Thus measures like conservation of these beneficial organisms are vital to ensure that their population being maintained and protected. Conservation requires detailed knowledge of phenology and resources requirements of natural enemies. The practice of conservation includes action to preserve and increase natural enemy population by modifying their surrounding environment or existing practices. Some of the important conservation practices includes habitat manipulation, use of selective pesticide, use of cultural practices that favour their survival and multiplication and avoidance of practices that are harmful, providing alternate host for them, cultivation of cultivar that favour colonization, provision of refugia and food like pollen and nectar for adult stage of natural enemy. Yet, there is need to create a suitable ecological infrastructure within the agricultural landscape to enhance the activity of natural enemies. Conserving natural enemies provides a cost-free and eco-friendly way of managing the pests in cultivation.

Keywords: Biological control, conservation, Natural enemies, IPM, Pesticides

SEED GERMINATION OF GUAVA (*PSIDIUMGUAJAVA* L.) AS AFFECTED BY DIFFERENT SCARIFICATION TREATMENTS

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Seed germination studies depends on seed viability and dormancy aspects, besides essential requirements and factors for the same. Of the various factors involved in seed germination, dormancy plays a significant role. In guava, seed dormancy is more of physical nature (due to hard seed coat) than being physiological. A field experiment was conducted to study influence of scarification treatments on seed germination of guava (*Psidiumguajava*L.). The objective of the study was to get maximum germination of guava seeds. Three scarification methods were used i.e. water soaking (for 24, 48 and 72 hours), hot water soaking (at 70, 80, 90 and 100°C) and sulphuric acid soaking (at 10, 20, 30, 40 and 50 % dilution). Duration for hot water soaking and sulphuric acid soaking was kept as quick dip (5 seconds), 1 minute and 3 minutes. All these treatments significantly decreased days to emergence of seedling over control (25 days). Among the scarification methods and durations used, treatment of guava seeds with 20 per cent sulphuric acid for 3 minutes was judged best with maximum germination per cent (51.7 %), minimum days to emergence (11.7 days) and girth of seedlings (3.50 mm after 150 days of sowing). Seeds without any scarification treatment also showed poor germination (24.7 %). On the basis of the findings, it can be concluded that the scarification of guava seeds with 20% sulphuric acid would result in better seedling emergence and further development.

KEYWORDS: Guava, scarification, seed germination, sulphuric acid, hot water soaking

ROLE OF NANOTECHNOLOGY IN PEST MANAGEMENT: A REVIEW

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Scientists throughout the world are searching for solutions for the havoc caused by the indiscriminate use of synthetic chemical pesticides. Nanotechnology has emerged as a rapidly evolving field with a potential to revolutionize agriculture and food systems. The property of particles to behave differently when reduced to atomic level is being exploited by various international organizations for pest management. This analysis of the nano formulations provides an inside to the efficacy of these formulations in comparison to the conventional pesticides used. The pesticides are being applied in the form of nanoencapsulation, nanoparticles and nanoemulsion, against the target pest. The polymer based encapsulation of the pesticides have received the greatest attention for their ability to deliver the pesticide directly at the target site and is followed by formulations containing inorganic nanoparticles (e.g., silica, titanium dioxide). The high stability of nanoemulsions and their tendency of not to sediment and cream has found application in pest management. Investigations into the fate of nanopesticides remain scarce, and the current state of knowledge does not appear to be sufficient with their associated benefits and risks. A great deal of research will therefore be required over the coming years on the associated environmental and human risk of pesticides and cost effective manufacture of these.

Bioethanol Production from Banana Pseudostem –An Innovative Approach Towards Green Technology

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Global depletion of fossil fuels, rising fuel prices, environmental concerns, and pressures for oil independence are creating a strong market for biofuels (USDA ERS, 2009). Biofuels, from agricultural wastes, have the potential to be domestically and globally available for energy security, with most being carbon neutral or potentially carbon negative and supportable within the current agricultural infrastructure. BPS a potential feed stock for the ethanol production

Studies were undertaken with the objectives of investigating the effect of process parameters fermentation time, temperature and cellulase concentration on simultaneous saccharification and co-fermentation of banana pseudo stem by using *Saccharomyces cerevisiae* and *Pachysolen tanophyllis* (MTCC 1077) as fermenting strains and optimization of process parameters.



Three levels of temperature (25, 30 and 35°C), five levels of time (24, 48, 72, 96 and 120 hours) and five levels of cellulase concentration (5, 10, 15, 20 and 25 U/g cellulose) were taken as independent parameters. Ethanol concentration, reducing sugar concentration and pH were taken as dependent variables.

ANOVA of response performed using MSTAT software showed time, temperature and cellulase conc. and their interactions had significant effect on the responses viz: ethanol conc., reducing sugar conc. and pH. Empirical models developed using MINITAB 17 software representing ethanol concentration, reducing sugar and pH during fermentation fitted very well with the experimental data within the parameter range investigated.

PERSPECTIVES AND APPROACHES OF CONSERVATION TILLAGE IN SUSTAINABLE AGRICULTURE: A REVIEW

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Modern agriculture aims at obtaining sustainable production without degrading the natural resources like soil, water, nutrients, energy etc, thus conserving the environment with the advent of modern agricultural technologies during the Green Revolution Era, yield targets could be achieved by intensive cultivation but there has been tremendous degradation and exploitation of natural resources. This has led to an imbalance in agro-ecosystem. Therefore, development of alternate crop /soil/ water management practice for conserving these resources is vital. Conservation tillage is one of the options in this context. Conservation tillage is the most extreme form of minimum tillage, which not only include methods resulting in reduced tillage intensity but also combines the use of several implements in one operation. Major advantages of conservation tillage over conventional tillage are improvement in soil structure, higher aggregate stability. Zero tillage helps in improving Organic Carbon, total N content and water holding capacity of the soil. The cost of cultivation is reduced in case of zero tillage and it achieves overall sustainability of eco-system. Though, there are certain limitation of conservation tillage but from resources conservation points of view the overall performance of conservation tillage is better than conventional tillage. Therefore, the adoption of conservation tillage in the modern context seems to be a viable and profitable proposition.

Keywords: Conservation tillage, conventional tillage, soil quality, Sustainable agriculture.

ASSESSMENT OF GENETIC VARIABILITY IN LINSEED USING INDUCED MUTAGENESIS

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Induced mutagenesis has been proven as viable approach to produce crops with desired traits such as higher yield and better adaptability. Interest in medicinal plants has grown enormously from the use of herbal products such as natural cosmetics and for self-medication by the general public. *Linum usitatissimum* L. (linseed), medicinally important plant, cultivated for its flax, bark fibre as well as its oil is known to possess little genetic variability due to its self pollination mode of reproduction. Therefore, this experiment was primarily aimed at increasing genetic variability for the enhancement of existing linseed varieties. Dry, dormant and healthy seeds of two linseed varieties IC0096650 and padmini were treated with different doses of sodium azide, gamma rays both individually and their combination treatments. Untreated seeds were taken as control. The observation were made on seed germination, growth parameters such as shoot length, root length and chlorophyll content to establish the mutagenic sensitivity of the linseed and the selection of desired progeny for subsequent generation. The percentage of seed germination, seedling growth and chlorophyll content decreased with the increasing concentration of both the mutagens. Data obtained in this study were statistically significant at 5% level. Significant differences were found in the growth parameters of the treated plants as compared to the control. Furthermore, it was elucidated that the var. IC0096650 was most sensitive towards higher doses of mutagens as compared to var. padmini.

Keywords: Genetic variability, sodium azide (SA), gamma rays, *Linum usitatissimum* L., *in vitro* growth, germination and chlorophyll content.

MUTAGENIC SENSITIVITY OF PHYSICAL AND CHEMICAL MUTAGENIZED POPULATION OF A VALUABLE MEDICINAL PLANT TRIGONELLA FOENUM-GRAECUM L.

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Plants have been an important source of medicine for thousands of years. Use of plants for the treatment of many diseases dated back to prehistory and people of all continents have this old tradition. India is the major producer of fenugreek and its main consumer for culinary and medicinal uses. *Trigonella foenum-graecum* L. is highly economical spice as well as medicinal plant in the family of Fabaceae. Genetic variation is indispensable to any crop improvement program. Therefore, this experiment was conducted to determine the mutagenic sensitivity of physical and chemical mutagen. Dry and healthy seeds of *Trigonella foenum-graecum* L. were treated with six doses of EMS (0.01% to 0.06%) and Gamma (50 to 300 Gy). Assessments were made on the *in vitro* seed germination and seedling growth for estimation of mutagenic sensitivity of the *Trigonella foenum-graecum* L. The rate of seed germination and seedling growth inhibition increased with increasing doses of treatments. It was elucidated that the present *Trigonella foenum-graecum* L. variety was most sensitive towards higher doses of EMS in comparison to gamma rays. Therefore, lower doses of treatments would be more suitable for inducing desirable mutation in fenugreek.

Keywords: *Trigonella foenum-graecum* L., mutagenicity, *in vitro* growth and germination.



ORGANIC FARMING: AN ECO-FRIENDLY WAY TO SUSTAINABLE AGRICULTURE

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In the post independence period, the most important challenge in India has been to produce enough food for the growing population. Hence, high-yielding varieties are being used together with irrigation water, fertilizers, or pesticides. This combination of high-yielding production technology has helped the country to develop a food surplus. Exhaustion of the natural potential, destruction of the agrosphere and environmental pollution resulting from increased manmade environmental modification expressed as climate change, has posed threat to existence of humankind. As time went by, extensive dependence on chemical farming has shown its darker side. The land is losing its fertility and is demanding larger quantities of fertilizers. Pests are becoming resistant and warrant frequent sprays, which resulted in residues much above the safety levels. Therefore need for a new philosophy of sustainable development aroused. To reverse this trend, one of the possible means is to go to organic agriculture. A critical appraisal reveals that organic farming systems offer some solutions to the problems, currently besetting the agricultural sector of industrialized or green revolution countries. Organic farming can provide quality food without adversely affecting the soil's health and the environment; however, a concern is whether large-scale organic farming will produce enough food for India's large population. Organic farming unites all agricultural systems that maintain ecologically, socially and economically advisable agricultural production. Organic farming has potential to overcome drawbacks of conventional farming. There is urgent need to adopt the organic farming practices to improve the health our environment and we should take it as potential option to mitigate climate change.

ENHANCED SACCHARIFICATION OF IONIC LIQUID PRETREATED AGRICULTURAL WASTE WITH IMMOBILIZED ENZYMES FOR BIOETHANOL PRODUCTION

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Agricultural waste has been considered as potential sustainable feedstocks for alternate energy production. Bioconversion of renewable lignocellulosic biomass to biofuel and value added products are globally gaining significant prominence. The depletion of the world's petroleum supply and environmental issues associated with crude oil usage increase a demand for developing alternative, environmental friendly and non-petroleum dependent energy source. Lignocellulose is a major structural component of agricultural waste and consists of cellulose, hemicelluloses and lignin. The effective utilization of all three components would play a significant role in the economic viability of cellulosic ethanol. Lignocellulosic biomass conversion process involve several steps viz. effective pretreatment, saccharification of pretreated biomass, fermentation and downstream processing. The waste material must be first pretreated to convert the recalcitrant lignocelluloses structure to reactive cellulosic intermediates before enzymatic hydrolysis. World-wide, extensive research has explored the conversion of agricultural waste into fermentable sugars by various pretreatment technologies. In recent years, there has been a trend of using immobilized enzyme on magnetic nanoparticle for enhance stability, activity and reusability of enzymes. Since the high surface area:volume ratios of magnetic nanoparticles can effectively improve the enzymatic loading and catalytic efficiency of the immobilized enzyme. The magnetite-loaded enzymes are easy to recover by magnetic field, which may optimize operational cost and enhance the product's purity. In this work, we prepared the magnetic nanoparticles coated them with amino silane and immobilized them with cellulase and β -glucosidase via glutaraldehyde coupling reaction for enhanced saccharification of agricultural waste for bio-ethanol production. Pretreatment of waste materials was carried out with ionic liquid (1-ethyl 3-methyl imidazolium acetate, EmimOAc) and ammonia and it was found that, there was enhanced saccharification in pretreated biomass in comparison to without pretreated biomass.

Keywords: Magnetic nanoparticle, Enzyme immobilization, Saccharification, bioethanol

GENETIC CHARACTER VARIABILITY STUDIES IN DESI CHICKPEA (*CICER ARIETINUM* L.) GENOTYPES

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Keeping the importance of the crop and the aspects to be studied, the present investigation entitled "Genetic Character Variability Studies in Desi Chickpea (*Cicer Arietinum* L.) Genotypes" was conducted in *rabi* 2014-15 at the Research Farm of Agricultural Research Station, Ummedganj, Kota, Agricultural University, Kota to assess the variance revealed sufficient amount of variability present in the genotypes studied. Harvest index recorded maximum phenotypic range of variation followed by 100 seed weight, number of pods per plant, plant height and number of nodules per plant. The high to moderate genotypic coefficient of variation and phenotypic coefficient of variation was observed for harvest index, plant height, 100 seed weight and number of seeds per pods, seed yield per plant, secondary branches per plant and primary branches per plant. The genotypic and phenotypic path coefficient analysis revealed that biological yield per plant and harvest index exhibited high and positive direct effects on seed yield per plant. The results of path coefficient analysis revealed that for improvement of seed yield in chickpea through selection programme, more emphasis should be given to harvest index, days to 50 % flowering number of seeds per pod and number of pods per plant.



PROCESSING AND UTILIZATION OF BY-PRODUCTS OF SUGAR INDUSTRIES**Kapil Kumar, Suresh Chandra, Samsher, Prince and Tarun Kumar**

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By-products of cane sugar and beet sugar production include fibre from both cane and beet and Molasses and bagasse are by-products of sugar industry and can be employed as substrates for invertase production. molasses residual concentrated syrup from which no more sugar can economically be removed, Sugar beet pulp is used almost entirely for animal feed, mixed with molasses in loose or pellet form. Because of the higher nitrogen content of sugar beets, nitrogen in the form of urea need not be added, as it must when sugarcane bagasse is used for animal feed. Other uses for beet pulp are as edible fibre, for addition of soluble fibre to baked goods and processed foods, and for inclusion in paper manufacture. Feed use for bagasse is relatively minor. The major use is as fuel for the cane factory, where one ton of dry bagasse is equivalent in energy value to two barrels of fuel oil. Freshly produced bagasse contains about 50 percent moisture and becomes drier on storage. Bagasse is also widely used as filler for paper, fibre board, and particleboard especially in areas where wood is in short supply. Paper quality ranges from kraft-process brown paper through newsprint to glossy white. Molasses from both sugarcane and sugar beets is a major component of animal feed. Sugar beet molasses that has been subjected to desugarization contains reduced carbohydrate levels and may be blended with cane molasses. Production of ethanol (ethyl alcohol) for industry and distilled spirits is common at most cane and beet factories. Rum is produced from cane molasses in the Western Hemisphere; beverage alcohol is produced from beet molasses in Europe.

ADVANCE IN AGRONOMIC MANAGEMENT OF INDIAN MUSTARD (*BRASSICA JUNCEA*)**Shreya Sinha¹, Jyoti Singh².**¹ Deptt of Agriculture Chemistry and Soil Science U.P. College, Varanasi (U. P.)

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India is the fourth largest oilseed economy in the world. Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production and ranks second after groundnut sharing 27.8% in the India's oilseed economy. The mustard growing areas in India are experiencing the vast diversity in the agro climatic conditions and different species of rapeseed-mustard are grown in some or other part of the country. Under marginal resource situation, cultivation of rapeseed-mustard becomes less remunerative to the farmers. This results in a big gap between requirement and production of mustard in India. Therefore site-specific nutrient management through soil-test recommendation based should be adopted to improve upon the existing yield levels obtained at farmers field. Effective management of natural resources, integrated approach to plant-water, nutrient and pest management and extension of rapeseed-mustard cultivation to newer areas under different cropping systems will play a key role in further increasing and stabilizing the productivity and production of rapeseed-mustard. The paper reviews the advances in proper land and seedbed preparation, optimum seed and sowing, planting technique, crop geometry, plant canopy, appropriate cropping system, integrated nutrient management and so forth to meet the ever growing demand of oil in the country and to realize the goal of production of 24 million tonnes of oilseed by 2020 AD through these advanced management techniques.

MICROALGAE: THE FUTURE OF CLEAN SUSTAINABLE ENERGY**Deepak Kumar**

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Sustainability is a key principle in natural resource management. In recent years, dependence on non-renewable energy is increased which is the sole reason for the increase of greenhouse gases. Sustainable development goals could only be achieved when there is less depletion of fossil fuels which in turn would reduce carbon footprint. Therefore, there are vigorous research initiatives aimed at developing alternative renewable and potential carbon neutral biofuel in solid, liquid as well as gaseous form. First generation biofuels derived from food crops such as sugarcane, maize and rapeseed place an enormous strain on world food markets and contributed to water shortages. Second generation biofuels are derived from lignocellulosic agriculture and forest residue or waste and from non-food crop feedstocks address some of the problems of first generation biofuels. Based on current knowledge of technologies third generation biofuels specifically derived from microalgae are considered to be technically viable option of alternative energy resource which is devoid of major drawbacks of first and second generation biofuels. Microalgae are photosynthetic microorganism that can produce lipid, protein and carbohydrate in large amount that can be converted to biofuels. This study investigates the potential of local water body derived microalgae for production of bio-fuel. Crude lipids constituting 12.6% of the dried and filtered algal biomass was extracted. Triacylglycerides (TAGs) and free fatty acids (FFAs) present in the extracted lipids were converted to fatty acid methyl esters (biodiesel) using transesterification and esterification respectively with a 77.8% conversion rate using a fixed bed reactor. The conversion was determined using 300 MHz ¹H NMR spectroscopy. The study highlights that algae extracted from local water bodies have tremendous potential for biodiesel production and can be considered for industrial scale-up for commercial applications

PERIPHYTON ANALYSIS IN TARAI PONDS OF PANTNAGAR, UTTARAKHAND**Jettiboina Mahija and Hema Tewari**

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Hypothesis - Periphyton is a group of organisms consisting of the plants or animals attached to benthic sediment, rock, and at the bottom and edges of water-bodies. They are used to indicate the degree of pollution in a body of water, and other variations in ecological condition for estimating the exact status of pond ecosystem

METHOD - The periphyton assessment of Pond 1(rearing pond) and Pond 2(stocking pond) was conducted from March to April. Natural substrates like stone and wood, containing attached algal mats was collected from both ponds and then scraped out, diluted in fixed quantity of water (10 ml). The sample is preserved in sampling bottles using 5% formalin solution and Lugol's iodine solution and observed under 10X or 40X power of compound microscope.

RESULT- Water quality parameters such as pH, D.O, temperature, Carbon dioxide content and TDS were analyzed (APHA). Temperature and dissolved oxygen content increased in the month of summer. That is, temperature about 3.6°C and 4.5°C has been raised in pond 1 and pond 2 respectively from March to April. Carbon dioxide content during the study is 24.5mg/l with alkaline pH. TDS and D.O was found to be 186.5 mg/l and 3.9 mg/l in an average respectively. The commonly found periphyton were *Euglena*, *Chlorella*, *Chlamydomonas*, *Melosira*, *Tabellaria*, *Gyrosigma*, *Navicula*, *Nitzschia*. Equal abundance of diatoms is seen. More abundance of green algae in pond 1 and blue-green algae (*Anabaena*, *Oscillatoria*) in pond 2 has been noted.

Implication - We know that Periphyton communities indicate the degree of pollution in the water and other variations in ecological condition. A high diversity count suggests a healthy ecosystem. Thus from the above observations, we concluded that Pond 2(Stocking pond) is less polluted than Pond 1 (rearing pond).

PLANTS WITH THERAPEUTIC POTENTIAL IN PARTS OF WESTERNUTTAR PRADESH

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The relationship between human and herbs dates from the far past with ample evidences from the old literature – *Atharva Veda*, *Charaka Samhita*, *Rig Veda* and *Sushruta Samhita*. According to World Health Organization, about 75% of the world population are using herbs for basic healthcare needs. Traditional system of medicine continue to be widely practised on many accounts. Thus a survey was carried out in some parts of Western Uttar Pradesh to identify and record the use of medicinal herbs currently practiced by the local people and is confirmed by the help of many medicinal healers. People used these locally available herbs for health and believed that these are less expensive and have no side effects as compare to modern medicine. In total 65 species belonging to 59 genera and 34 families were recorded which is used in primary health care system by the local people. *Euphorbiaceae*, *Amaranthaceae*, *Liliaceae*, *Malvaceae*, *Papilionaceae*, *Asteraceae*, *Apiaceae*, *Lamiaceae* are the major families. Almost all the plant parts like leaves, seeds, roots and bulb have medicinal constituents to alleviate various diseases.

Keywords : Charaka Samhita, indigenous, ethno-medicinal, medicinal herbs, Western Uttar Pradesh , primary health care system, diseases.

MAJOR PEST OF PEA AND THEIR INTEGRATED PESTMANAGEMENT

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Major pest of Pea is a Stem fly (*Ophiomyia phaseoli*) and it cause serious damage in pea. The maggots bore into the stem thereby causing withering and ultimate drying of the affected shoots, thus reducing the bearing capacity of the host plants. The adults also cause damage by puncturing the leaves, and the injured parts turn yellow.

The damage is more severe on seedlings than on the grown up plants.

Management of stem fly is including, Avoid sowing of the crop earlier than mid-October to check the attack of the pest. Remove and destroy all the affected branches during the initial stages of attack. Sow the crop in the second fortnight of October to escape the damage of the pest. Apply 7.5 kg of phorate 10G or 25 kg of carbofuran 3 G per ha in furrows at the time of sowing. On the crop, spray three times 750 ml of oxydemeton methyl 25 EC in 750 L of water per ha. The first application should be just after germination and the other two at an interval of 2 weeks each.

EFFECT OF DIFFERENT SUBSTRATES ON MYCELIAL RUN OF *HYPsizYGUS ULMARIUS* (BULL.EX.FR.) REDHEAD. (BLUE OYSTER MUSHROOM)

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Mushroomcultivation is an environmental-friendly way of producing vegetarian protein and recycling theagricultural residues. It fits very well in sustainable farming & has several economic advantages. They are capable ofproducing the highest quantity of protein per unit area and time from agricultural residues.After harvesting of different flushes of blue oyster mushrooms, the spent mushroom substrate is used as good soil conditioner. There are still many agricultural substrates which need to be evaluated for enhanced mycelia run of *H. ulmarius*. Hence, The study was conducted to compare the effects of different agricultural residues like wheat straw, paddy straw, brassica straw and their combinations (wheatstraw + paddy straw, wheat straw + brassica straw and paddy straw + brassica straw in 1:1 proportion of w/w), on the mycelial growth of *Hypsizygus ulmarius* (Bull.ex.Fr.) Redhead. (blue oyster mushroom).The experiment was carried out in the MushroomTechnology Laboratory, Department of Plant Pathology, CCS Haryana AgriculturalUniversity, Hisar .The experiment was conducted in a completely randomized design (CRD) with five replications for each treatment. The results revealed that maximummycelial growth was achieved 20 days after post inoculation on wheat straw (304.3 mm) followed by wheat straw + paddy straw (1:1 w/w) (277.4 mm), paddy straw (255.5 mm), wheat straw + brassica straw (1:1 w/w) (227.6 mm), brassica straw (203.7 mm) and paddy straw + brassica straw (1:1 w/w) (177.3 mm). The findings of this study showed that wheat straw was found to be the most appropriate substrate for fastest mycelia development of *H. ulmarius*.



EFFECT OF DIFFERENT LEVELS AND SOURCES OF SULPHUR ON SOIL PROPERTIES, YIELD AND NUTRIENT UPTAKE BY MUSTARD**Prashant Deo Singh¹, Sanjeev Singh²**¹Department of Soil Science and Agricultural Chemistry SVPUA&T Meerut, ²Department of Agronomy, SVPUA&T Meerut

In the world Oilseed Brassicas, mustard accounting for over 13.2 per cent of edible oil supply and it is the third most important edible oil source after soyabean and palm. In India, it is the major oil seed crop ranks second in acreage with 0.0 million ha, followed by the groundnut. Sulphur is the 13th most abundant element in the earth's crust and it's a essential secondary plant nutrient which is required by plant and animals for their normal growth and development. In Brassicas, which are more susceptible to S-deficiency as it enhance the oil quantity and quality both. In the past, farmers were using S-containing fertilizers viz., ammonium sulphate and SSP but recently they have started using high N and P fertilizers which are S-free viz., urea, DAP, and triple super phosphate. Therefore, the field experiment was carried out at Research Farm, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during Rabi season 2015-16, to find out the optimum level and different source of Sulphur for obtaining height yield of mustard crop. In the study it was found that sulphur significantly responsible for oil content of mustard and all the growth and yield parameters increased significantly when applied at RDF (NPK: 120:60:60 kg ha⁻¹) + 40 kg S ha⁻¹ through SSP.

Keywords: SSP,DAP,RDF**RAPID GREENER BIOSYNTHESIS OF ZINC OXIDE NANOPARTICLES USING MEDICINALLY IMPORTANT PLANT ANACYLUS PHYTHRUM****Sapna Tyagi¹ and Tanveer Alam²**

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This study provides a simple, green and efficient approach to produce ZnO nanoparticles (ZnO-NPs) for various applications without using toxic chemicals. Zinc oxide nanoparticles have charmed meticulous research interest because of its important application in the field of medicine, pigment, electronics and piezoelectricity. Leaf extract of *Anacylus phythrum* was used as reducing as well as capping agent for the synthesis of ZnO nanoparticles. The zinc nanoparticles were characterized by UV- Vis spectrophotometer, X-ray diffraction (XRD), Transmission electron microscopy (TEM) and Fourier transform infra-red (FTIR) spectroscopy. XRD and TEM results revealed that hexagonal wurtzite ZnO-NPs with mean particle size of 27–85 nm were produced by different bio-fuels present in the plant extract FTIR study shows that the amines, alcohols, and other functional group containing biomolecules present in the plant extract.

Keywords: - Zinc oxide nanoparticles, Green synthesis, *Anacylus phythrum***ADVANCES IN FOOD AUTHENCITY TEST****Satish chand*, Navneet kumar, kailash pati tripathi****department of horticulture institute of agricultural sciences****banaras hindu university, varanasi-221005**

Food authenticity is rapid growing field due to increasing public awareness concerning food quality. The process which can verify food is in a compliance with is level description, can be defined as food authentication¹. Recent food scares such as bovine spongiform encephalopathy and avian flu outbreaks, olive oil adulteration with hazelnut oil or the adulteration of milk with melamine have led to media and public attention regarding the origin of food and the more general concept of food authenticity². A variety of analytical techniques, for verification of food stuff origin have been developed and tested. Advanced tools like ELISA, Genomics, Proteomics, Metabolomics, NMR, IR, GC-MS, LC-MS etc. are being emerged as major authentication methodologies for discrimination of authentic food products from adulterated product³. A total of honey samples (polyfloral and acacia) from different countries have been analyzed in terms of ¹H-NMR spectroscopy coupled with multivariate statistical methods⁴. FT-IR spectroscopy has been used as accurate and valid technique for the detection and quantification of the adulteration of goat or sheep milk with cow milk in both binary and tertiary mixtures⁵. A DNA based method coupled with High Resolution Melting (HRM) analysis has been reported to differentiate Basmati rice from non-Basmati rice varieties using microsatellite markers⁶. The future applications will cover more food commodity by using newer technologies such as NMR, isotopic methods, IR-MS and DNA-based technologies.

PROCESSING AND UTILIZATION OF BY-PRODUCTS OF SUGAR INDUSTRIES**Kapil Kumar*, Suresh Chandra, Samsher, Prince and Tarun Kumar**

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By-products of cane sugar and beet sugar production include fibre from both cane and beet and Molasses and bagasse are by-products of sugar industry and can be employed as substrates for invertase production. molasses residual concentrated syrup from which no more sugar can economically be removed, Sugar beet pulp is used almost entirely for animal feed, mixed with molasses in loose or pellet form. Because of the higher nitrogen content of sugar beets, nitrogen in the form of urea need not be added, as it must when sugarcane bagasse is used for animal feed. Other uses for beet pulp are as edible fibre, for addition of soluble fibre to baked goods and processed foods, and for inclusion in paper



manufacture. Feed use for bagasse is relatively minor. The major use is as fuel for the cane factory, where one ton of dry bagasse is equivalent in energy value to two barrels of fuel oil. Freshly produced bagasse contains about 50 percent moisture and becomes drier on storage. Bagasse is also widely used as filler for paper, fibre board, and particleboard especially in areas where wood is in short supply. Paper quality ranges from kraft-process brown paper through newsprint to glossy white. Molasses from both sugarcane and sugar beets is a major component of animal feed. Sugar beet molasses that has been subjected to desugarization contains reduced carbohydrate levels and may be blended with cane molasses. Production of ethanol (ethyl alcohol) for industry and distilled spirits is common at most cane and beet factories. Rum is produced from cane molasses in the Western Hemisphere; beverage alcohol is produced from beet molasses in Europe.

EPIGENOMICS PROJECTS ON CROP PLANTS

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Epigenomics is the study of the all the epigenetic modifications on the genetic material of a cell, known as the epigenome. Epigenetic modifications viz chromatin modifications, DNA methylation, RNAs (coding and noncoding) etc. are reversible modifications on a cell's DNA or histones that affect gene expression without altering the DNA sequence. Epigenomic maintenance is a continuous process and plays an important role in stability of eukaryotic genomes by taking part in crucial biological mechanisms. Epigenomics research in plants emerged after discovery of impact of epigenetic events in plant physiology viz vernalization, DNA repair, response to abiotic and biotic stresses etc. Various epigenomics studies have been done on crop plants to improve abiotic and biotic stress resistance. Currently, various research projects are in progress worldwide; to better understand the plant epigenomics, so that it can be applied for crop improvement programs in near future. Plant epigenomics is still in its budding state and needs high throughput research and development for its application in crop improvement programs. Most of the currently ongoing epigenomics projects are contributed towards understanding all the possible epigenetic events that occur in plant genome. Various researchers have encouraged the development of epigenomics databases like pENCODE, Esembl, EPIC and many others; to enhance collaboration and collect the information of various epigenomics projects being conducted worldwide. With the availability of plant genome information and recent technologies, the future of epigenomics is promising to apply this area of research for the crop improvement programs.

Keywords: Epigenetics, epigenomics, plant genome annotation, DNA methylation, Histone modifications.

PLANTS WITH THERAPEUTIC POTENTIAL IN PARTS OF WESTERNUTTAR PRADESH

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The relationship between human and herbs dates from the far past with ample evidences from the old literature – *Atharva Veda*, *Charaka Samhita*, *Rig Veda* and *Sushruta Samhita*. According to World Health Organization, about 75% of the world population are using herbs for basic healthcare needs. Traditional system of medicine continue to be widely practised on many accounts. Thus a survey was carried out in some parts of Western Uttar Pradesh to identify and record the use of medicinal herbs currently practiced by the local people and is confirmed by the help of many medicinal healers. People used these locally available herbs for health and believed that these are less expensive and have no side effects as compare to modern medicine. In total 65 species belonging to 59 genera and 34 families were recorded which is used in primary health care system by the local people. *Euphorbiaceae*, *Amaranthaceae*, *Liliaceae*, *Malvaceae*, *Papilionaceae*, *Asteraceae*, *Apiaceae*, *Lamiaceae* are the major families. Almost all the plant parts like leaves, seeds, roots and bulb have medicinal constituents to alleviate various diseases.

Keywords : Charaka Samhita, indigenous, ethno-medicinal, medicinal herbs, Western Uttar Pradesh , primary health care system, diseases.

MAPPING OF QTLS IN MAIZE (*ZEA MAIZE L.*) FOR HIGH FE AND ZN CONTENT

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Micronutrient deficiencies also termed as hidden hunger, especially those arising from zinc (Zn) and iron (Fe) pose serious human health problem for more than 2 billion people worldwide, especially pregnant women and children below five years of age. In order to alleviate nutrient deficiency previous efforts to supply extra minerals through supplementation or food fortification are still in practice but difficult because of high cost, especially in developing countries. Medical supplements and fortification of food products have been tried in several countries for decades to ameliorate the devastating problem of hidden hunger. However these measures have their own limitations. Iron and zinc biofortification of maize is considered a cost-effective solution to circumvent these problems. Biofortification aims at either increasing accumulation of these minerals in edible parts, endosperm, or to increase their bioavailability. Therefore, to increase the concentration of Zn and Fe in maize kernel and cob is an important way to alleviate the deficiency of Zn and Fe. To create the variety with high concentration of Zn and Fe, it is pre-requisite to identify germplasm with high concentrations of both elements and understand their genetic mechanism. Besides measuring the extent of genetic variability, systematic genetic and molecular analysis of target traits contributing to kernel micronutrient concentration assume importance in breeding for micronutrient enriched maize. Analysis using DNA based markers can effectively complement phenotypic characterization and can aid in identifying promising lines with high genetic diversity. As bioinformatics and large scale genetic tool develop, the quantitative trait loci (QTLs) analysis provides a powerful genetic approach in identifying novel genes affecting a certain traits. Although lots of researchers have been taken about micronutrients variation in bean, rice, wheat, maize, only a few were related to QTL analysis for the micronutrient



concentration. Furthermore, micronutrient accumulation in maize cob and its genetic mechanism have not been explored. Therefore it is of great importance to study molecular mechanism of Zn and Fe accumulation in maize kernel and cob.

Keywords: Maize, Biofortification, Micronutrient, QTL Mapping, Zn and Iron.

EFFECT OF DIFFERENT INOCULUM LEVELS OF *H.AVENAE* ON PHYSIOLOGY OF WHEAT

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Agriculture in present scenario is facing several constraints regarding nematode problem in cereals. Among cereals, wheat being one of the most important source of dietary supplements is experiencing huge amount of yield losses due to the infestation of cereal cyst nematode (*Heterodera avenae*). Yield is an attribute of several physiological processes taking place inside the plant system. These physiological processes whether photosynthesis or transpiration are directly or indirectly being hampered by the nematode feeding behaviour. Nematode feeding leads to reduced leaf area and photosynthetic pigments. These factors can be held accountable for lower photosynthetic rate in nematode infected plants. Intraroot migration and feeding has a detrimental effect on vascular bundles. Thus affecting its water uptake capacity and hence inducing water stress conditions. In order to counter the limited water availability, plant tends to reduce the water loss through transpiration. So, the resultant effect is lower transpiration rate. In present investigation, seeds of wheat cv. WH 1105, susceptible to cereal cyst nematode were sown on 14th Nov. 2016 in pots of 1 kg capacity having nematode infested soil. The infested soil was mixed with autoclaved soil to get the desired inoculum levels i.e. 5, 10 and 15 eggs and juveniles/g soil. Autoclaved soil was taken as control. Physiological parameters i.e. photosynthetic rate and transpiration rate was measured 30 days after sowing. The photosynthetic rate at the inoculum level 5 eggs and J2/g soil was statistically at par with the control plants. Thereafter, significant decrease was observed in the inoculum level 10 eggs and J2/g soil and 15 eggs and J2/g soil. With the increase in inoculum level from 5 eggs and J2/g soil to 15 eggs and J2/g soil there was significant reduction in transpiration rate at each inoculum level. Cereal cyst nematode was found to be altering wheat physiology significantly.

BIOCHEMICAL RESPONSES OF RICE (*ORYZA SATIVA* L.) VARIETIES UNDER SODIC SOIL

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The investigation entitled "Biochemical and nutrient responses of rice varieties under sodic soil" was conducted during the kharif season in 2015 at the experimental site of Department of Crop Physiology at Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad-224 229 (U.P.) in randomized block design with three replications and eight varieties, four tolerant (CSR36, CSR43, Narendra Usar 3, NDR 2009) and four susceptible (Swarna sub 1, IR28, IR64, IR29). Evaluate the performance of tolerant varieties and susceptible varieties in sodic soil. Observations were recorded at 60, 90 DAT and maturity. Results indicate the biochemical characters such as chlorophyll content, proline content and catalase activity was increased in tolerant varieties and decrease in susceptible varieties. CSR36 and CSR43 had a greater tolerance to sodic soil than IR64 and IR29.

KEYWORDS: Salinity, rice, chlorophyll, proline and catalase.

EFFECT OF MICRONUTRIENT AND ORGANIC MANURE IN GRAIN YIELD OF RICE (NDR-359)

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A field experiment was conducted during kharif season of 2016 at farmers field in the village of Nabada, Hapur. Data revealed that different nutrients and micronutrient had significant effect on yield attributing characters viz No. of panicles/m² and panicles wt (g). Combine application of 10 t FYM+100% RDF (120:60:60 NPK/ha)+Zn (0.5% spray)+Fe (0.5% spray) produced significantly higher grain yield of rice (5.53 t/ha) than 100% NPK alone (4.54 t/ha). 100% NPK + 25 Kg Zn/ha produced significantly more grain yield of rice (4.82 t/ha) than 100% NPK alone. Combine application of 10 t FYM+100% NPK+Zn (0.5 spray) recorded significantly higher grain yield of rice (5.38 t/ha) than 100% NPK alone. The increase in rice grain yield with 10 t FYM+100% RDF+Zn (0.5%) + Fe (0.5% spray) was to the tune of 21.8%, 14.7% and 2.7% than 100% NPK alone, 100%, NPK+25 Kg Zn and 10 t FYM + 100% RDF + Zn (0.5%) spray.

EFFECT OF IRRIGATION SCHEDULING ON TOMATO YIELD (*LYCOPERSICON ESCULENTUM*) AND WATER USE EFFICIENCY UNDER DRIP IRRIGATION

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Water is a most limiting factor and main source of crop production in irrigation sector. Efficient management of available water resources is very essential to meet the increasing competition of water between agricultural and non-agricultural sectors both. In present study, it has been analyzed that total production of 2841.05 quintal/hectare has been obtained under various treatments considered in the study and it has observed that maximum production of 634.52 quintal/hectare has been obtained under the treatment T3 (3 hr water applied in time interval of



three day) whereas minimum achieved under treatment T5 (control) as 507.32 quintal/hectare out of three treatments such as T1 (1 hr water applied in one day time interval), T2 (2 hr water applied in two day time interval) and T4 (4 hr water applied in four day interval) whereas highest fruit weight also recorded in T3 treatment as 10.50 kg/plant and lowest 5.40 kg/ plant was obtained under T5 treatment. Highest water use efficiency (WUE) and benefit-cost ratio (BCR) also achieved under the T3 as 3.25 q/ha-cm and 3.01 respectively. Indian agriculture today faces the challenge of meeting demand for safe and quality food. Care has to be taken in protecting the natural resources and the environment in the race for food security. Water is a major input in agriculture. The water use efficiency of the crops has to be increased in order to reduce the water loss from the field.

CONTROL OF SOIL POLLUTION PROSPECTIVE: PHYTOSTABILIZATION AND PHYTOEXTRACTION POTENTIAL OF *PARTHENIUM HYTEROPHORUS* L. AGAINST NICKEL AND CHROMIUM

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Parthenium hysterophorus L. is considered as useless plant species. It has high proliferation rate and ecological adaptability to exist in every type of climate. *P. hysterophorus* were exposed to various concentrations of nickel (Ni) and chromium (Cr) i.e. Ni (10, 20, 40 and 50mg/kg) and Cr (10, 15, 30 and 40mg/kg). The phytostabilization and phytoextraction potential of *P. hysterophorus* to heavy metals Ni and Cr were evaluated. The following parameters were taken in consideration: (Biological Concentration Factor (BCF), Biological Accumulation Coefficient (BAC) and Translocation Factor (TF)) to determine the potential. The Ni was accumulated more in shoot than root (TF<1) in comparison to Cr (TF>1) and transfer less amount of Cr from root to shoot. *P. hysterophorus* accumulate both heavy metals with almost equal efficiency. Hence from the experiment it concluded that *P. hysterophorus* can be used for phytoextraction of Ni from soil with low Ni contamination and phytostabilization of Cr.

Keywords: *P. hysterophorus*, Nickel, Chromium, Biological concentration factor, Biological accumulation coefficient and Translocation factor.

ASSESSMENT OF CYTO-GENOTOXICITY CAUSED BY HEAVY METAL (CD) IN *LYCOPERSICON ESCULENTUM* MILL.

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Heavy metals are among the most toxic and environmentally hazardous pollutants. Cadmium is very toxic among heavy metals and geno-toxicity of Cd is associated with its effect on structure and function of DNA. Analysis of the genotoxic potential of a substance by the investigation of induced chromosomal alterations represents an effective method for biomonitoring studies and for estimation of the degree of pollution. The present study was designed to study the cyto-genotoxic effect of cadmium in terms of seed germination, pollen fertility and meiotic behavior in tomato (*Lycopersicon esculentum* Mill.), one of the most widely cultivated vegetable crops of the world. For this seeds of tomato were treated with different concentrations (20ppm, 40ppm, 60ppm, 80ppm, and 100ppm) of $\text{Cd}(\text{NO}_3)_2$. Seed germination and pollen fertility were significantly reduced at higher concentrations of Cd. Chromosomal abnormalities were dose dependent and found to increase with increasing dose of Cd. Various chromosomal aberrations such as univalents, multivalents, stickiness, bridges, laggards, precocious separations, stray bivalents, disturbed polarity, micronuclei etc were recorded during meiotic analysis of pollen mother cells (PMCs). However, these aberrations were found to be more frequent at higher doses. On the basis of these results, it was concluded that the higher concentrations of Cd were more effective and genotoxic for the plant.

DISTRIBUTION AND DIVERSITY OF PHYTOPLANKTON IN SELECTED PONDS OF ALIGARH DISTRICT, U.P., NORTH INDIA

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The present study was carried out to evaluate the distribution and diversity of phytoplankton in selected ponds of Aligarh district in U.P., North India. Monthly sampling from all the three selected ponds in five replicates was made for a period of 12 months (July 2011–June 2012) at 9:00–11:00 h. A total of 16 species of phytoplankton belonging to 4 genera were found with the Bacillariophyceae and Chlorophyceae being the most abundant taxa. The Shannon–Wiener diversity index calculated for phytoplankton ranged from 2.04 to 2.61. The statistical relationships between water temperature, transparency, dissolved oxygen and free carbon dioxide and phytoplankton groups were also computed for assessing the impact of anthropogenic disturbances on phytoplankton diversity of selected ponds. *Anacystis* species, *Spirulina* species and *Navicula* species identified in the fresh water ponds reveals that the studied ponds are subjected to pollution.



USE OF PEANUT MEAL S AN ALTERNATIVE PROTEIN SOURCE TO FISH MEAL IN PRACTICAL FEEDS FOR FINGERLING HETEROPNEUSTES FOSSILIS (BLOCH)

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An eight-week feeding trial was conducted to replace the fish meal protein by peanut meal in the feeds for fingerling *Heteropneustes fossilis*. Four practical diets (40% crude protein; 17.21 kJ/g gross energy) replacing 0% (Diet 1), 20% (Diet 2), 40% (Diet 3) and 60% (Diet 4) fishmeal protein by peanut meal on protein to protein basis were prepared. The diets were fed to triplicate groups of fish (7.52±0.08g; 8.65±0.52cm) near to satiation. Replacement of fishmeal by peanut meal was found to be feasible up to 20% as evident by insignificant differences ($P>0.05$) among the growth indices such as live weight gain (622.91-649.86%), feed conversion ratio (1.92-1.95), protein efficiency ratio (1.28-1.30), protein productive value (0.17-0.18); specific growth rate (3.53-3.59%) and hematological indices such as hemoglobin (10.38-10.51 g/dL), hematocrit (31.83-32.54%) and RBCs ($2.82-2.86 \times 10^6/\text{mm}^3$) in fish fed diets 1 and 2. However, further replacement of fishmeal protein by peanut meal protein beyond 20% resulted in a significant decrease ($P<0.05$) in growth and hematological parameters. Data generated during this study would be useful in formulating cost-effective commercial feeds for the intensive culture of this fish.

Keywords: Replacement, Fish meal, Peanut meal, fingerling *Heteropneustes fossilis*

SURVEY ON NATURAL OCCURANCE OF ENDOPHYTES IN MAIZE ECOSYSTEM (*Zea mays* L.)

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Fungi that occur inside a asymptomatic plant tissue are known as fungal endophytes. Since a decade there has been high focus on artificial establishment of entomopathogenic fungi as an endophyte in various agri-horticultural crops for pest management. But little focus has been given to identify their natural occurrence. So we have conducted the survey in maize at definite phenophases of crop growth i.e. Seedling stage, knee height stage and reproductive stage, where entomopathogenic fungi were continuously applied for pest management. A surface sterilization and isolation technique was used for the isolation of fungus from roots, stem and leaves. 9 genera of fungus i.e., *Aspergillus* spp., *Beauveria* spp., *Fusarium* spp., *Metarrhizium* spp., *Mucor* spp., *Penicillium* sp., *Rhizopus* spp., *Trichoderma* spp. and *Lecanicillium* spp. have been isolated as naturally occurring entomopathogenic fungal endophytes. Among them *Lecanicillium* sp. found to be the dominant fungus with 33.33 % colonisation followed by *Rhizopus* sp. with 25.66 %, *Mucor* sp. with 23.66 %, *Aspergillus* sp. with 19.66 % and *Fusarium* sp. with 13.33 % and the least less than 10 % colonisation was observed in *Penicillium* sp. with 7.66 %, *Trichoderma* sp. 6.33 %, *Beauveria* sp. with 5.33 % and *Metarrhizium* sp. with 2.66 %. Among the different plant part colonised, percent colonisation was high in roots with average of 30.78 ± 7.22 % followed by stem with 12.33 ± 2.28 % and least in leaves with 27.77 ± 0.77 %. Thus, the study indicates the potential of natural establishment of endophytes after repeated and continuous use of entomopathogenic fungus for pest management. In addition to this, understanding the fungal diversity, extent of colonization and their association with various plant parts at different phenophases will provide a baseline data for better exploitation of this fungus as a new paradigm in biological control.

Keywords: Colonisation, Endophyte, Entomopathogenic, Maize and Phenophase.

EFFECT OF DIFFERENT INOCULUM LEVELS OF *H.AVENAE* ON PHYSIOLOGY OF WHEAT

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Agriculture in present scenario is facing several constraints regarding nematode problem in cereals. Among cereals, wheat being one of the most important source of dietary supplements is experiencing huge amount of yield losses due to the infestation of cereal cyst nematode (*Heterodera avenae*). Yield is an attribute of several physiological processes taking place inside the plant system. These physiological processes whether photosynthesis or transpiration are directly or indirectly being hampered by the nematode feeding behaviour. Nematode feeding leads to reduced leaf area and photosynthetic pigments. These factors can be held accountable for lower photosynthetic rate in nematode infected plants. Intraroot migration and feeding has a detrimental effect on vascular bundles. Thus affecting its water uptake capacity and hence inducing water stress conditions. In order to counter the limited water availability, plant tends to reduce the water loss through transpiration. So, the resultant effect is lower transpiration rate. In present investigation, seeds of wheat cv. WH 1105, susceptible to cereal cyst nematode were sown on 14th Nov. 2016 in pots of 1 kg capacity having nematode infested soil. The infested soil was mixed with autoclaved soil to get the desired inoculum levels i.e. 5, 10 and 15 eggs and juveniles/g soil. Autoclaved soil was taken as control. Physiological parameters i.e. photosynthetic rate and transpiration rate was measured 30 days after sowing. The photosynthetic rate at the inoculum level 5 eggs and J2/g soil was statistically at par with the control plants. Thereafter, significant decrease was observed in the inoculum level 10 eggs and J2/g soil and 15 eggs and J2/g soil. With the increase in inoculum level from 5 eggs and J2/g soil to 15 eggs and J2/g soil there was significant reduction in transpiration rate at each inoculum level. Cereal cyst nematode was found to be altering wheat physiology significantly.



EFFECT OF MICRONUTRIENT AND ORGANIC MANURE IN GRAIN YIELD OF RICE (NDR-359)**Sanjeev Kumar Singh¹ and Bikramaditya²**¹Kisan PG College Simbhaoli, Hapur²Department of Agronomy, C.S.S.S. (P.G.) College, Machhara, Meerut, U.P. India

A field experiment was conducted during kharif season of 2016 at farmers field in the village of Nabada, Hapur. Data revealed that different nutrients and micronutrient had significant effect on yield attributing characters viz No. of panicles/m² and panicles wt (g). Combine application of 10 t FYM+100% RDF (120:60:60 NPK/ha)+Zn (0.5% spray)+Fe (0.5% spray) produced significantly higher grain yield of rice (5.53 t/ha) than 100% NPK alone (4.54 t/ha). 100% NPK + 25 Kg Zn/ha produced significantly more grain yield of rice (4.82 t/ha) than 100% NPK alone. Combine application of 10 t FYM+100% NPK+Zn (0.5 spray) recorded significantly higher grain yield of rice (5.38 t/ha) than 100% NPK alone. The increase in rice grain yield with 10 t FYM+100% RDF+Zn (0.5%) + Fe (0.5% spray) was to the tune of 21.8%, 14.7% and 2.7% than 100% NPK alone, 100% NPK+25 Kg Zn and 10 t FYM + 100% RDF + Zn (0.5%) spray.

MANAGEMENT OF TOMATO LEAF CURL VIRUS AND ITS VECTOR WHITE FLY (*BEMISSIA TABACI*) IN FIELD CONDITION**Amit Kumar Yadav, *Ramesh Singh Yadav, Hem Singh, Abhishek Kumar and Jaskaran Singh**

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Tomato (*Lycopersicon esculentum* Lin.) is one of the most widely grown vegetables. The notoriety of *B. tabaci* as a pest obscured by its role as an efficient vector of a large number of viral diseases of tomato in the tropical and subtropical parts of the world. Among all, tomato leaf curl virus is shown to be transmitted by the vector, whitefly (*Bemisia tabaci* Genn.) have seriously hampered the cultivation and production of tomato. A pot experiment were conducted during 2015-16 to evaluate the different plant leaf extracts 10% (Bougainvillea, Marigold, and Bael), seed kernel extract 5% (Neem and Jatrofa), plant oils 2% (lemon grass and Eucalyptus) and chemicals (Acetamiprid 0.1%) for management of virus vector white flies (*Bemisia tabaci*). The effect of plant leaf extracts, seed kernel extract, plant oils, bio agent and chemicals were found to be effective for reducing whiteflies population. The maximum decrease number of whitefly was recorded 3.00, 3.67, 1.67, 2.33 in Acetamiprid followed by Neem seed kernel extract 4.00, 4.33, 2.67, 3.00 after 7 and 14 days of first and second spray. Whereas, untreated control was recorded with 13.00, 14.67, 15.00, 16.00 respectively and also reduced the disease severity 62 to 65 % of tomato leaf curl virus, pots treated with Acetamiprid.

BIO- EFFICACY OF VARIOUS HERBICIDES AGAINST MIXED WEED FLORA OF WHEAT CROP.**B.K Mishra,¹ A.K Singh² and S.P Vishwakarma**

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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.

FIG - A MICROHABITAT SHOWING FASCINATING TRI-TROPHIC INTERACTION**Numreen Nazir*, Mohammad Asif, Mohammad Mahboob, Rehmat Jahan, Malka Mustaqim and Qudsia Tahseen**

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Fig syconium represents an interesting microhabitat that harbours unique tri-trophic relationship between fig, fig wasp and nematode. Fig syconium releases semiochemicals to attract the specific fig wasp to the flowers (florets). Fig wasp enters the syconium through ostiole (an opening on its surface). Apart from pollinating the fig flowers, it also carries specific nematodes belonging to different genera. Female fig wasps are behaviorally and morphologically adapted for pollination and egg laying at the expense of its own life. The newly hatched females carry pollen and nematodes to a receptive syconium at a different location. Inside the syconium, wingless male wasp with long abdomens mates with females and die after mating inside the syconium. There are five successive developmental stages of syconis and each stage is synchronized with development and growth of specific nematode species. The nematode genera reported so far from fig syconium are *Teratodiplogaster*, *Parasitodiplogaster*, *Sigmodiplogaster*, *Prodelphodiplogaster*, *Canalodiplogaster* and *Schistonchus*. Figs collected from different areas of Aligarh and Kashmir were dissected with sharp scalpel and placed in a petriplate for about 20-30 minutes till the emergence of nematodes. The nematodes isolated were *Schistonchus* sp. and *Teratodiplogaster* sp. These nematodes were fixed in formaldehyde-glycerol and further dehydrated. Scanning electron microscopy was done to study morphological characters of *Schistonchus* sp. and *Teratodiplogaster* sp.



The fig, fig wasp and nematode interaction is an optimum system that shows the occurrence of host specificity and the complex relationships in tri-trophic interactions that are fundamental to understand the evolutionary and co-evolutionary processes.

Keywords: fig, syconium, fig wasp, nematodes, interaction, tri-trophic

EVALUATION OF DIFFERENT NUTRIENT MEDIA ON RADIAL GROWTH AND SCLEROTIAL FORMATION OF *SCLEROTINIA SCLEROTIORUM* (LIB.) DE BARY CAUSING WHITE STEM ROT OF MUSTARD

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The present study was conducted to note the differences in radial growth and sclerotial formation of *Sclerotinia sclerotiorum* on different nutrient media viz., Potato Dextrose Agar (PDA), Malt Extract Agar (MEA), Richard's Agar (RA) and V-8 Juice Agar (V8JA). The results indicated a marked variation in radial growth of *S. sclerotiorum* on different nutrient media. Significantly maximum radial growth was measured on Malt Extract Agar (31.66 mm) followed by Potato Dextrose Agar (26.66 mm). However, minimum radial growth (21.66 mm) was recorded on both Richard's Agar and V-8 Juice Agar media after 3 days of inoculation. Early initiation of sclerotial formation was recorded only on Malt Extract Agar only 8 days after inoculation. Interestingly, the number and size of sclerotia also varied on different nutrient media when recorded 10 days after inoculation. Maximum number of sclerotia was recorded on Potato Dextrose Agar (32) followed by Malt Extract Agar (30) yet they were similar in size i.e., 5-10 mm. However, relatively less number of sclerotia was yielded from Richard's Agar medium (27), ranging in size from 4-10 mm. V-8 juice agar was found to be the least selective nutrient medium for sclerotial number (20) and size (3-5 mm).

CORRELATION AND PATH COEFFICIENT ANALYSIS IN BRINJAL (*SOLANUM MELONGENA* L.)

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The study was carried out with eight parents and 28 F₁ hybrids of brinjal at SVPUA&T Meerut during Kharif 2010 to find out correlation and path coefficient analysis among the different yield attributing traits and direct and indirect effect of traits on yield. Data recorded for twelve characters viz. "plant height, primary branches per plant, plant spread, days to first flowering, days to first fruit set, days to first harvest, average fruits weight, fruit length, fruit diameter, fruit index, fruits per plant and yield per plant. Highly significant and positive association of fruit yield per plant was recorded with fruit length, fruit index, plant height and average fruit weight while non significant and positive correlation were found between fruits per plant and fruit diameter. Fruit yield per plant showed negative and significant correlation between days to first harvest, days to first fruit set and days to first flowering. Fruits per plant showed negative and significant correlation between average fruit weight, fruit index, fruit diameter, days to first harvest, plant spread, fruit length and days to first fruit set. Path coefficient analysis for fruit yield involving 11 independent variables revealed that fruit diameter gave maximum positive and direct effect on yield per plant followed by fruit length, fruits per plant, average fruit weight and days to first fruit set. Fruit Index showed maximum indirect effect via fruits per plant at genotypic level. At phenotypic level, fruit diameter showed maximum direct effect on fruit yield per plant followed by fruit length, fruits per plant, average fruit weight and days to first fruit set, while fruit index showed maximum indirect effect on yield per plant via fruits per plant and plant height via fruits per plant.

EXPRESSION OF HETEROSIS FOR YIELD IN BARLEY

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To judge better heterotic responses, a study was conducted for two winter season during 2009-10 and 2010-11 at Genetics and Plant breeding research farm ND, University of Agriculture and Technology, Kumarganj, Faizabad-224 229 (U. P.), INDIA, using 4 sets of crosses (NDB-943 x NDB-1173, DL 88 x K-890, DWR-57 x PL-762 and Azad x K-750) during the *rabi* 2008-11 at Research Farm of Genetics and Plant Breeding, NarendraDeva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). Six genetic populations (P₁, P₂, F₁, F₂, B₁ and B₂) of above four crosses were evaluated in Compact Family Block Design with three replications in normal and saline sodic soils.

Under both the environments positive and highly significant heterosis was observed for initial seed germination (cross I), plant height (cross III), peduncle length (cross IV), spike length (cross III), chlorophyll content (cross IV), grains weight/spike (cross II), grain yield/plant (cross III), grain size (cross IV), 1000-grain weight (cross I) and for grain hardness and amylose content (cross II). In general, considerable amount of heterosis over better parent was observed for almost all the characters under normal soil. Heterosis over better parent for grain yield/plant varied from 3.06% (cross II) to 15.03% (cross I). The maximum heterobeltiosis was displayed by the cross III (8.82%) followed by cross IV (4.19%) and cross II (3.06) for grain yield per plant. Similarly, maximum heterobeltiosis was also reported for other traits in normal soil in the crosses viz., cross I (12.00%) for initial seed germination, cross III (1.79%) for plant height, cross II (19.97) for number of effective tillers, cross II (15.25%) for spike length, cross IV (5.76 %) for chlorophyll content, cross I (6.56%) for number of grain/spike, cross II (2.22%) for days to



maturity, cross II (16.85%) for harvest index, cross I (15.03%) for grain yield/plat, cross I (5.50%) for grain size, cross IV (15.03%) for 1000-grain weight, cross I (5.84%) for protein content, cross III (11.76%) for grain hardness and cross II (11.90%) for amylose content.

Under both the environments (normal and saline sodic soil) positive and highly significant heterosis were observed for grain yield/plant (cross I), grain size (cross I), 1000-grain weight (cross IV), protein content (cross I), grain hardness (cross III) and amylose content (cross II).

IMPACT OF DIFFERENT LEVELS AND SOURCES OF SULPHUR ON GROWTH, YIELD AND QUALITY OF MUSTARD (*BRASSICA JUNCEA* L.)

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The present study was conducted at the Student Instructional Farm of N. D. University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during Rabi season 2015-2016, to evaluate the impact of different levels and sources of sulphur on growth, yield and quality of mustard (*Brassica juncea* L.). In this experiment the mustard variety “NDR-8501” was taken as test crop, which was sown of 1st November, 2015. The experiment consists of seven treatments viz. absolute control (RDE-NPK:120:60:60), RDF + 20 kg S ha⁻¹ through SSP, RDF + 40 kg S ha⁻¹ through SSP, RDF + 20 kg S ha⁻¹ through Sulphur Bentonite, RDF + 40 kg S ha⁻¹ through Sulphur Bentonite, RDF + 20 kg S ha⁻¹ through Phosphogypsum and RDF + 40 kg S ha⁻¹ through Phosphogypsum. Experiment of laid out in Randomized Block Design (R.B.D.) in arrangement with three replications on silt loam soils having pH (8.2), electrical conductivity (0.31 dS/m), low organic carbon (0.32 %), low available nitrogen (145.50 kg ha⁻¹), available phosphorus (8.78 kg ha⁻¹), medium potassium (188.50 kg ha⁻¹) and low available sulphur (15.23 kg ha⁻¹). The result revealed that the application of RDF + 40 kg S ha⁻¹ through SSP produced significantly higher growth characters like plant height, number of branches, yield attributes like number of siliqua plant⁻¹, length of siliqua (cm), grain yield, stover yield and oil content in grain as compared to other treatments, respectively.

Keywords: Mustard (*Brassica juncea* L.), SSP, sulphur bentonite, phosphogypsum, growth, yield attributes and oil content.

KRISHI VIGYAN KENDRAS (KVKs) - A POWERFUL TOOL TO TRANSFER OF TECHNOLOGY

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An agricultural invention-and-innovation continuum in all facets of agriculture and allied activities with its effective diffusion is key to sustainably increase the agricultural production and productivity with environment sustainability. The Krishi Vigyan Kendras (KVK) is of national importance which would help in accelerating the agricultural production and also in improving the socio-economic conditions of the farming community. The main aim of Krishi Vigyan Kendras (KVKs) to conduct technology assessment and refinement, knowledge dissemination and provide critical input support for the farmers with a multidisciplinary approach. KVKs are playing a proactive role in transferring new technology at field level with beneficial impacts. They have an edge in technology transfer over other service providers by virtue of their having better technical expertise and demonstration units. KVKs are envisaged various activities such as on-farm testing (OFT) to assess the location specificity of agricultural technologies under various farming systems, frontline demonstrations (FLD) to establish production potential of technologies on the farmers' fields, capacity development of farmers and extension personnel to update their knowledge and skills on modern agricultural technologies, to work as knowledge and resource centre of agricultural technologies for supporting initiatives of public, private and voluntary sectors in improving the agricultural economy of the district and provide farm advisories using ICT and other media means on varied subjects of interest to farmers. Need based training programmes are being conducted by the KVK in various disciplines such as agronomy, horticulture, soil science, plant protection, women in agriculture, agricultural engineering and others. KVK would produce quality technological products (seed, planting material, bio-agents, livestock) and make it available to farmers, organize frontline extension activities, identify and document selected farm innovations and converge with ongoing schemes and programmes.

Keywords: On farm testing, front line demonstration, training and technique.

INTEGRATED FARMING SYSTEM: A BETTER TOOL FOR SOIL HEALTH AND SUSTAINABLE AGRICULTURE.

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Integrated farming system is the system invariably having combination of crop and animal components. Where, the product and byproduct of one component can be used for other component. The demand for food is increasing day by day due to decreased food production; there is continuous conversion of agricultural lands to residential lands and also the number of farmers working in the field is drastically reduced. The primary objective of the IFS is to maintain production of food and other goods and services that contribute to food security and income generation to the rural poor. Other functions that are just as important are achieving environmental sustainability and contributing to agriculture sustainability and ecosystem services. Continuous production of crops without external inputs reduce the ability of the soil resource base to both provide and retain nutrients which often results in a decline in productivity. Integrated farming systems are often viewed as a sustainable alternative to commercial farming systems particularly on marginal lands with the objective of reversing resource degradation and stabilizing farm incomes. Addition of organic residues in the form of animal and plant wastes could also help in improving the soil health and thereby productivity over a longer period of time with lesser environmental hazards. It improves soil fertility and soil physical structure from appropriate crop rotation and using



cover crop and organic compost. It reduce weeds, insect pests and diseases from appropriate crop rotation. It improves space utilization and increase productivity per unit area. It provides diversified products.

EFFECT OF HIGHER DOSES OF FERTILIZERS ON CROP ESTABLISHMENT AND PRODUCTIVITY OF LATE SOWN VARIETIES OF WHEAT (*TRITICUM AESTIVUM* L. EMEND. FIORI AND POAL)

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A field experiment was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during *khari* season of 2012-13 with carried out in RBD with three replications, the treatments comprised of five varieties viz., V₁-NW-1014, V₂- NW-2036, V₃- UP-2425, V₄- PBW-373 and V₅-DBW-14 and three fertilizers levels viz., 100 per cent recommended dose (120:60:60 kg NPK ha⁻¹), 125 per cent recommended dose (150:75:75 kg NPK ha⁻¹) and 150 per cent recommended dose (180:90:90 kg NPK ha⁻¹). NW-1014 variety of late sown wheat were maintained higher number of initial plant population, plant height, number of tillers, dry matter accumulation, yield attributes except 1000-grain weight, grain and straw yield and NPK uptake kg ha⁻¹ than DBW-14. All these growth and yield parameters were registered higher under 180:90:90 kg NPK ha⁻¹ being at par with 150:75:75 kg NPK ha⁻¹ and found significantly superior over 120:60:60 kg NPK ha⁻¹. Highest NPK uptake kg ha⁻¹ was received under NW-1014 followed by all rest varieties of wheat. The lowest uptake of NPK was recorded under DBW-14 variety. Lowest uptake of NPK kg ha⁻¹ with the application of 120:60:60 kg NPK ha⁻¹ was closely associated with low production of dry matter and less nutrient content in grain and straw.

EFFECT OF WINTER MAIZE-BASED INTERCROPPING SYSTEMS ON MAIZE YIELD, ASSOCIATED WEEDS AND ECONOMIC EFFICIENCY

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A field experiment was conducted during winter seasons of 2016-17 at technology park of krishi vigyan Kendra Buxa Jaunpur district of Uttar Pradesh, India to study the effect of winter maize (*Zea mays* L.) based intercropping systems on maize yield, associated weeds and economics under irrigated condition of eastern Uttar Pradesh. Nine maize-based cropping systems such as maize sole, potato (*Solanum tuberosum* L.) sole, mustard [*Brassica juncea* (L.) Czernj. & Cosson] sole, pea (*Pisum sativum* L.) sole, linseed (*Linum usitatissimum* L.) sole, maize + potato (1:1), maize + mustard (1:1), maize + pea (1:2) and maize + linseed (1:2) were tested in randomized block design with three replications. Maize + potato system recorded higher yield attributes and grain yield of maize followed by maize + pea than sole stand of maize. Potato was showed most compatible intercrop planted with winter maize as it gave higher maize-equivalent yield, land-equivalent ratio, productivity, monetary returns and lowered weed population, weed dry-biomass and highest weed-control efficiency under irrigated conditions of eastern Uttar Pradesh. Pea was the next best intercrop with winter maize.

CLIMATE STRESS MITIGATION AND ETHNO-BOTANICAL POTENTIAL OF ORPHAN LEGUMES

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Crop species which are adapted to hot and dry climates will become increasingly important as the world warms. There has been supporting research and education in the biological sciences which is devoted to agricultural crop improvement for the relief of poverty, with a focus on legumes. The funding agency has supported research on legumes because of their importance in providing high quality protein in the diets of resource-poor farmers. Among these crops are many stress tolerant legume species found in India and Africa, which are relatively minor and neglected crops. A new program me called “Stress Tolerant Orphan Legumes” (STOL) has been launched with an aims to support systematic studies of their potential to address the loss of agricultural productivity in areas of the globe that are suffering the greatest climate stresses.

There are clear signs that climate change is already having severe effects on the agriculture where several crops are failing as result of the changed climate. In addition to direct effects of heat and drought on crops, the country is suffering soil loss due to increase in desert area per year. Over grazing, intensive cultivation, removal of tree cover, poor water management have all been as a reasons for this loss which can not be compensated by any means. One more versatile fact remains that large tracts of land are being taken out of production for different types of constructions by the governments for the people as well as by the people for their settlements in urban areas. There are three possible ways to mitigate this looming disaster. First one is the adoption of stress tolerant legume species which may help farmers to fight the ravages of climate stress: production of grain to feed the family and also provide income; fodder and forage to livestock; ground cover as remedy for soil degradation. For this reason there should be a diversity of species where some crops may prove to be multipurpose, providing grain and fodder, forage and other crops may be specialized for other function such as soil remediation.

In this study we are undertaking only twelve orphan legumes viz., *Cajanus cajan*, *Lablab purpureus*, *Macrotyloma uniflorum*, *Phaseolus acutifolius*, *Phaseolus lunatus*, *Phaseolus vulgaris*, *Tylosema esculentum*, *Vigna aconitifolia*, *Vigna radiate*, *Vigna subterranean*, *Vigna umbellata*, *Vigna unguiculata* for their potential of climate stress mitigation, ethno-botanical and ethno-medicinal uses.



EFFECT OF FUNGICIDES SPRAYS ON SHELF LIFE OF KINNOW FRUITS STORED UNDER AMBIENT CONDITIONS**Vivek Beniwal*, A.K. Godara and Prince**

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The cultivation of Kinnow mandarin has assumed a considerable importance during the recent years in India and it is grown in Haryana, Punjab, Himachal Pradesh Rajasthan and some other parts of the country. The superb qualities of fruits are generally harvested during the peak harvesting season but the demand pick up a later. It is essential to store the Kinnow fruits for a considerable period to avoid a glut in the market during harvesting season. However, the market quality of fruits deteriorates quickly during the storage because of fungal decay and attack by a variety of microorganisms that causes post harvest rotting (Sharma *et al.*, 2008). Hidden or well determined pre harvest contamination at the time of harvest is not easy to eradicate by mere post harvest application of fungicides. As per Govt. regulating bodies allows only pre harvest application of specific chemicals for decay control but not for post harvest treatment. Only the pre harvest field application of fungicides is the finest approach to control the post harvest fruit rotting. Keeping above these factors in account the field trial was carried out on Kinnow plants at farmer's field, Sirsa. Pre harvest foliar application of copper oxychloride (0.3%), copper oxychloride (0.3%) & Carbendazim (0.1%), copper oxychloride (0.3%) & Thiophanate methyl (0.1%), copper oxychloride (0.3%) & Mancozeb (0.2%), copper oxychloride (0.3%) & Streptocyclin (500ppm) and copper oxychloride (0.3%) & Aureofungin (500ppm) were sprayed on the plants. Copper oxychloride (0.3%) was applied in 1st week of July and 1st week of August and other fungicides applied in 3rd week of September. Controlled plants received only water spray. Fruits were harvested in mid December and packed in CFB (corrugated fiber board) boxes and stored at ambient temperature. The experimental design was randomized block design with seven treatments including control. These treatments were replicated three times and each replication consisted of 4kg fruits. During storage the fruits were analyzed at 5 days interval up to 60 days after the storage. The data of PLW and decay loss for both the years (2015-16 and 2016-17) were pooled and analyzed statistically. The copper oxychloride (0.3%) & Carbendazim (0.1%) is exhibited greater influence in minimizing the PLW. The maximum PLW (9.90%) was observed in control whereas it was minimum (6.55%) in copper oxychloride (0.3%) & Carbendazim (0.1%) treatment. Therefore, it can be visualized from the data that Carbendazim (0.1%) and Thiophanate methyl (0.1%) in combination with copper oxychloride (0.3%) treated fruits can be marketed up to 45 and 40 days respectively and provides complete protection to the fruits from infection up to 15 days of storage.

Keywords: Kinnow, PLW, Decay loss, Fungicides, Shelf life**NEEDS AND ADVANTAGES OF PRECISION FARMING IN INDIA****Pushpanjali¹, Pratishtha Diwaker², Ravindra Kumar Dhaka³ and Jitendra Singh Ranawat⁴**^{1, 2} SKN College of agriculture, Jobner, Agriculture University, Jobner, Rajasthan³ College of Forestry, ACHF, Navsari Agricultural University, Navsari -396450 (Gujarat)⁴ College of Horticulture and Forestry, Jhalawar, under Agriculture University, Kota, Rajasthan

Agriculture is the backbone of our country and economy, which accounts directly and indirectly for almost 30 per cent of Gross Demand Product (GDP) and employs 70 per cent of the population. Today's agriculture technology available in the country could not meet the forthcoming demand of food so we have to divert towards the new technologies, for revolutionizing our agriculture productivity. Since long, it has been recognized that crops and soils are not uniform within a given field. Over the last decade, technical methods have been developed to utilize the modern electronics to respond to field variability. Such methods are known as spatially variable crop production, global positioning system based agriculture, site specific and precision farming. Precision farming is comprehensive information based farm management system to identify, analyze and manage variability within fields for optimum profitability, sustainability and protection of the land resources. It basically means adding the right amount of treatment at the right time and the right location within a field. Precision farming lays emphasis on crop management using information technology like Global Positioning System, Geographical Information System, Grid Sampling, Yield monitors, Remote sensors, Variable rate technology, Yield mapping and Auto-guidance. The goal of precision farming is to control the variability within the field and main concept behind precision farming is that production inputs (seed, fertilizer, chemicals etc.) should be applied only as needed and where needed for the most economic production. Need of precision farming is due to reduction in soil fertility, soil degradation, soil salinization, soil erosion, indiscriminate use of pesticides and irrigation, imbalanced fertilization and poor sustainability of agriculture land. Strategies for precision farming should include reduction in fertilizer, chemical and seed costs, increase in yields, improvement in the quality of the crop, improved economic analysis- computerized capturing, storing and analyzing field records, reduce skip and overlap with input application, longer working hours and high labour productivity. Precision farming has been confined to developed countries and reasons of limitations in developing countries like India is due to small land holdings, heterogeneity of cropping system and market imperfections, lack of technical expertise, knowledge and technology and high cost of investment. The methodology could be adopted in order to operationalize precision farming in India is to create multidisciplinary teams involving agriculture scientists in various fields, engineers, manufacturers and economists to study the overall scope of precision agriculture, making availability of all precision farming tools, government legislation restraining farmers from using indiscriminate farm inputs and creating awareness amongst farmers about precision farming. Thus, precision farming is the present need of the country and has several advantages for control spatial variability in the climate change era.

Keywords: Agriculture, Gross Demand Product, Global Positioning System (GPS), Geographical Information System (GIS), Remote Sensing (RS), Precision Farming.

ECO- TOURISM AND SUSTAINABLE DEVELOPMENT

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The issues related to environment are becoming more and more critical with the passage of time. The importance of these issues is being felt all across the globe. Environmental pollution is now a seriously debated issue all over the world. Various reports have indicated towards the horrifying future which the inhabitants on earth are waiting. We all are moving towards self destruction due to over ambitious strides of modern man. Rampant and unplanned exploitation of natural resources is a cause of serious concern. Amidst all these worldwide developments, the issue of sustainable development has gained even more significance. The utmost concern of sustainable development is that the nature of today's growth and development must be such that future generations also reap benefits of the same. In the name of development, we are making the life of our future generations extremely miserable due to serious challenges being posed to world environment.

Eco- tourism is an emerging area these days. However, it has its own merits and demerits. On the side of merits, it can be cited that Eco- tourism can come quite handy in making people aware about the environmental concerns and making them feel the beauty as well as significance of preserving Earth's environment. On the demerits side, it can be pointed out that Eco- tourism results in polluting these tourists sites due to overcrowding of tourists at these sites which causes pollution and other environmental concerns at these places. Present paper by authors is an attempt to present Eco- tourism as a means of educating masses about environmental concerns and significance of sustainable development.

TOXICITY AND FORMATION OF ACRYLAMIDE DURING FOOD PROCESSING: A REVIEW

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Acrylamide (C_3H_5NO ; 2-propenamide), is a colourless, non-volatile crystalline solid, soluble in water. Acrylamide is one of the toxic compounds formed in food products during processing, specifically high temperature long time processing like baking, frying, etc. Acrylamide increases the incidence of cancer in rats at doses of 1-2 mg/kg body weight per day. Acrylamide is principally formed in plant based foods and found in high heat treated starchy foods such as potato, cereal and bakery products. Fried and baked products contain high level of acrylamide. Acrylamide content in French fries and breads ranges from 59-5200 and 10-3200 $\mu g/kg$. According to WHO (2005), the maximum permissible level of acrylamide is 21-140 $\mu g/70$ kg body weight for general population. Formation of acrylamide during processing of foods is dependent on factors such as presence of amino acid asparagines, reducing sugars and processing conditions like temperature, time and moisture content. The major pathway leading for acrylamide formation in foods is a part of the Maillard reaction with free amino acid (asparagine) and reducing sugars. Asparagine, is the free amino acid present in potatoes in high level (about 90 mg per 100 g), needs free sugars to form acrylamide. Asparagine is believed to be precursor of acrylamide and is the limiting factor in acrylamide formation. However, many studies have revealed that the acrylamide formation in food products can be reduced by giving some pre-treatments to the foods. Blanching, soaking and addition of phenolic compounds tend to decrease the rate of acrylamide formation in food products. The objective of this review is to discuss the formation of acrylamide and its toxicity based on recent studies.

Keywords: Acrylamide, food toxicity, asparagines, maillard reaction, food processing

EFFECT OF CLIMATE CHANGE ON VEGETABLE CROPS

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Climate change is one of the most important global environmental challenges in the history of mankind. A change in global or regional climate patterns in particular, a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon di oxide produced by the use of fossil fuels. The phenomena will lead to a situation of high temperature, and low light with excess or deficit moisture. Vegetable crops plants are herbaceous succulents and much prone to abiotic stress. Environmental interaction may make the stress response of plants more complex or influence the degree of impact of climate change. High temperature and water stress can affect the photosynthesis, reproductive growth and mineral uptake resulting in poor growth of vegetables. Studies indicated that high temperature can cause significant losses in tomato production and productivity due to reduced fruit set, smaller and low quality fruits. In tomato, water stress accompanied by temperature above 28⁰ C induce about 30-45% flower drop in different cultivars. Soil water stress at early stages of onion growth causes 26% yield loss. Chilli under rainfed condition also suffers drought stress leading to yield loss up to 50-60%. High temperature leads to more formation of male flower in cucurbits especially in bottlegourd. To maximize the production of any crop, it is important to understand, how these environmental factors affect plant growth, development and production. Small changes in temperature and rainfall will have significant impact on quality of vegetables with resultant implications in domestic and external trade.



COMBINING ABILITY AND GENE ACTION STUDIES FOR GRAIN YIELD AND COMPONENT CHARACTERS IN PEARL MILLET [*Pennisetum glaucum* (L.) R. BR.] UNDER ARID CONDITION OF RAJASTHAN

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The experiment was conducted with 50 hybrids which were generated through $L \times T$ mating design using 10 lines and 5 testers as parental material along with 3 standard check hybrids and evaluated in RBD with 3 replications during *kharif* 2014 season to study combining ability along with inheritance of grain yield and component characters of pearl millet. The analysis of variance revealed significant difference among all the hybrids for all the characters studied. Ratio of GCA and SCA variances was below unity for all the characters which indicate of greater role of non-additive genetic variance in the inheritance of these traits. The per cent contribution of lines to total variance in hybrids were higher in magnitude as compared to testers for the characters ear head length (cm), test weight (g) and harvest index while testers were higher for the characters days to 50% flowering, days to maturity, plant height (cm), no. of effective tillers/plant, ear head diameter, biological yield/plant (g) and seed yield/plant (g) and lines $\times$ testers were higher for characters viz. harvest index, ear head diameter (cm) and ear head length. The degree of dominance (σ^2D/σ^2A)^{0.5} was found greater than unity for all the characters, indicating the over dominance. Among the female parents, RMS 6A, ICMA 92777 and JMSA 20073 were identified as good general combiners for grain yield per plant and some other component traits. Amongst male parents, H77/833-2 and RIB 57SO5 were good general combiner for most of the characters. Among the fifty hybrids, nine hybrids showed the best performance with significantly positive sca effect for grain yield. The cross combinations JMSA 20073 $\times$ RCB-IC 925 S3 19-3-1, ICMA 04999 $\times$ H77/833-2 and RMS 6A $\times$ MIR 97092-2-4 were recorded the significant sca effect in desirable direction for grain yield and some other important characters. Thus, these hybrids can be commercially exploited through heterosis breeding programme after testing in multi-locational trial.

Keywords: *Pennisetum glaucum*, Combining ability, $L \times T$ mating design, GCA, SCA.

EFFECT OF CLIMATE CHANGE ON INSECT POPULATION

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Climate change refers to a Change in climate over time, either due to natural variability or as a result of human activity. The occurrence of climate changes is evident from increase in global average temperature, changes in the rainfall pattern and extreme climatic events. Most of the warming observed over the last 50 years is attributable to human activities as a result of this the surface temperature is predicted to increase by 1.4 to 5.8°C from 1990 to 2100. If temperatures rise by about 2°C over the next 100 years, such changes in climate and weather could profoundly affect the status of insect pests of crops. These may arise not only as a result of direct effects on the distribution and abundance of pest populations but also indirect effects on the pests host plants, competitors and natural enemies (Porter, et al., 1991). Keeping these facts in view, we can observe its impact on arthropods diversity and its extinction, geographical distribution and population dynamics of insects; expression of resistance of plants to insect pests, effectiveness of transgenic crops for pest management, effectiveness of insecticides. These seasonal and long term changes would affect the fauna, flora and population dynamics of insect pests. The abiotic parameters are known to have direct impact on insect population dynamics through modulation of developmental rates, survival, fecundity, voltinism and dispersal. The studies showed that, declined survival rate of brown plant hopper, *Nilaparvatha lugens* (Stal) and rice leaf folder, *Cnaphalocrocis medinalis* (Guen) at higher temperature indicates the impacts of rising temperature could do the changes in the pest population dynamics of rice ecosystem. By this we can say that climate change is playing a vital role in effecting the insect population, so adaptation of different integrated pest management strategies will help in reducing the effect of climate change on insect population.

EFFECT OF WEDGE GRAFTING IN GUAVA ON DIFFERENT AGE ROOTSTOCK UNDER SHADE NET AND OPEN CONDITION

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Rootstocks at younger age is bound to avoiding the diseases, reduce the cost of graft in nursery and will be short statured, prone to enable less damage in transport as well as better survival on transplanting. Age of rootstock influenced the success of wedge grafting. With this objective the present investigation was carried out at Chaudhary Charan Singh Haryana Agricultural University, Hisar during the year 2017. The experiment was laid out in CRD with three replications to find out the suitable age for successful wedge grafting with polycap of guava rootstock cv. L-49 under different growing conditions (shade net and open condition) with different age of rootstock (8,12 and 16 months). The result revealed that under shade net + 12 month old rootstock takes minimum days (28.7) were required for successful grafting and maximum scion length (10.8cm) were recorded on 95 days after grafting followed by 8 months. At 12 months age, guava seedlings the diameter attained about 10 mm (due to growth in cambium). 10 mm diameter of seedling might be most appropriate for quick and successful grafting avoiding the diseases, pest and desiccation because of appropriate level of plant hormones. In the experiment, the interaction between growing conditions and period after grafting was found significant. Present results suggest that highest scion length and minimum days required for successful grafting were found best under shade-net on 12 month old seedling followed by 8 month old seedling.

Keywords: Guava, Rootstock age, Seedling, Propagation, shade- net, Wedge grafting



MORPHOMETRIC ANALYSIS OF DOMAGOR-PAHUJ WATERSHED OF BUNDELKHAND REGION OF UTTAR PRADESH USING GIS AND REMOTE SENSING

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Morphometric analysis of Domagor-Pahuj watershed of Jhansi district in the Bundelkhand region of Uttar Pradesh was done using GIS and remote sensing. In this study an attempt has been made to evaluate various linear, areal and basin relief aspects of the watershed. For Domagor-Pahuj watershed the maximum frequency in case of first order stream was 61 and that for second, third and fourth order streams was found as 27, 21 and 5, respectively. The watershed was having large number of streams of smaller lengths which means the watershed was less permeable. It had high bifurcation ratio and elongated in shape which would produce extended peak flow. The drainage density of the study area showed high drainage density value, it may be due to the presence of impermeable sub-surface material, sparse vegetation and high relief in nature. Value of constant of channel maintenance was found to be 0.208 km²/km, which indicated that the watershed was under the influence of high structural disturbance, low permeability and high surface run-off. The elongation ratio value of the study area was found to be 0.688, indicating that moderate to low relief of the terrain, elongated in shape with moderate infiltration capacity and moderate runoff. The moderate value of relief ratio indicates the presence of basement rocks that are exposed in the form of small ridges and mounds with lower degree of slope and clearly showed the medium permeability of watersheds. The study watershed area was having lower relative relief indicating the lowest runoff potential. This morphometric study may be useful for the planning of rainwater harvesting and watershed management.

NATURAL RESOURCES CONSERVATION

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Natural resource conservation is the ethical use and protection of valuable resources such as trees, minerals, wildlife, water, sunlight, atmosphere, land along with all vegetation and crops. Some natural resources such as sunlight and air can be found everywhere are known as ubiquitous resources. There are very few resources that are considered inexhaustible these are solar radiation, geothermal energy and air. In 1982 the UN developed the World Charter for Natural resources conservation, which recognized the need to protect nature from further depletion due to human activity.

Natural resource conservation is a discipline in 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. Hence sustainable development can be followed where there is a judicious use of resources which compromises the needs of the present generations as well as the future generations. A successful management of natural resources should engage the community because of the nature of the shared resources the individuals who are affected by the rules can participate in setting or changing them. The right to resources includes land, water, fisheries and pastoral rights. The users or parties accountable to the users have to actively monitor and ensure the utilization of the resource compliance with the rules and to impose penalty.

Key Words- Natural resource conservation, sustainable development, right to resources

PROBLEM OF WEEDS IN RICE AND THEIR MANAGEMENT

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Weed competition is the major problem in rice in all over the world. Weeds increase the cost of cultivation and also cause the major yield losses in rice. Due to weeds in rice near about 41% yield loss are occur, and cost of cultivation increase. In recent year due to scarcity of water and labour method of rice cultivation being shifted from transplanting to direct method of rice seeding, weeds problem are more in direct seeded rice than in transplanted rice. Several method are use to control weeds like mechanical, physical, biological and chemical etc, in which chemical method is most effective to control weeds in rice. Many pre and post emergence herbicide use in rice like Beutachlor, Pendimethilin, Bispyribac sodium, ehoxysulfuran, fenoxaprop, penoxsulam, etc , but the use of herbicide in large amount continuously not ecologically sound effective, it have negative effect on human health, soil fertility and environment. Due to continuous use of herbicides Herbicide-Resistant biotype weeds are emerge. So control of weeds in rice suitable practice and package are adopted, reduce the seed of volunteer weeds by cleaning of field, summer deep ploughing and soil solarisation. Hand hoeing is effective against creeping perennials. Stale seedbed, bioherbicide etc. are use to effective control of weeds in rice field.

Key words- Weed, cost of cultivation, direct seeded rice, pre emergence, post emergence, herbicide, herbicide resistance biotype, volunteer weeds, solarisation, bioherbicide, creeping perennials.

EFFECT OF SEEDLING AGE AND PLANT HORMONES ON GROWTH, QUALITY AND BOLTING IN ONION (*ALLIUM CEPA* L.)

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In the investigation the response of 6, 8 and 10 week old seedlings of onion cv. N-53 was studied along with foliar application of Cycocel (500 & 1000ppm), Ethephon (2000 & 2500ppm) and Paclobutrazol (1000 & 2000ppm) in factorial RBD replicated thrice during *Rabi* season of 2014-2015 at Division of Vegetable Science and Floriculture, SKUAST, Jammu. The outcome of experiment showed that the 10 week old seedlings out performed to other aged seedlings in terms of vegetative attributes viz., plant height at 70 (42.64 cm) and 100 DAT (63.46 cm), number of leaves per plant at 70 (5.45) and 100 DAT (9.34) and leaf length (62.34 cm). Interactive results between seedling age and plant hormones showed significantly higher vegetative growth and quality in the plots having 8 week old seedlings with paclobutrazol at 2000 ppm. The lowest bolting was recorded in 8 week old seedlings (16.99%) which were statistically superior 10 and 6 week old seedlings. Significantly higher days to first bolt was observed in 8 week old seedlings (99.71 days) over 10 and 6 week old seedlings (96.19 and 77.76 days), respectively. It is evident from the results; application of Paclobutrazol 2000ppm recorded the maximum TSS (9.49⁰B) along with lowest bolting (35.99%) up to 97.22 days after transplanting. Interactive results between seedling age and plant hormones showed maximum TSS (11.50⁰B) and lowest bolting (9.64%) in the treatment having 8 week old seedlings with Paclobutrazol 2000 ppm (A₂P₂). The storage studies also pointed out minimum rotting (72.20%) and total weight loss (70%) in this treatment.

Keywords: Bolting, Growth, Plant hormones, Seedling age, Quality

PRECISION FARMING: AN OPTION FOR SUSTAINABLE AGRICULTURE

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With the present scenario of exploding population growth, for ensuring food security and satisfaction of ever increasing demand along with maintaining sustainability, it is imperative to maintain soil quality. Precision agriculture is the only solution to identify the status and causes of spatial and temporal variability. It helps in careful management of soil and crop to enhance agricultural production. Basic steps in precision agriculture include assessing variation, management of variation and evaluation. Techniques which come under precision agriculture are GIS (Geographical Information System), GPS (Global Positioning System), basic computer components, mobile computing, advanced information processing, yield monitoring etc. These techniques help to decide precise land management practices. With the advent of satellite based GIS and GPS techniques, variation in the form of soil map can be assessed. In deriving remote sensing data, spectral behaviour of soil and its component is used e.g. using LANDSAT satellite imagery and DEM (Digital Elevation Model). Management of variation is done by site specific agronomic practices viz. DRIS (Diagnosis and Recommendation Integrated System), suitable tillage operation, frequency and depth of irrigation, salinity status of soil, site specific fertilizer recommendation, rate of chemical pesticides which maintain soil health, saves energy and cost. It results in reducing excessive and indiscriminate use of chemical inputs having higher cost and hazardous impact on environment. For example, NO₃-N can potentially be removed from shallow underground water table thus protecting water quality also. Thus, precision agriculture includes soil property mapping and decision making for minimum input and optimum yield by optimizing rate of input, evaluation of yield potential which ultimately makes agricultural production sustainable.

Keywords: Spatial variability, Temporal variability, GIS, GPS, DEM, DRIS

EFFECT OF DIFFERENT PRUNING INTENSITIES ON WOOD PRODUCTION AND YIELD OF LATE SOWN WHEAT VARIETIES UNDER DALBARGIA SISSOO BASED AGRISILVICULTURE SYSTEM

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Field experiment was conducted during rabi season of 2010-2011 under AICRP on Agroforestry, Department Forestry, JNKVV, Jabalpur (M.P.). Dalbargia sissoo was planted in 5x5 m spacing in the year 1988. The treatment combination involved in main plot were four pruning treatments (viz. no pruning, 25% pruning, 50% pruning and 75% pruning) and one open (without tree) in main plot and three late sown wheat varieties (viz. M.P.-3020; GW 273 and GW 366) 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 inter cropping with D. sissoo three late sown wheat varieties were sown in 20 cm row spacing fertilized with recommended dose of fertilizer i.e. 100:60:40 N:P:K kg ha⁻¹. The result revealed that crop under open condition recorded significantly higher plant height (77.26 cm), number of effective tiller/MRL (50.53), length of ear head (9.04 cm), number of grains/ear head (41.46) and 1000 grains weight as compared to no pruning which recorded significantly lowest plant height (72.2 cm), number of tillers/MRL (39.86), length of ear head (8.22 cm), number of grains/ear head and 1000 grain weight (27.68gm). Grain yield open under condition (without tree) recorded significantly higher grain yield (1892 kg ha⁻¹) at par with 75% pruning (1700 kg ha⁻¹), 50% pruning (1658 kg ha⁻¹) and 25% pruning (1633 kg ha⁻¹) but significantly superior to no pruning (Rs. 1209 ha⁻¹). The percent reduction in grain yield under no pruning 25% pruning, 50% pruning and 75% pruning over open condition was 36.1, 13.7, 10.9 and 10.1% respectively. Grain yield of wheat was significantly influenced by different varieties. Wheat variety GW-273 recorded significantly higher grain yield (1778 kg ha⁻¹) closely followed by MP-3020 (1617 kg ha⁻¹) but superior to variety GW-366 which recorded significantly lowest grain yield of 1483 kg ha⁻¹. Variety MP-3020 was at par with GW-273. The percent reduction in grain yield in GW-266 and MP-3020 over GW-273 was 16.7 and 9.0 percent respectively. Agrisilviculture system gave significantly higher monetary return (Rs. 29003 ha⁻¹) than growing of crop alone (Rs. 14317 ha⁻¹) or tree alone (Rs. 14531). Managed agroforestry system, wheat+D.sissoo in 25% pruning gave higher monetary returns (Rs. 33,580 ha⁻¹) at par with 50% and no pruning but significantly superior to 75% pruning (Rs. 23332 ha⁻¹) crop alone and tree alone. Among varieties GW-273 recorded high monetary return (Rs. 27,927 ha⁻¹) at-par with MP 3020 (Rs. 26,870 ha⁻¹) but significantly superior to GW-366 (Rs. 23,400 ha⁻¹).

Keyword:- Agroforestry, Agrisilviculture system, Dalbargia sissoo, Monetary return, Pruning.



EVALUATION OF POPULATION DENSITY OF *MELOIDOGYNE INCOGNITA* ON GROWTH AND ROOT KNOT DEVELOPMENT ON CHILLI CV. G-4.**Rahul Kumar Sharma**

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Chilli is widely grown commercial cash crop in the world and it suffers from severe yield loss due to infection of Root-knot nematode (*Meloidogyne incognita*) worldwide. The present experiment was conducted under pot condition to determine the effect of various inoculum levels (500, 1000, 2000, 4000, 6000, 8000 & 10,000 J₂/kg soil) of *M. incognita* on growth and root knot development of chilli cv. G-4. The observations recorded after 60 days of inoculation and it founds that *M. incognita* is a potential pathogen, which caused significant reduction in all growth parameters at and above initial inoculum level of 500 J₂/kg soil in terms of length, fresh and dry weight of shoot and root of chilli cv. G-4 and increase root knot index (RKI) up to 0.25-3.50. Highest reduction in shoot length (57.2%), root length (62.8%), shoot fresh weight (68.8%), root fresh weight (70.8%), shoot dry weight (72.0%) and root dry weight (72.3%) and highest RKI, 3.50 were observed at highest inoculum level i.e. 10,000 J₂/kg soil and least RKI, 0.25 and highest reproduction factor (Rf), 11.88 was found at the lowest inoculums level 500 J₂/kg soil.

Keywords:Chilli, *Meloidogyne incognita*, inoculum levels, growth and root knot development.

RECENT ADVANCES IN GENETICS AND BREEDING OF RAPESEED MUSTARD**KUMAR, RAJENDRA, MAURYA, BRIJESH KUMAR, SINGH, SAHADEV**

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Rapeseed mustard is an important *Brassica* oilseed crop, which accounts for 13.9 per cent of the world's vegetable oil production and supply more than 12.5 per cent of the edible oil in the world. They are being used in medicine, condiments, pickles and in several religious ceremonies etc.. *Brassica* oil, in addition, serve as an important raw material for industrial products like soaps, lubricants, paints, plasticizers etc. Breeding methods employed for the improvement in rapeseed and mustard depends upon mode of reproduction and inheritance of characteristics thus, on the basis of mode of reproduction oilseed *Brassica* can be divided in two groups viz., Self compatible (*amphidiploids*, *B. carinata*, *B. napus* and *B. juncea*) promotes self-pollination and self-incompatible (diploids; *B. nigra*, *B. oleracea* and *B. campestris* promotes self-incompatibility which ultimately leads to cross-pollination. Therefore, the breeding methods such as Pureline selection, mass selection, bulk and pedigree methods have been widely used for improvement in autogamous crops utilizing the advantage of additive gene action. On the other hand, in case of cross-pollinated groups; self-incompatibility offer unique opportunity of exploitation of heterosis. The existence of male sterility also provides chances for hybrid breeding.

Now, different biotechnological methods viz., protoplasts fusion, tissue culture and transgenics for various biotic and abiotic stress have been exercised.

EFFECT OF SEED TREATMENT OF BIO-CONTROL AGENTS AND FUNGICIDES ON GROWTH, BIOMASS AND YIELD OF LENTIL (*LENS CULINARIS* MEDIK)**Vaibhav Pratap Singh¹, Rajesh Kumari^{1*}, Govind Kumar Bagri², Dheeraj Kumar Bagri³**¹Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, Uttar Pradesh, India-202002²Department of Soil Sciences and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India-221005³Department of Animal Husbandry and Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India-221005

The present study was conducted in experimental field of Department of Plant Protection, Aligarh Muslim University, Aligarh to know the effect of different bio-control agents and fungicides on growth, biomass and yield of lentil crop. It is clear from the results that seed treatment with different bio-control agents (*Trichoderma viride*, *Pseudomonas fluorescence* and combination of *T. viride* + *P. fluorescence*) and fungicides (Carbendazim, Thiram, and combination of Carbendazim + Thiram) significantly enhanced the growth (plant shoot and root length), biomass (fresh and dry weight of shoot and root) and yield of crop (pod number, pod fresh weight and weight of 100 grain without and with shell). Among the different bio-control agents used, combination of *T. viride* + *P. fluorescence* proved best in enhancing growth i.e. plant height (47.66 cm shoot and 12.8 cm root), biomass i.e. fresh weight (shoot 15.66g and root 0.74g) and dry weight (shoot 2.41g and root 0.16g) and yield i.e. number of pods/plant was 30, pod fresh weight was 3.06g and weight of 100 grains with shell (10.7g) and without shell (7.03g). This was followed by *Trichoderma viride* and *Pseudomonas fluorescence*. This combination increased nodules number too. Among the fungicides used, Combination of Carbendazim + Thiram was proved best in increasing growth i.e. plant height (40.16 cm shoot and 8.83 cm root), biomass i.e. fresh weight (shoot 6.34g and root 0.37g) and dry weight (shoot 1.24g and root 0.07g) and yield i.e. number of pods/plant i.e. 24 and pod fresh weight i.e. 1.4g. This combination of fungicides also enhanced the weight of 100 grains and number of nodules. This was followed by Carbendazim and Thiram.

Keyword: Bio-control agents, Fungicides, Growth, Biomass, Yield, Lentil crop.



ROLE OF INSECTICIDE SYNERGISTS AND THEIR FUTURE TRENDS IN INTEGRATED PEST MANAGEMENT**S. Ramesh Babu*, D. Rakshith Roshan, Deepak Kr. Jaiswal and Kamal Ravi Sharma**Department of Entomology and Agril. Zoology, Institute of Agricultural Sciences,
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In latest years there is a wide possibility for natural control, under this situation enormous usage of chemicals in IPM programme is unreasonable. There is a need to explain the farmers to apply less quantity of insecticides. But this little quantity may not give effective control of pests. In order to increase the toxicity of insecticides which is to be applied in small quantities, a non-toxic material should be added. This non-toxic material is known as synergist. As control agents, synergists can potentially render resistant populations susceptible and prevent the development of resistance. Synergists are among the most straight forward tools for overcoming metabolic resistance because they can directly inhibit the resistance mechanism itself. The synergist and the combination must each undergo full-scale testing, and in some assays the old insecticide must be again tested alone to give the baseline data for measuring non target synergism. In some instances, formulation can be a critical problem. This is particularly true where the insecticide and synergist have different polarities. Even if the materials can be placed in solution together, there is no guarantee that they will not separate during storage, during application, on or in the plant, or inside the insect. Adjuvants and surfactants are sometimes necessary to ensure good insecticide synergist mixtures. This adds a further complication to research evaluations, because these additives may enhance or detract from penetration of the cuticle, and as such are quasisynergists or quasiantagonists. Also the formulation must be photostable and nonphytotoxic.

Keywords: Synergists, Insecticides, Resistance, IPM**“RESOURCE CONSERVATION TECHNOLOGIES IN RICE- WHEAT CROPPING SYSTEM IN INDO GANGETIC PLAINS”****Sanyogita Chaudhary*, Vasundhra Kaushik and Shiv Vendra Singh**

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Rice- wheat cropping system is the major production system of India. Indo Gangetic Plain (IGP) is extended in 13.5 mha. IGP is formed by three distinct river system- the Indus the, Ganga and the Brahmaputra. This IGP produce 50% food for the 40 % population of India and majority of which is contributed by Rice-Wheat Cropping System (RWCS). Resource conservation technologies (RCTs) are practice when followed results in saving of energy, cost and also reduce environmental pollution over conventional methods of cultivation. System of rice intensification (SRI), a new rice cultivation system was developed saves nearly 80 % seed, 25-40 % water and reduces the use of agrochemicals. Alternate Wetting and Drying (AWD) system mainly focus on improving nutrient use efficiency along with the saving of water. In some pockets in south India rice ratooning (ability of rice plant to regenerate) gives 2.0-2.7 tonnes additional yield within 60-70 days. Adoption of zero tillage system overcomes the short turn around period between rice harvesting and sowing of wheat. It reduces the cost of seed bed preparation and seed use residual moisture of rice field for germination. Similar to SRI, System of Wheat Intensification is also a new wheat growing technology which saves seed, nutrients and water, ultimately lowering the cost of cultivation. All the RCTs mainly emphasized on conservation of resources like water, nutrients and environmental quality ultimately reduce the cost of cultivation and improve soil health. Thus the adoption of RCTs in RWCS saves inputs besides improving crop productivity, higher net return reducing environmental pollution. RCTs are more effective in combination rather than individual application.

Keywords: SRI, Alternate drying and wetting, Rice ratooning, Zero tillage and SWI.**EFFECT OF COMBINED USE OF CHEMICAL AND BIOLOGICAL FERTILIZERS ON SOIL HEALTH AND NUTRIENT AVAILABILITY TO PLANTS****Rekha Ratanoo¹, Sarita Rani²**¹Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab (141001), India¹Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana (125001), India

The post green revolution era has realized the deteriorating soil health due to abundant use of chemical fertilizers for soil fertility management. In Indo-gangetic plains farmers use 10.5 to 24.5% higher doses of fertilizers as compared to recommended doses. The excessive use of these chemical fertilizers leads to leaching, pollution of water resources, crop susceptibility to disease attack, acidification oralkalization of the soil or reduction in soil fertility. Beneficial microflora like PGPR, N fixing bacteria, and mycorrhizal colonization are adversely affected due to changes in soil chemical properties by fertilizer application. Use of bio fertilizers and organic fertilizers not only improves the soil health towards sustainability in crop production but also reduce the amount of chemical fertilizers thus cutting down the inherent cost of production and soil degradation rate. However, these alternative nutrient sources have their own limitations. For example, due to the low nutrient content larger quantity of organic manures are needed. Biofertilizer led buildup of soil microflora is slow and depends on soil and climatic conditions, therefore significant effects are realized in subsequent years. However, combined use of chemical fertilizers, organic manures and biofertilizers is most preferred soil fertility management technology to improve the deteriorating soil health as well as to sustain the crop production at higher levels.

Keywords: Soil health, Integrated nutrient management, Sustainable crop production

MITIGATION STRATEGIES OF PLANT ABIOTIC STRESS BY SUSTAINABLE AGRICULTURE**By RELANGI SAIRAM¹, KOLLURI RAMU²**

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Current soil management strategies are mainly dependent on inorganic chemical-base fertilizers, which caused a serious threat to human health, environment and plant system. The exploitation of beneficial microbes as a bio-fertilizer has become importance in agriculture sector for their potential role in food safety and sustainable crop production. The eco-friendly approaches inspire a wide range of application of plant growth promoting rhizobacteria (PGPRs), endo and ecto-mycorrhizal fungi, cyanobacteria and many other useful microscopic organisms led to improved nutrient uptake, plant growth and plant tolerance to abiotic and biotic stress. The present review highlighted bio-fertilizers mediated crops functional traits such as plant growth and productivity, nutrient profile, plant defense and protection with special emphasis to its function to trigger various growth and defense-related genes in signaling network of cellular pathways to cause cellular response and thereby crop improvement. The use of bio-fertilizers towards sustainable agriculture in reducing problems associated with the use of chemicals fertilizers. In both conventional and sustainable agriculture, plants are exposed to abiotic and biotic factors of the environment. These include factors such as drought, flooding, low temperature, heat, high light intensity, UV-B radiation and soil salinization. Environmental factors that limit plant growth and development are considered as stress factors. It is now known that tolerance to abiotic stress is complex and many authors suggest that the plasticity of cell metabolism and its fast acclimation to changes in environmental conditions is a main essential step in stress tolerance.

Keywords: Bio-fertilizer, Crop improvement, Abiotic stress Environmental stress, Mode of action of bio-fertilizers, Sustainable agriculture.

PHYTOREMEDIATION: A TOOL FOR ENVIRONMENTAL CONSERVATION**Vikas Kumar Jain^{1*}, Anil K. Singh¹, Anupam Tiwari¹, Risha Varan², Prashant Bisen³, Namrata³ and Sumit Pal¹**¹Department of Horticulture, ³Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, ²College of Agriculture, G.B.P.U.A.&T, Pantnagar, Uttarakhand, India

Toxic metal pollution of water bodies and crop fields is a major environmental problem, and most of the conventional remediation approaches do not provide any acceptable solutions. The use of plants specially selected and engineered for metal-accumulation and environmental clean-up is a revolutionary technology to be practiced called phytoremediation. The first hyper accumulators of heavy metals characterized were members of the family Brassicaceae and Fabaceae. The number of metal-accumulating taxa identified to date has now grown to 397. Presently, around 45 and more plant families are known to having metal-accumulating species. Most active hyper accumulators include species of *Alyssum* and *Thlaspi* (Brassicaceae). The use of such hyper accumulator plants to extract metals from surface-contaminated land could represent a low-technology, natural means of *in situ* soil remediation which perform in an eco friendly manner without affecting globe. In specific situations, soils remediated with this technology are expected to have significant economic, aesthetic, and technical advantages over traditional technological solutions. Here, a description of some generally accepted bioremediation tools and a focus on the combination of two approaches, phytoremediation and bioaugmentation, resulting in rhizoremediation is included. During rhizoremediation, exudates derived from the plant like some secondary metabolites can help to stimulate the survival and action of bacteria, which subsequently results in a more efficient degradation of pollutants. The root system of plants can help to spread microbes through soil and help to penetrate generally impermeable soil layers. The inoculation of pollutant-degrading bacteria on plant seed can be an important advancement to improve the efficiency of phytoremediation.

Continuous phytoextraction is based on the genetic and physiological capacity of specialized plants to accumulate, translocate, and resist high amounts of metals. Major disadvantages of using naturally occurring metal hyper accumulators for continuous phytoextraction are their relatively low biomass, slow growth rates, and the lack of any hyper accumulators for the most environmentally important metallic pollutants (e.g. lead, cadmium, arsenic, and uranium). However, understanding the biological mechanisms of hyper accumulation may help in the development of superior plants for the phytoremediation of metals.

IMPACT OF AGRICULTURE ON BIODIVERSITY**ARSHI JAMIL AND SHABBIR ASHRAF**

Department of Plant Protection, Aligarh Muslim University, Aligarh, Uttar Pradesh

Biodiversity is vital to agricultural production and food safety apart from being an exquisite constituent of environmental conservation. But there occurs an unavoidable clash between the two. Due to agriculture extension there is a continuous loss of biodiversity in 'natural habitats'. Changes in cultivation practices and technologies and expansion in farmlands has significantly increased the global production but at the same time resulted in severe degradation of natural resources including soil, water and biological diversity in and around agricultural farmlands. The prevailing models of agricultural growth have resulted in wear away of massive biodiversity including plant genetic resources, insects, livestock, soil organism and many other flora and fauna at highly alarming rate leading to economic losses endangering the food productivity and food security. Thus, to maintain equilibrium between biodiversity and agriculture there is a need to integrate agricultural practices with well-planned strategies that not only conserve biodiversity through sustainable agriculture but also enhance it at all levels in farming systems. One such practice includes the replacement of conventional agriculture with conservation agriculture that involves the use of 3 basic principles: zero tillage for minimal soil disturbance; expanded crop rotation and a stable organic soil cover. These practices will help in much more sustainable use of biodiversity resources and ultimately an increased crop production for proper management of natural resources and to achieve sustainability in agriculture.



EFFECTS OF FOLIAR SPRAY OF GA_3 , Zn^{2+} AND MH(MALEIC HYDRAZIDE GROWTH COMPONENTS OF CAJANUS CAJAN CV MANIK (PIGEON PEA) AND VIGNA UNGUICULATA CV PUSA KOMAL

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The experiments were conducted at the botanical garden of Botany Department, Meerut College, Meerut, Uttar Pradesh in Kharif season in the year 2003-2004. The effect of foliar spray of different concentrations (50ppm, 100ppm, 200ppm) of Gibberellic Acid GA_3 , Zn^{2+} and Maleic Hydrazide (MH) on *Cajanus cajan* had been studied. Weekly treatment of foliar spray solutions were given till flowering.

It is clear from the results of the present study that the weekly foliar applications of GA_3 and Zn^{2+} concentrations (50ppm, 100ppm, 200ppm) had promoting effect on growth in terms of parameters like plant height, number of branches, number of leaves per plant and number of root nodules per plant. But the gradual decrease in all these parameters were recorded in MH treated plants as concentration increase from 50ppm to 200 ppm. The maximum productivity was recorded in 200ppm of GA_3 and Zn^{2+} treated plants.

EFFECT OF HERBICIDE COMBINATION OF DIFFERENT DOSE ON GRAIN YIELD AND ECONOMICS OF TRANSPLANTED RICE (*ORYZA SATIVA* L.) IN *TYPIC USTOCHREPT* SOIL

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A field experiment entitled "Effect of herbicide combination of different dose on grain yield and economics of transplanted rice in *Typic Ustochrept* soil was conducted during Kharif 2016, to find out the grain yield and economics of transplanted Rice (*Oryza sativa* L.). Among weed management practices combination of the different application of herbicide i.e. Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha⁻¹ PE fb 25g a.i ha⁻¹ POE), Anilophos fb Bispyribac Sodium (400 g a.i ha⁻¹ PE fb 25g a.i ha⁻¹ POE) and Pyrazosulfuron fb Azimsulfuron (150 g a.i ha⁻¹ PE fb 30 g a.i ha⁻¹ POE) performed selectivity towards narrow and broad leave weeds, respectively. Highest grain yield and economics were observed under the two hand weeding followed by the Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha⁻¹ PE fb 25g a.i ha⁻¹ POE). The lowest grain yield was recorded under the weedy check. Uncontrolled weed growth caused 20 to 80 percent grain reduction in rice. Among weed management practices, this research finding indicates that the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha⁻¹ PE fb 25g a.i ha⁻¹ POE) proved to be the most effective in minimizing the total weed density, biomass of weed and maximum grain yield, net return and benefit ratio, which have the potential of being used as best combination of herbicides. Effective weed control practices could be used for the better production of transplanted rice in *Typic Ustochrept* soil of Uttar Pradesh.

Keywords: Weeds density; grain yield; Pyrazosulfuron; profitability, Bispyribac Sodium

IMPROVING THE RESOURCE CONSERVATION AND USE EFFICIENCY THROUGH THE INTEGRATED FARMING SYSTEM APPROACH

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Integrated farming system 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 farmer, that constitute 84.97% of total operational holding in India and has 44.31% operational area. Conservation of farm resource like soil, water and energy is the key factor of success of any of the IFS approach. Studies conducted at IIFSR (Singh, 2014) showed that zero tillage drilling was time, energy and cost-effective to the extent of 70.2%, 67.2% and 66.4% respectively. It is the positive interaction of two or more components within the farm to enhance productivity and profitability in a sustainable and maintain ecological balance in environment. In farming system, the enterprise interactions occur either natural and intentional depending on the cultivator need and available resource. Integrated farming system also provides a better scope for efficient water use by putting the same water for several uses like producing crop, fish, dairy, mushroom, poultry, duckery etc. Multiple use of water are best possible through diversification of farming system. The IFS approach leads to the sustainable improvement of farmhouse, enhance input efficiency, raising the family income and satisfying the basic needs of farm families. In India, 19 major pre-dominant farming system exist with majority as crop+livestock (85%).

Key word: profitability, zero tillage, efficiency and conservation



EFFECT OF HERBICIDE COMBINATION OF DIFFERENT DOSE ON GRAIN YIELD AND ECONOMICS OF TRANSPLANTED RICE (*ORYZA SATIVA* L.) IN *TYPIC USTOCHREPT* SOIL**Arun Kumar¹, Kapil kumar² Shrawan Singh Thori³ and S.L.Khaswan⁴**¹Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, U.P., India²Swami keshwanand Rajasthan Agricultural University, Bikaner-334006, Rajasthan, India³National Research Centre on Seed Spice, Tabiji (Ajmer)-305206, Rajasthan, India⁴Rajasthan State seeds corporation, Jaipur Rajasthan India

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Keywords: Weeds density; grain yield; Pyrazosulfuron; profitability, Bispyribac Sodium**IMPROVING THE RESOURCE CONSERVATION AND USE EFFICIENCY THROUGH THE INTEGRATED FARMING SYSTEM APPROACH****Arun Kumar¹, Kapil kumar², S S Thori³, S L khaswan⁴ and M K Jat³**¹Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, U.P., India²Swami keshwanand Rajasthan Agricultural University, Bikaner-334006, Rajasthan, India³National Research Centre on Seed Spice, Tabiji (Ajmer)-305206, Rajasthan, India⁴Rajasthan State seeds corporation, Jaipur Rajasthan India

Integrated farming system 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 farmer, that constitute 84.97% of total operational holding in India and has 44.31% operational area. Conservation of farm resource like soil, water and energy is the key factor of success of any of the IFS approach. Studies conducted at IIFSR (Singh, 2014) showed that zero tillage drilling was time, energy and cost-effective to the extent of 70.2%, 67.2% and 66.4% respectively. It is the positive interaction of two or more components within the farm to enhance productivity and profitability in a sustainable and maintain ecological balance in environment. In farming system, the enterprise interactions occur either natural and intentional depending on the cultivator need and available resource. Integrated farming system also provides a better scope for efficient water use by putting the same water for several uses like producing crop, fish, dairy, mushroom, poultry, duckery etc. Multiple use of water are best possible through diversification of farming system. The IFS approach leads to the sustainable improvement of farmhouse, enhance input efficiency, raising the family income and satisfying the basic needs of farm families. In India, 19 major pre-dominant farming system exist with majority as crop+livestock (85%).

Key word: profitsbility, zero tillage, efficiency and conservation**IN-VITRO REGENERATION AND ASSESSMENT OF GENETIC FIDELITY USING RAPD MARKERS IN GLADIOLUS (*GLADIOLUS HYBRIDA* L.)****Arun Kumar^{*1}, Pushpendra Kumar¹, Ashwini Kumar¹, Vandana Sharma¹ and Rakesh S. Vinukonda^{2,3}**¹Department of Agriculture Biotechnology, ²Department of Horticulture, S.V. P. University of Agriculture and Technology, Meerut (UP) 250 110.³CSIR-National Botanical Research Institute, Lucknow (UP) 226 001.

Gladiolus (*Gladiolus hybrida* L.) is a bulbous ornamental plant, have a great commercial importance in cut flower industry all over the world as well as in India. The genus *Gladiolus* belongs to the family Iridaceae. In India, gladiolus is cultivated on 11660 ha area and produce 106 crore cut flowers. *In-vitro* propagation techniques, assumes significance, especially for securing rapid multiplication of the novel cultivars using different explants sources and media. In present study the *in-vitro* regeneration of gladiolus cultivar *White prosperity* was achieved using shoot bud of cormels as an explant. The concentration and combination of plant growth regulators governed the regenerative capacity of explants. The cytokinin, BAP efficiently produced multiple shoots in gladiolus on B5 and MS media. The number of shoots varied from 1.3 to 3.0 shoots per explant on B5 media and 0.6 to 2.3 shoots per explant on MS media. The length of *in-vitro* developed multiple shoots varied from 2.2 to 3.8 cm in B5 media and 1.1 to 2.9 cm in MS media, 30 Days After Inoculation (DAI). The maximum number of shoots (3.0 and 2.3) were recorded with treatment of 1 mg/l BAP in both B5 and MS media respectively. Maximum rooting (1.5cm) were observed at 1.0 mg/l BAP and 2 mg/l NAA in MS media. The genetic fidelity of *in-vitro* raised multiple shoots were determined by Randomly Amplified Polymorphic DNA (RAPD) markers. The RAPD primers produced 35 distinct bands in fourteen *in-vitro* regenerated clones and one mother plant. The average of scorable bands was 3.5 bands per primer. Total 525 bands were generated by all primers, showed monomorphic banding pattern indicating no genomic



variations occurred in *in-vitro* raised plants. As per the RAPD markers study all the randomly selected clones were similar to the mother plant.
Keywords: Gladiolus, genetic fidelity, *in-vitro* and RAPD.

CONSERVATION PRACTICES OF SOIL AND WATER RESOURCES TO MAINTAIN LONG TERM FERTILITY

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The population of the county is continuously increasing while our water and soil resources declining, even unable to support growth will come from conservation measures and from the development of new resources. Water and soil resources saved through an effective conservation plan can be utilized to reduce the impact of withdrawal from hydrologic systems, to help maintain base flows in streams, and delay the development of more costly water sources. Soil health describes the ability of a soil to function at its potential specifically “the capacity of a soil to functions a vital living ecosystem that sustains plants, animal, and human” needs. The soil and ecosystem health are essential components of land as well as water use and management decision making remains a challenges the renewed emphasis on the concept of soil health as an indicator of healthy agriculture ecosystem is one step toward answering that change. The last two decades have seen significant advancement in the development of qualitative and quantitative indicators of soil health that are accessible to many users. However, the goal of any resources condition assessment methodology or technique has to be to contribute to important decision making and, ultimately improved resource and human condition. For conservation of soil and water some practices may be followed such as non-tillage, diversion channels/runoff, wetland habitat restoration, vegetative buffer strips, relocation of livestock, ditch bank/gully stabilization, terraces, wastewater treatment, conservation tillage, streambank fencing, alternative water source, cover crop, reforestation, improved manure spreading. So, this study is presents a novel method for quantification of the overall long term water quality benefits of conservation management practices.

PLANTS WITH THERAPEUTIC POTENTIAL IN PARTS OF WESTERN

UTTAR PRADESH

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The relationship between human and herbs dates from the far past with ample evidences from the old literature – *Atharva Veda*, *Charaka Samhita*, *Rig Veda* and *Sushruta Samhita*. According to World Health Organization, about 75% of the world population are using herbs for basic healthcare needs. Traditional system of medicine continue to be widely practised on many accounts. Thus a survey was carried out in some parts of Western Uttar Pradesh to identify and record the use of medicinal herbs currently practiced by the local people and is confirmed by the help of many medicinal healers. People used these locally available herbs for health and believed that these are less expensive and have no side effects as compare to modern medicine. In total 65 species belonging to 59 genera and 34 families were recorded which is used in primary health care system by the local people. *Euphorbiaceae*, *Amaranthaceae*, *Liliaceae*, *Malvaceae*, *Papilionaceae*, *Asteraceae*, *Apiaceae*, *Lamiaceae* are the major families. Almost all the plant parts like leaves, seeds, roots and bulb have medicinal constituents to alleviate various diseases.

Keywords : Charaka Samhita, indigenous, ethno-medicinal, medicinal herbs, Western Uttar Pradesh , primary health care system, diseases.

DEFICIT IRRIGATION FOR CROP PRODUCTION UNDER DROUGHT STRESS

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Agriculture uses more than two thirds of the total freshwater of the earth. This issue causes substantial conflict in freshwater allocation between agriculture and other economic sectors. Deficit irrigation (DI) is key technology because it helps to improve water use efficiency. There is a lack of understanding of the mechanisms with which plants respond to DI. In particular, little is known about how DI might increase crop production while reducing the amount of irrigation water in real-world agriculture. It is found that DI is largely implemented through three approaches: (1) growth stage-based deficit irrigation, (2) partial root-zone irrigation, and (3) subsurface dripper irrigation. Partial root-zone irrigation is the most popular and effective because many field crops and some woody crops can save irrigation water up to 20 to 30 % without or with a minimal impact on crop yield. Improved water use efficiency with DI is mainly due to the following: (1) decreases transpiration water loss, (2) improves the photosynthesis to transpiration ratio, and (3) reduces soil evaporation. The mechanisms involved in the plant response to DI-induced water stress include the morphological traits, e.g., increased root to shoot ratio and improved nutrient uptake and recovery; physiological traits, e.g., stomatal closure, decreased leaf respiration, and maintained photosynthesis; and biochemical traits, e.g., increased signaling molecules and enhanced antioxidation enzymatic activity.

Keywords: Crop production, Deficit irrigation, Drought stress, WUE



TITLE OF . :-BIOTECHNOLOGICAL INVENTIONS IN PLANT GENETIC RESOURCE MANAGEMENT

MAJOR THEME AREA OF CONFERENCE- INNOVATION IN BIOTECHNOLOGY AND PLANT GENETIC RESOURCES

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Plant Genetic Resources are the foundation on which agriculture sector around the world is based on. In the present global scenario of increasing population, climate change, declining natural resources ensuring food security is major challenge for agricultural scientist across the globe. The intensity of this challenge is amplified by increasing deforestation, urbanization, pollution, natural habitat destruction, spread of invasive alien species, changing life styles, globalization, over-grazing and changes in land-use pattern. Hence there is urgent need to conserve plant species are now in danger of becoming extinct. Recent advances in biotechnology mainly in field of *in vitro* culture, molecular biology, genomics are important tools in hand of plant breeders to address above challenges. Tissue culture help to multiply elite genotypes rapidly, meristem-tip culture and shoot-tip grafting help to get virus free plantlets. Seed bank, seedling bank, gene bank, pollen bank, cryopreservation of ovum, sperm or embryo, embryo micropropagation, somatic embryogenesis are ex situ germplasm conservation methods. Significant progress has been made for conserving endangered, rare, crop ornamental, medicinal and forest species, especially for non-orthodox seed and vegetatively propagated plants. Medium-term conservation by means of *in vitro* slow growth culture and Cryopreservation (liquid nitrogen, -196°C) for long term storage are effective means nowadays for germplasm conservation. DNA-based molecular markers are playing significant role in detecting the genetic variation available in germplasm collections and breeding lines and in identifying useful alleles in these gene pools and assist in their further introgression or incorporation in cultivated genotypes. Germplasm characterisation followed by bioinformatics software tools for storing, retrieving, organizing, analyzing, and visualizing biological data has simplified task of bio resource management. Comparative genomics together with bioinformatics tools reveals evolutionary divergence and genomic co-linearity among the cereals that may highlight significance of minor cereals, small millets from nutritional aspect. New high-throughput technologies like next-generation sequencing (NGS) is improving our knowledge of plant genetic resources for their conservation and effective use in crop improvement.

EVALUATION OF BIOCONTROL AGENTS AGAINST PHYTOPHTHORA BLIGHT IN PIGEONPEA

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Pigeon pea is an important pulse crop of the world which is an important source of protein and other nutrients. *Phytophthora* leaf blight is a major disease of pigeon pea which is caused by *Phytophthora drechsleri* f.sp. *cajani*. In vitro evaluation of different isolates of *Trichoderma* and a strain of *Pseudomonas fluorescens* against *Phytophthora drechsleri* f.sp. *cajani* was carried out to test the efficiency of these antagonists as biocontrol agents against the test pathogen. Ten isolates of *Trichoderma* species were tested against the blight pathogen under dual culture experiments. Volatile and non-volatile metabolites released from the antagonists were also tested against the pathogen. Percent inhibition in the mycelial growth of the pathogen was determined. All *Trichoderma* isolates showed significant inhibitory effect on the pathogen in all the experiments. Under dual culture tests maximum and minimum percentage of inhibition was showed by AN-33 (81.7%) and AN-37 (63.4%) respectively. Under volatile experiments AN-48 (62.6%) and AN-6 (46.9%) showed maximum and minimum percent inhibition respectively. Under non-volatile experiments, the highest inhibition of pathogen was observed at 15% concentration of the culture filtrates of the bio agents. At this concentration AN-33 exhibited the maximum (72%) and AN-6 showed the minimum (43.5%) inhibition to the pathogen growth. *Pseudomonas fluorescens* showed significant inhibition in the mycelial growth of the pathogen under dual culture test with percentage inhibition of 43%. The study suggests that the *Trichoderma* spp. has a potential to be used as biocontrol agents against *Phytophthora* Blight of pigeon pea. *Trichoderma* isolate AN-33 was identified as the most effective isolate out of the ten isolates studied.

Keywords: *Phytophthora*, *Trichoderma*, *Pseudomonas*, antagonist, volatile, non-volatile compounds

TILLING/ECOTILLING: PRESENT STATUS AND FUTURE PROSPECTS

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Reverse genetic is an important complement to forward genetics in which functional study of gene starts with gene sequence rather than a mutant phenotype. Gene regions are targeted for mutation discovery using PCR and standard SNP discovery methods. Nucleotide sequence variation is a major determinant of heritable phenotypic difference and has been exploited by humans for crop improvement since the dawn of domestication. TILLING and EcoTILLING are high-throughput and low-cost non transgenic approach for the discovery of induced mutations and natural polymorphisms. The advent of TILLING and EcoTILLING technologies has provided a powerful tool in carrying out reverse genetics research for any plant because TILLING can provide allelic series of mutations, including knock-outs. Successful applications of the TILLING technique for functional genomics have been established in *Arabidopsis*, *Drosophila* and zebra-fish. A vast majority of genes has not yet been mutated in most plants and TILLING provides a way ahead to explore these genes in a comprehensive manner and reverse genetics allows their study. The application and current status of TILLING and EcoTILLING technologies in various plants and crops including *Arabidopsis*, *Lotus*, wheat, maize, rice, barley, soybean, tomato, and sugar-cane has been reviewed in this article.

Keywords: Reverse genetics, SNP discovery, TILLING, EcoTILLING and *Drosophila*



RESPONSE OF SELECTED LENTIL CULTIVARS AGAINST THE ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA***Taruba Ansari, Mohd Asif, Amir Khan, Moh Tariq, Faryad Khan and Mansoor Ahmad Siddiqui**

Section of Plant Pathology and Plant Nematology, Department of Botany, Aligarh Muslim University, Aligarh, India (202002).

The root-knot nematode, *Meloidogyne incognita* is one of the most serious plant parasitic nematodes causing considerable losses in the yield of pulse crops. Although synthetic nematicides are instantaneously effective but are hazards to the environment. Among all the alternatives to nematicides, the use of resistant cultivars is an inexpensive and eco-friendly strategy. The cultivars resistant to root-knot nematodes have comparatively better crop yield than susceptible varieties and can be employed as a component of integrated nematode management. In the current study, five cultivars of lentil were tested for their response to *Meloidogyne incognita* by inoculating with 1500 second stage juveniles. Tested cultivars were assessed for their susceptibility and resistance behaviour against *M. incognita* on the basis of root-knot index. The nematode displayed variable effects on the reproduction and plant growth of lentil cultivars. During our study, none of the tested cultivars were observed to be immune or highly resistant to nematode infection according to the rating scale. Malika was the only cultivar which was found moderately resistant against *M. incognita* as it showed least value of root-knot index (2.4) whereas Desi was highly susceptible having highest root-knot index (4.4). *Meloidogyne incognita* played key role in altering the normal physiology of the host plant. Chlorophyll and carotenoid content of leaves was significantly reduced on nematode infestation. This suggests that nematode resistant cultivars should be put in practice to limit lentil yield losses in root-knot nematode infested soil.

Keywords: Lentil, Cultivars, *Meloidogyne incognita*, Resistance.**USE AND IMPORTANCE OF REMOTE SENSING IN INTEGRATED PEST MANAGEMENT****Awaneesh Kumar^{1*}, Sudhir Kumar² and Promish Kumar³**

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Remote sensing is the important source of information in many agro environmental studies. It is used for vegetation monitoring and for mapping land cover from a regional level to a global level. Remote sensing is commonly used for yield forecasts, monitoring post-harvest residues, crop classification and on-site meteorological condition. The remote sensing tool, which is also provide valuable information in an integrated pest management context, allowing for a complete understanding (via remote mapping or spatial modeling) of the spatial complexity of the abiotic and biotic characteristics of the field and its crop. Also providing information about the pest population that are present, or likely occur. The mechanism of damage by the pest largely influences the physiological response of plants. Major types of pest damage mechanisms are classified as leaf curling, wilting, chlorosis or necrosis, stunted growth, reduction in leaf area due to severe defoliation, germination reduction, stand reduction, assimilation sapping, tissue consumption and turgor reduction. While many of these responses are difficult to visually quantify with acceptable levels of accuracy, precision, and speed. Thus, remote sensing instruments that measure and record changes in electromagnetic radiation.

EFFECT OF FOLIAR APPLICATION OF NAA, GA₃ AND NPK ON FRUIT DROP, GROWTH, YIELD AND QUALITY OF BER (*ZIZYPHUS MAURITIANA* LAMK.) C.V. BANARASI KARAKA**Poornima Devi¹, Dr. R.K.S. Gautam¹, Jyoti Singh², Sunil Kumar Maurya³, Deepika Kannaujia⁴**

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The present investigation was undertaken on the effect of foliar application of NAA, GA₃ and Zinc Sulphate on fruit drop, growth, yield and quality of ber (*Zizyphus mauritiana* Lamk.) c.v. Banarasi Karaka at main experiment station, Department of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology Kanpur (U.P.) during the years 2016–2017. Plants received uniform cultural operations throughout the experimental period. The experiment was conducted in randomized block design with ten treatments comprising of each three levels of NAA @ 10, 20 and 30 ppm, GA₃ @ 20, 30 and 40 ppm and control (water spray), respectively. Spray was done in month of November at fruit setting. The results were found that the foliar spray of NAA @ 20ppm proved most effective in recording maximum initial fruit setting (159), fruit retention (12.22%) and minimum fruit drop (87.78%). The spray of GA₃ 20 ppm resulted in maximum length (4.71cm), width (2.76cm) and volume (15.64cc), stone fruit weight (15.68g), weight of fruit pulp (14.64g) stone ratio and weight of fruit which contributed to maximum yield. The better fruit quality parameters viz. TSS, sugar and ascorbic acid were also recorded with the application of the growth regulators and nutrients.

Keywords: Ber, NAA, GA₃, fruit, yield, quality.

GENOMICS RESEARCH AND ITS ROLE IN PLANT BREEDING**MAURYA, BRIJESH KUMAR, KUMAR ,RAJENDRA, SINGH, SAHADEV²**Department of Genetics & Plant BreedingSardar Vallabhbhai Patel University of Agri. and Tech. Modipuram Meerut U P 250110 C C S Uni. Meerut²

Genomics is a discipline in genetics that applies recombinant DNA, DNA sequencing methods, and bioinformatics to sequence, assemble, and analyze the function and structure of genomes. Advances in genomics have triggered a revolution in discovery-based research to understand even the most complex biological systems such as the brain. The field includes efforts to determine the entire DNA sequence of organisms and fine-scale genetic mapping. The term genomics was coined by Thomas H. Roderick (1987). At that time, this term was taken to mean mapping and sequencing to analyze the structure and organization of genomes, but today genomics includes sequencing of genomes, determination of complete sets of proteins encoded by an organism, the functioning of genes and metabolic pathways in an organism. Several techniques have been developed for genome sequencing such as Maxam and Gilbert technique, Sanger technique, Whole genome shotgun sequencing, Random shotgun sequencing, DNA chips (MICROARRAYS), and Direct sequencing techniques. It can provide comparing a wide variety of genomes, the nature of horizontal gene transfer and microbial evolution can be studied. Plant breeding has been very successful in developing improved varieties using conventional tools and methodologies. Nowadays, the availability of genomic tools and resources is leading to a new revolution of plant breeding, as they facilitate the study of the genotype and its relationship with the phenotype, in particular for complex traits. Next Generation Sequencing and high-resolution maps have led to a significant improvement in the identification of molecular markers linked to specific genes and to QTLs. The most important advantage comes from the dense genome coverage, which allows the identification of markers closely linked to any target genomic region, with the advantages that this tight linkage provides.

EFFECT OF CHEMICAL FERTILIZERS AND VARIOUS BIOFERTILIZERS ON PHENOLOGY IN BARLEY**Priti Malik, Meena Sewhag, Karmal Malik and Shweta**

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An experiment was done during *Rabi* 2015-16 and 2016-17 at the Research Area of Agronomy Section, Chaudhary Charan Singh 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. Experiment was done with the various fertilizer levels (50 per cent RDF, 75 per cent RDF and 100 per cent RDF) and different combination of biofertilizers (uninoculated, *Azotobacter*, *Azospirillum*, PSB, biomix i.e *Azotobacter*+*Azospirillum*+PSB, *Azotobacter*+PSB and *Azospirillum* +PSB) showed that chemical fertilizers have pronounced effect on duration for phenological stages of barley. Days taken to emergence were not significantly affected by various doses of chemical fertilizers. 50 % tillering was increased significantly with increase in the dose of chemical fertilizers. 50% heading took significantly higher days in case of 100% RDF following 75% RDF and 50% RDF. Days for 50% anthesis and days taken to maturity were also increased with the dose of chemical fertilizers.

Days to emergence and 50% tillering were found non significant due to application of biofertilizers. Biomix showed maximum effect on 50% heading, it doesn't differ significantly from *Azotobacter* + PSB but was significantly higher than *Azospirillum* +PSB in both years. Uninoculated experiment showed least days to 50% heading, 50% anthesis and days taken for maturity.

Keywords: chemical fertilizers, biofertilizers, RDF, Biomix, phenological stages.

COMPARISON OF ORGANIC AND CONVENTIONAL FARMING UNDER RICE CULTIVATION**Babita Joshi*, Hem Chandra Joshi, Prinsa Ramola, S.K. Guru**

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Since time immemorial, agriculture has been the quintessential profession for the survival of human race. The exponential growth of world population is an alarming crisis for providing food security to 795 million undernourished people apart from feeding the overall 7.3 billion people. Certainly, production has scaled up, but research conducted over past six decades suggests that this form of practice is unsustainable owing to the corresponding climate damage. There has been a consistent degradation in quality parameters of atmosphere, due to indiscriminate use of inorganic fertilizers contributing 14 % of greenhouse gases and has led to shrinkage and degradation of soil fertility. The answers to the prevailing questions of food security and climate change lies with the practice of organic farming that employs a blend of conservational practices with technology to improve yield while maintaining the ecosystem health. To compare which mode of cultivation is better, conventional or organic, a field experiment was conducted at G.B.P.U.A &T Pantnagar, U.S Nagar (Uttarakhand) during kharif of 2016 in rice (PantBasmati-1). The experiment was arranged in randomized block design with two treatments and three replications. Various physiological and agronomical parameters mainly plant height, tiller number etc. were evaluated at three different stages maximum tillering, flowering and at maturity. It was found that for almost all the parameters conventional mode of cultivation shows higher values as compared to organic mode of cultivation except in chlorophyll content.

EFFECT OF GA₃ AND STAGE OF APPLICATION ON THE SEED CROP OF CARROT (*DAUCUS CAROTA* L.) CV. PUSA KESAR.**Murari Lal, Vishwa Nath, Rajat kumar sharma and mahesh kumar singh**

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The carrot (*Daucus carota* L.) is one of the major root vegetable which ranks first as an important member of family umbelliferae it is most nutritious and liked vegetable as well as salad in Indian population. Keeping these importances the present study was undertaken at the Department of Horticulture Raja Balwant Singh College, Bichpuri, Agra during 2013 – 2014.



The experimental variety was Pusa Kesar and transplanted as steckling having 10 cm root and 10 cm shoot length at the distance of 50 X 50 cm. The trails have 9 treatment combinations including 3 concentrations of GA₃ viz. 0, 200 and 400 ppm and 3 stages i.e. 20, 30 and 40 days after planting. The experiment was conducted under Factorial Randomized Block Design which was replicated three times.

On the basis of data recorded during experimentation it was found that maximum increase in plant height (133.39 cm), number of primary branches (5.00), number of umbels per plant (39.55), weight of seed per plant (78.88 gm) and weight of 100 seed (502.02 mg) with foliar application of 400 ppm GA₃ at the stage of 40 days after transplanting of stecklings.

BIOREMEDIATION AND SUSTAINABLE ENVIRONMENT

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In early times, we believed that we had unlimited abundance natural resources; today, however, the resources in the world show, in greater or lesser degree, our carelessness and negligence in using them. The problems associated with contaminated sites now assume increasing prominence in many countries. Contaminated lands generally result from past industrial activities when awareness of the health and environmental effects connected with the production, use and disposal of hazardous substances were less well recognized than today. Environmental contamination is increasing day by day because of increase in population, industrialization and urbanization. The term bioremediation has been introduced to describe the process of using biological agents to remove toxic waste from environment. Bioremediation is the most effective management tool to manage the polluted environment and recover contaminated soil. Bioremediation is an attractive and successful cleaning technique for polluted environment. This technology includes biostimulation (stimulating viable native microbial population), bioaugmentation (artificial introduction of viable population), bioaccumulation (live cells), biosorption (dead microbial biomass), phytoremediation (plants) and rhizoremediation (plant and microbe interaction). Rapid advances in the last few years have helped us in the understanding of process of bioremediation. The use of culture independent molecular techniques has definitely helped us to understand the microbial community dynamics, structure and assisted in providing the insight in to details of bioremediation which has surely facilitated to make the technology safer and reliable.

Keywords: Bioremediation, Bioreactors, Biopiling, Environmental pollution.

EFFICIENCY OF DIFFERENT LIGHT SOURCES IN LIGHT TRAPS IN MONITORING INSECT DIVERSITY

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Collections of a light trap provide significant clue to the diversity of insects active at night (south wood and Henderson, 2000), their respective affinity to different wavelengths of light and to understand and predict how populations function (south wood and Henderson, 2000). Such information, if properly documented, could be put to multi-dimensional use by field- researchers, such as, selection of light-traps for attracting specific order of insects. In spite of the market being flooded with different models of light traps with light sources varying in their intensity and wavelengths, no scientific data on the trap collection, diversity, number and its efficacy is available for ready use. Such a data could shed light on the insects attracted to specific range of light. In this regard, a comparative analysis of different light trap collections becomes mandatory in order to study the efficacy of different wavelengths of light in attracting insects of specific orders viz., Coleoptera (sushil et al., 2004), Hemiptera (rai and khan, 2002; manimaran and manickavasagam, 2000), Lepidoptera (rose et al., 2004), hymenoptera and Diptera (Nair et al., 2004). Further correlating this data with weather parameters could help to predict the period of maximum insect diversity and activity. In order to make such information available, a complete segregation of the individual trap collection over a period of time on the basis of order and total catch, and simultaneously correlating it with the prevalent weather conditions becomes necessary. Hence, a comparative analysis of the light-trap collections using three different light sources and different agro ecosystem was carried out correlating with weather conditions. The results of the preliminary observations obtained over two years are presented herein.

Keywords: Light Traps, Insect Diversity, Agro ecosystem

MICROBIOLOGICAL AND PHYSICO- CHEMICAL ASSESSMENT OF THE WATER QUALITY OF THE SACRED RIVER BHAGIRATHI, INDIA

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The sacred river Bhagirathi originates from Gaumukh (3,812 m a.s.l.) and passes through Gangotri (3,140 m a.s.l.), Harshil (2,620 m a.s.l.), Uttarkashi (1,158 m a.s.l.) and Tehri (640 m a.s.l.), where the Asia's highest dam, the Tehri Dam is constructed is joined by the Alaknanda at Deoprayag (457 m a.s.l.) and finally named as the river Ganga afterwards. Water quality of the sacred river Bhagirathi was evaluated by microbiological and physico- chemical methods. Mean seasonal variations in colony forming units (CFU.ml⁻¹) of bacterial density recorded at 28 ± 2 °C in both high and low altitude zone of the Bhagirathi. A perusal of data revealed that it was minimum in winter and attained peak in monsoon. The water quality improved substantially during autumn. However at low altitude a minimum density was recorded in winter season. The density increased during the increased temperature in summer season and finally attained a maxima during monsoon season, when the higher temperature is coupled with highest nutrient load in the river due to heavy precipitation.



Keywords: Microbiological, water quality, Bhagirathi

GENETIC VARIABILITY AND CHARACTER ASSOCIATION AMONG YIELD AND YIELD CONTRIBUTING TRAITS IN GARLIC GERMPLASM

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A field experiment was conducted during Rabi season of 2014-15 at SKNAU, Jobner (Rajasthan) to study the genetic variability and character association among yield and yield contributing traits in sixteen genotypes of garlic. Analysis of variance revealed significant variability for all of the traits. High estimates of PCV along with GCV were observed for volume of bulb and weight of ten uniform cloves. High estimates of broad sense heritability and genetic advance as per cent of mean were observed for volume of bulb and bulb yield. On the basis of mean performance, the genotype G-1 was the highest yielder. Correlation and path analysis revealed that selection programme based on number of cloves per bulb, ascorbic acid, dry weight of bulb, circumference of bulb and number of leaves per plant might prove effective in enhancing productivity level in garlic.

EFFICACY OF SOME SELECTED BIOPESTICIDES AGAINST *HELICOVERPA ARMIGERA* (HUB.) USING DETACHED LEAF BIOASSAY IN CHICKPEA

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A laboratory experiment was conducted to evaluate the efficacy of different biopesticides against the second instar larva of *Helicoverpa armigera* at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Hyderabad during 2016-2017. Different doses/dilution of biopesticides was used during experiment against second instar larvae of *H. armigera* and recorded the per cent mortality. Among the selected biopesticides neem seed powder, HaNPV and Spinosad showed superior and recorded maximum per cent mortality at 24 hr and 48 hr day after release. *The metarhizium anisopliae*, *streptomyces sp.* and consortia which were at par each other.

KEY WORD- *Helicoverpa armigera*, biopesticides, chickpea

BIODIVERSITY CONSERVATION: ex-situ and in-situ Conservation

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The loss of biological diversity is one of the most pressing global concern of our day. The loss of species and ecosystem degradation will continue to have negative impacts on the functioning of the planet. Biodiversity refers to the variety of all forms of life on earth, including the different plants, animals, micro-organisms, the genes they contain and the ecosystem they form. It is considered at three main levels including species diversity, genetic diversity and ecosystem diversity. All efforts should be made to conserve all threatened species and special attention should be paid to the species which are the sole representatives of their respective taxa. 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 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. A biosphere reserve is visualized as a perfect natural ecosystem to preserve, not only the wild habitats but also the full wild life gene bank and the life style of the native tribals. Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats. In-situ conservation requires protection of wild animals in their natural habitats. So, it is necessary to conserve aquatic and terrestrial natural habitats for the wild animal. These habitat declared as prohibited reserves. 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. Due to increasing pressures from industrial, agricultural, and other developmental activities world-wide, biological diversity is being threatened. Pollutants, encroachment into undeveloped areas, and global warming are the three causes of biodiversity decline. Extinctions are increasing at an alarming rate. Thus, conservation efforts are imperative, this current trend is to be slowed, if not stopped. World-wide efforts must be undertaken, as this is a global problem. To ensure intra and inter generational equity, it is important to conserve biodiversity. Some of the existing measures of biodiversity conservation include; botanical gardens, biosphere reserves, seed banks and national parks and zoological gardens.

Keywords: Biodiversity; in-situ conservation; botanical garden; gene bank; biosphere reserves; Global warming

IMPORTANCE OF BIODIVERSITY CONSERVATION

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The variety of life on Earth, its biological diversity is commonly referred to as biodiversity. The term biodiversity was coined as a contraction of biological diversity by E.O. Wilson in 1985. Biodiversity includes the genetic variability and diversity of life forms such as plants, animal microbes, etc. living in a wide range of ecosystems. Biodiversity produces a number of products harvested from nature and sold in commercial markets. The loss of biodiversity directly influences the social life of the country possibly through influencing ecosystem functions.



Biodiversity holds great ecological value because it is indispensable to maintain the ecological balance. Any disturbance in the delicately fabricated ecological balance maintained by different organisms, will lead to severe problems, which may threaten the survival of human beings. Biodiversity has great economic value because economic development depends upon efficient and economic management of biotic resources. So, it is highly essential for the human beings to take care of their surrounding species and make optimum use of their service, for better economic development. Biodiversity is the life support system of our planet- we depend on it for the air we breathe, the food we eat, and the water we drink. Wetlands filter pollutants from water, trees and plants reduce global warming by absorbing carbon, and bacteria and fungi break down organic material and fertilize the soil. It has been empirically shown that native species richness is linked to the health of ecosystems, as is the quality of life for humans. Thus, it is rightly told, survival of the man depends upon the survival of the biosphere.

BIODIVERSITY OF HORTICULTURAL CROPS IN HIMALAYAN REGION OF UTTARAKHAND

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Uttarakhand Himalayan Region i.e. Central Himalaya is rich in its flora and fauna and is also known as a natural reservoir. This state is well known for its biodiversity. It is estimated that there are about 7000 species of plants in the state though till date only 85% flora explored. Uttarakhand has almost all the different Agro-geo climatic zones making it particularly conducive to commercial horticulture. The Uttarakhand region has proved to be suitable for growing different types of temperate, sub-tropical and tropical fruits. Also, the region has wide scope for growing different kinds of vegetables, flowers, ornamental plants, mushrooms, and medicinal plants in its different climatic zones. Temperate fruits, such as apple, pear, peach, plum, apricot, cherry and walnut, are grown in the places of 1,000 m to 3,000 m. The places from 300 m to 1,400 m are planted with citrus, mango, litchi, banana, guava, papaya, strawberry and different vegetables and crops. Apple is the most important among the various fruits grown in the region. Among vegetables, potato is the most importance crop. The land used for production of various vegetables in the region was almost twice increased and their production was increased by 2.5 times during the past two decades. This clearly indicates that growing of fruits and vegetables has spread over larger areas of land. However, lack of proper marketing facilities, and absence of post-harvest technologies and storage are serious constraints to a more rapid and systematic development of fruit and vegetable cultivation and marketing in the region. Floriculture can generate employment opportunity and enhance income of farmers. Farmers have started raising many flowers. Exquisite varieties of flowers like carnation, lily, chrysanthemum, gladiolus, gerbera and Indian red roses that are in high demand in domestic as well as in European markets are produced in the state. Uttarakhand has emerged as the largest producer of Gerbera in the entire region of northern India. State is having very suitable climate for horticultural crops. Therefore to maintain the horticulture diversity, some off season vegetables and commercial fruit species can be promoted as sustainable livelihood option.

BIO ETHANOL PRODUCTION FROM POTATO PEEL WASTE

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Bio-ethanol is one of the energy sources which can be a potential alternative to petroleum-derived fuels and has the potential to meet the increasing demand for energy for industrial processes, heating, and transportation. In Food processing industries particularly potato chips manufacturing industries generate a huge volume of potato peel as the byproduct which is usually discarded causing environmental concern due to its microbial spoilage. Traditionally, potato peel waste is used for producing low-value animal feed, fertilizer which causes wastes of an abundant nutritive material having the properties of antioxidant, antibacterial, chemo preventive and anti-inflammatory. However, bio-ethanol produced from potato wastes has a large potential market. Potato peel waste contains sufficient quantities of starch, cellulose, hemicelluloses and fermentable sugars to warrant use as an ethanol feedstock. However, some pretreatment process is needed: specifically, liquefaction and saccharification processes are needed to convert starch of potato peel waste into fermentable sugars before ethanol fermentation. In the present study, a number of batches of potato peel waste were hydrolyzed with various enzymes and/or acid and fermented by *Saccharomyces cerevisiae* var. bayanus to determine fermentability and ethanol production. Enzymatic hydrolysis with enzymes released 18.5 g/L reducing sugar and produced 7.6 g/L of ethanol after fermentation. The results show that potato peel waste, a by-product of the potato industry features a high potential for ethanol production. This Bio-ethanol, blended with gasoline/petrol generally known as gasohol, can be used in vehicles. By using this energy source we can control environmental pollution as well as management of waste generated in food processing.

BIOLOGY AND FUNCTIONAL RESPONSE OF *COCCINELLA TRANSVERSALIS* FAB. ON COWPEA APHID, *APHIS CRACCIVORA* KOCH

Rakshith H. S., Sachin S. Suroshe., Suresh M. Nebapure., Subhash Chander and Sweetee Kumari

Cowpea aphid, *Aphis craccivora* Koch is one of the important pests of legumes. It is a cosmopolitan and polyphagous species causing 30-35 per cent damage to vegetable crops globally. A farmer always goes for the chemical control options which is not only expensive but also have deleterious effects on human health, environment and non-target organisms. Integrated pest management is ecologically compatible method, wherein biological control is one of the most effective means of achieving ecologically sustainability. The coccinellid predator, *Coccinella transversalis* Fab. Is an efficient predator known for its appetite on cowpea aphid under vegetable ecosystem. With this background studies on biology, morphometric and functional response of *C. transversalis* on cowpea aphid were carried out under laboratory conditions at 27±1°C and 65±5 % relative humidity. Morphometric observations were recorded from stereoscopic microscope using 'Vimage' software and



functional response experiment was conducted with ten replications and data analysed by fitting Holling's disc equation. Total life span for male and female was ranged from 47-64 and 60-71 days, respectively. Both male and female of *C. transversalis* were found to exhibit type II functional response. The maximum prey consumed by females (56.4) and males (53.5) was achieved at maximum prey density of 120. The study of biology and morphometric will help us in knowing the weak and strong links, construction of life tables and for efficient mass production in laboratory. The functional response studies offer a good conceptual platform to understand the actions of biological control agents in augmentative releases.

Keywords: *A. craccivora*, Biology, *C. transversalis*, Functional response, Morphometry.

ROLE OF HORMONE AND BIO-REGULATOR IN SUSTAINABLE AGRICULTURE

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With bio-regulators and sustainable agriculture is more becoming more advanced day by day the possibility for using input to enhance production, environmental, soil fertility and food security. The role of plant growth regulator become more vital; plant growth regulators provide an immediate impact on sustainable crop improvement programmes and are less time consuming. Application of plant growth regulators must be specific their action and toxicology as well as environmentally safe. Plant bio-regulators (PBRs) have found specific niches in the production of commercial vegetable but may opportunities continue to exist for improving qualities, efficiency and coordination on commercial production. Probably one of the most significant ongoing roles for bio-regulators has been in the acceleration of flowering and sex expression seed production especially in cucurbits. But even with the intensive and divers production of vegetable crops in the open condition, the applications of regulators in the actual field production have been limited. Bio regulators can be used to promote fruit uniformity for harvest in processing tomato etc. plant bio regulators in vegetable production provide professional and research with the information needed to effectively tap this versatile recourse to enhance the cultivation of vegetable. Advance in PBRs technology will likely be achieved through a better understanding of the mechanism responsible for developmental processes and a more comprehensive description of the specificity of substances in mediating key biogeochemical steps.

Keywords: Plant hormone, bio-regulators, mechanism responsible

ROLE OF BIOTECHNOLOGY IN VEGETABLE CROPS

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The role of biotechnological tools like micropropagation, molecular markers, anther culture, cybridization, induced male sterility and transgenics in the production of specific parental lines or hybrids in vegetables. Micropropagation can be used for maintenance of male sterile lines either controlled by recessive genes tomato, muskmelon, chilli or dominant genes cabbage, maintenance of self-incompatible lines in cole crops and maintenance of hybrids as such through tissue culture. Molecular markers can be used for assessment of genetic diversity, construction of linkage maps, varietal and marker assisted selection for traits of interest. Anther culture techniques can be utilized for development of self-incompatible lines in cole vegetables and also to develop inbred lines in cross-pollinated vegetables. A genetically modified tomato, or transgenic tomato, is a tomato that has had its genes modified, using genetic engineering. The first commercially available genetically modified food was a tomato engineered to have a longer shelf life the Flavr Savr tomato in 1994. The cry1Ac gene is source from the soil bacterium *Bacillus thuringiensis* Bt. Several other research institutions, both public and private have also been developing Bt brinjal using different genes. Meristem culture *in vitro* provides a reproducible and economically viable method for producing pathogen free plants than the conventional propagation which lead to virus transmission to new generation. As meristem tips are free from viruses, elimination and generation of virus free plants are possible through *in vitro* meristem culture (Jha and Ghosh, 2005). In vitromicropropagation is an alternative to conventional propagation of potatoes (Chandra and Birhman, 1994) that generally occurred vegetatively by tubers and segments of tubers and rarely by seeds

GENETIC IMPROVEMENT OF QUANTITATIVE TRAIT LOCI (QTL) FOR YIELD RELATED COMPONENT IN RICE (*ORYZA SATIVA* L.)

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Rice (*Oryza sativa* L.) is one of the most important staple foods in the world's population. These QTL alleles of yield related traits make a significant contribution of high yielding rice breeding program. The QTL as a genetic locus where functionally different alleles segregate and cause significant effects on a quantitative trait of advent molecular marker technology, QTL mapping on chromosome linkage maps has become a standard procedure in quantitative genetics. They can be used to identify the QTLs with dominance effects in the whole rice genome. Thousand-grain weight (TGW), grain number per panicle (GPP) and panicle number per plant are the three yield components traits. However, TGW and GPP were often focused in the past QTL mapping studies due to their direct contribution to yield. The molecular markers developed for QTL analysis of enhancing breeding efficiency by marker assisted selection (MAS) for particular agronomic traits. Plant Breeders have focused on improving plant architecture as effective to increase yield potential in rice production. The demand of high yielding rice production for increasing greater stability to human population and changing global climate. In this study, we are using different kinds of rice germplasm and QTL information including its genome position and genetic effect. We mainly focus on the genetic action of major QTLs and phenotypic traits for improvement in rice breeding programme.

Keywords:- QTL, MAS, TGW, GPP, Rice and Yield



ROLE OF BOTANICAL INSECTICIDES IN IPM**M. Sreedhar and Megha G**

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The strategy of exclusive reliance on synthetic insecticides for managing all insect pests has created a number of ecological and environmental problems in addition to aggravation of the pest attacks on agricultural crops. This has once again focussed our attention on botanical insecticides as other alternative means of insect control. The insecticide of plant origin extracted from seeds, flowers, leaves, stem and roots are termed as botanical insecticides. Nicotine, rotenone, sabadilla, ryania, pyrethrum are more important botanical insecticides. These plant derived products are known to have been utilized by man since ancient times. Botanical pesticides exert a range of behavioural and physiological effects on the colonization, development, growth, survival and multiplication of insects. The toxic principles in botanicals are mostly alkaloids, heterocyclic nitrogenous compounds 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. But in addition to high insecticidal activity, botanical insecticides are safer to plant and animal life, biodegradability with sufficient residual action, ready availability of the plant or capability for cultivation with a reasonably short gestation period, yield products of consistent quality, naturally occurring phytochemicals exert a wide range of behavioural and physiological effects on the insects and therefore it is difficult for insects to develop resistance to these pesticides. The use of botanical pesticides for plant protection has assumed greater importance in recent years all over the world due to environmental deterioration and health hazards associated with the use of synthetic pesticides. It is hoped that extensive use of plant based pesticides in integrated pest management will help in conserving environmental quality.

BOVINE CUTANEOUS PAPILLOMATOSIS: AN EFFICACY OF TREATMENT STRATEGIES USING AUTOGENOUS VACCINES, AUTOHEMOTHERAPY, HOMEOPATHIC AND ALLOPATHIC MEDICINES**R.K.Singh^{*1}, Pankaj Chaudhary², Yogesh Sony³, Gulab Chandra¹ and Siddhartha Saha³**

Bovine papillomatosis (BP) is a chronic contagious proliferative disease of cattle caused by Bovine Papilloma Virus (BPV) which is characterized by warts or papilloma that occur mostly in cutaneous form and less frequently in mucosal form as exophytic papilloma. Cutaneous fibro- papillomatosis in cattle is very common and is characterized by the presence of multiple benign exophytic proliferations of the epidermis and of the underlying derma, which is again associated with infection with a BPV. A case of bovine papillomatosis in a cow and its treatment with the autogenous vaccine, Autohemotherapy, Homeopathic and Allopathic medicines is presented. A four to five year old female Holstein Friesian cross bred cow was presented with signs of various sizes of cauliflower growth and pedunculated cutaneous warts on neck, shoulder and teat having pain, bleeding and interference in milking. Based on the history and clinical picture, the case was diagnosed as bovine papillomatosis. The vaccine is prepared from sample collected from older wart growths under aseptic conditions, minced, suspended in normal saline, filtered through muslin cloth and treated with formalin. The animal was treated with a dose of 5 ml subcutaneously and re vaccinated at 7 day intervals for four weeks. The animal was also treated with its own blood and repeated once in a week. The animal was treated with homeopathic medicine Thuja-mother tincture and Thuja 200X and allopathic medicine Levamisole at dose of 2.5mg/kg/day on days 1,3,5,7,9 and 16 by per oral route, single shot of Ivermectin (S/C) @ 200µg/kg body wt. The animal was recovered completely in six weeks.

DRY AND RAINFED AGRICULTURE- CHARACTERISTICS AND ISSUES TO ENHANCE THE PROSPERITY OF INDIAN FARMING COMMUNITY**Mohinder Singh, N. K Tiwari, Naveen Kumar and K. R. Dabur**

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In India, more than 69.0 % of total net sown area comes under dry and rainfed system which contribute about 42 percent total food grain production and 80 percent of coarse grains/pulse crops. India ranks first among the rainfed agricultural countries in terms of both extent and value of produce. Due to population pressure on agricultural lands, the *poverty is concentrated in rainfed regions*. Soil and water management in dry lands and rainfed areas are the big challenges in enhancing the crop production and productivity future of agri-based industries. These two natural resources are the prime factors in determining the agricultural share in GDP of the nation. Also these are the crucial components for agriculture, forestry, environment and industry. The problem of conserving soil and moisture is of great concern in the regions of low and uncertain rainfall areas; forming parts of Punjab, Haryana, Rajasthan, Madhya Pradesh, Maharashtra, Andhra Pradesh and Karnataka. These tracts are characterized by scanty, ill-distributed and highly erosive rains, undulated topography, high wind velocity, etc. Soil and water resources are indiscriminately contaminated and over exploited, leading to situations where water become a scarce commodity in most parts of the world. Scarcity of water affects the agriculture and farmers' financial status. Realizing the gravity of the situation, agricultural experts world over are striving hard for finding newer ways to conserve soil and water resources. Governments, NGOs and agri-professionals are busy reframing the policies and taking steps to overcome conservation related issues. Soil and water conservation methods like rainwater harvesting, contour bunding, *in-situ* and *ex-situ* moisture harvesting, crop rotation, crop cover management, mulching, flood water management and improved agronomic practices, etc, are being harnessed in a big way throughout the country to address the looming crisis. On one hand erosion by wind and water has created some of the world's most productive soils; for instance the Indo-Gangetic Plains and Nile Delta; but conversely the accelerated erosion, especially induced by anthropogenic activities, has had drastically affected ecological diversity and sustainability of landscapes.



DEVELOPMENT OF THE WATER EFFICIENT LINES OF RICE WITH AEROBIC ADAPTATION THROUGH MARKER ASSISTED SELECTION**Bhoyar P.I.¹, Mahavir¹, Shikha Yashveer¹, Khushiram Battan², Sunita Jain¹ and R.K. Jain¹**

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Rice is central to the lives of billions of people around the world and single biggest user of water. Water scarcity and drought have seriously threatened the sustainability of irrigated lowland rice ecosystem in several parts of the world including India. Growing rice under continuously unsaturated soil conditions can maximize water-use efficiency and minimize both labor requirements and greenhouse-gas emissions. Rice production system, without constant standing water in non-puddled soils, referred to as 'aerobic rice'. In this system, rice is sown directly into dry soil and irrigation is given to keep the soil sufficiently moist for good plant growth, but the soil is never flooded. Development of aerobic rice varieties which combine the drought-resistant characteristics of upland varieties with the high-yielding traits of lowland varieties could be an effective strategy for saving water. Molecular markers provide a valuable tool for genetic analysis and plant breeding. The crosses of non-Basmati rice (HKR47) and Basmati rice (Pusa1121 and PB1460) with aerobic rice varieties (MAS25, MAS26 and MASARB25) were initiated and the SSR markers were used to genotype the selected plants with aerobic root adaptation. A number of plants were identified with higher root length and/or dry biomass, yield per plant, length/breadth ratio and with Pusa1121 and PB1460 specific alleles in homozygous or heterozygous condition at BAD2 locus; these lines shall serve as the novel material for the selection of stable aerobic Basmati rice varieties.

Keywords: Aerobic rice, Basmati rice, Water scarcity**SECTION: NATURAL RESOURCES CONSERVATION IN VITRO CALLUS PROPAGATION AND BIOACTIVE METABOLITES ESTIMATION UNDER SALT STRESS IN CALOTROPIS PROCERA****Juhi Dhillon, Vimala Y. and Ishwar Singh**

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Plants act as a treasure house for several bioactive compounds. These bioactive compounds vary in their structural arrangements and properties. The Fourier Transform Infrared (FTIR) Spectroscopy is an established way to characterize and to identify the functional groups. The aim of this research work is to develop callus in *C. procera* using leaf and stem as explants on MS Medium supplemented with 0.050mg/L BAP and 1mg/L IBA and to check the effect of Salt stress (50mM and 100mM) on the accumulation of bioactive compounds. The results of the FTIR analysis confirmed the presence of Phenols, Sterols, Aromatic compounds, Nitro compounds and Carboxylic acids in *C. procera* callus cultures.

Keywords: *Calotropis procera*, Salt stress, BAP (6- Benzylaminopurine), IBA (Indole-3-butyric acid), FTIR**EFFECTS OF SOME MEDICINAL PLANT EXTRACTS AGAINST MULTIDRUG RESISTANCE HUMAN PATHOGENIC BACTERIA****Neha pal¹, Narendra pratap singh², Mayadatt joshi³, Ram saxena⁴ and Dev anand⁵**^{1,3}School of Biological Engineering and Science, Shobhit University, Meerut, U.P^{2,3,5}Department of Botany, Meerut College, Meerut, U.P

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.**CONCEPT OF INTEGRATED PEST MANAGEMENT TO SUPPRESS PEST POPULATION****Ankit Kumar and Lakhi Ram**

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Integrated pest management is an approach for economic control of pests. It aims to suppress pest populations below the economic injury level. Entomologists and ecologists have urged the adoption of IPM pest control since the 1970s. IPM system is designed around five basic components. It includes cultural, mechanical, genetic, regulatory, and biological practices. The emphasis is on *control*, not *eradication*.



Cultural practices by selecting varieties best for local growing conditions. Plant quarantine and cultural techniques such as crop sanitation e.g., removal of diseased plants. Mechanical controls have hand-picking, barriers, traps and tillage to disrupt breeding. Monitoring include regular observation which is critically important. Biological control of insect pests and diseases through biological means is most important component of IPM. Parasitoids (*Trichogramma*, *Apanteles*, *Bracon*, *Chelonus*, *Brachemeria* etc.), Predators (Spiders, dragon flies, lady bird beetles, *Chrysopa* species etc.), Pathogens- These are micro-organisms which cause diseases in their hosts. Major groups of pathogens are fungi, viruses and bacteria. Fungi- *Beauveria* and *Metarhizium*, Virus- Nuclear polyhedrosis virus and granulosus viruses and in Bacteria- *Bacillus thuringiensis* and *B. popillae* are common. Biocontrol practices includes- Introduction, augmentation and conservation- the most important component of biological control is conservation and plays a major role in pest suppression. In this process, natural enemies present in the nature are protected from being killed. Some practices are required to protect them as the use of broad spectrum pesticides should be avoided, growing trap crop on the borders of main fields before the actual sowing of crop to trap pest and develop natural enemies, crop rotation and inter-cropping also help in conservation of natural enemies. Use of pesticides should be need based, judicious, based on pest surveillance with recommended doses and at economic threshold level.

EFFECT OF DROUGHT STRESS ON GROWTH AND DEVELOPMENT OF HIGHER PLANTS

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Drought stress is considered among the most destructive abiotic stresses that rapidly increased in intensity over the past few decades interfering world's food security. Drought stress may range from moderate and short to extremely severe and prolonged duration, restricting the crop yields. Drought is expected to affect plant growth for more than 50% of the agriculture lands. Drought stress affects plant water potential and turgor, enough to interfere with normal functions changing physiological and morphological traits in plants. Fresh weight, dry weight and relative water content are common growth parameters that are affected by drought. Furthermore, drought stress also influences the availability and transport of soil nutrients, as nutrients are carried to the roots by water. Therefore drought stress decreases nutrient diffusion and mass flow of water-soluble nutrients such as nitrate, sulfate, Ca, Mg, and Si. Drought also induces free radicals affecting antioxidant defenses and Reactive Oxygen Species (ROS) such as superoxide radicals, hydrogen peroxide and hydroxyl radicals resulting in oxidative stress. At high concentrations ROS can cause damage to various levels of organization, like initiate lipid peroxidation, membrane deterioration and degrade proteins, lipids and nucleic acids in plants. Drought also affects biochemical activities like nitrate reductase (NR), due to lower uptake of nitrate from the soil. It also accentuates the biosynthesis of ethylene, which inhibits plant growth through several mechanisms. Drought as a multidimensional stress, affects at various sub cellular compartment, cell organs and whole plant level. Thus drought negatively affects quantity and quality of growth in plants. Worldwide extensive research is being carried out to develop strategies to cope with drought stress through development of drought tolerant varieties, shifting the crop calendars, resource management practices etc. Recent studies indicate that microorganisms can also help plants to cope with drought stress.

PHENOLOGICAL BEHAVIOUR AND REPRODUCTIVE BIOLOGY OF KHEJRI (*PROSOPIS CINERARIA* (L.) DRUCE)

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Studies on reproductive biology of Khejri ryana Agricultural University, Hisar- 125004. Haryana, India

(*Prosopis cineraria* (L.) Druce) indicated that defoliation started during the month of November and continued till end of January. There was complete defoliation before the initiation of new vegetative growth and the new leaves started coming up after all the leaves had shed off. Initiation of leaf primordia was noticed during the last week of February. Inflorescence was a raceme panicle which was often axillary. Panicle initiation started in the first week of March and continued till first week of April. Maximum well developed buds were observed from April 7 to April 23. The floral buds began to open from first week of April to third week of April. The flowering pattern was observed asynchronous. The trees were in full bloom from second week of April to third week of May. Maximum flower opening ranging from 84.38 to 93.82 per cent was recorded between 0800-0900 h. The shiny stigma a reflection of stigma receptivity occurred between 0800 to 1100 h. Percent pod set varied from 0 for self pollination to 2.03 per cent for natural open pollination.

Keywords: Reproductive biology, *Prosopis cineraria* and pollination.

HYDROSTATIC PRESSURE TREATMENT: A NON THERMAL TECHNIQUE OF FOOD PRESERVATION

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Hydrostatic pressure treatment is an innovative and attractive technique of food preservation. The objective of this article is to review the different aspects and potential applications of Hydrostatic Pressure Treatment in food preservation. It is a non thermal process which allows the processing of product that can not be thermally treated. It involves the inactivation of micro-organism of food by the mean of ultra-high pressures, which extends the shelf life of processed food and maintains nutritional value and quality of food products. Pressure in the range of 300, 700 MPa are used for foods. These pressures, maintained for approximately 15 minutes, can cause more than a 10,000 fold



reduction in numbers of food poisoning bacteria such as *Salmonella*, *Compylobacter* and *Listeria* in milk and poultry meat. This technique is applied in fruit and vegetable processing industry; fish and meat industry; dairy and egg industry. HPP is the best novel technique that maintains food freshness, nutrition, taste, and flavor which produce greater quality products. It avoids the use of chemical preservatives that customers dislike. Since the process can be done with final packaging, it prevents the possibilities of recontamination and cross contamination. It destroys pathogenic microorganisms which guarantee safety and promote exportations. It also destroys spoilage microorganisms which gives higher quality with shelf life. The type of food packaging used also plays an important role in HPT. The physical and mechanical property of the material greatly influences the effectiveness of HPT on the food material. The packages must have the ability to prevent any deterioration in the product quality during HPT and excellent logistics should be applied to distribute the pressure- treated products. It is environmentally friendly because it only needs water and electricity. Commercial benefits of HPT technology require more research to fill the gaps and to fully understand the process to reduce the production cost.

Keywords: Hydrostatic pressure treatment, preservation, micro-organisms.

INTELLECTUAL PROPERTY RIGHTS ISSUES: DETERMINANTS OF PATENT RIGHTS- A CROSS-NATIONAL STUDY

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Recently, intellectual property rights have become one of the hottest, most significant issues of trade negotiations. Despite the continued claim that facilitates research activities and encourages technology transfer, the impact of IPRs on socio-economic development process of developing countries has evidently reflected in many areas, including health, agriculture and education. no doubt continue to have a significant impact on developing countries. This paper presents an a patent rights for 110 countries for the period 1960–1990. This is used to examine what factors or characteristics of economies determine how strongly patent rights will be protected. The evidence does indicate that more developed economies tend to provide stronger protection. But the underlying factors which influence patent protection levels are the country's level of research and development activity, market environment, and international integration, which are correlated with its level of development. The results qualify, however, that activity influences patent protection levels after a nation's research sector reaches a *critical* size. An implication of this is that to raise patent protection levels in weakly protecting countries, it is important to foster a significant research base in those countries and thereby create incentives for protecting patent rights. By influencing the incentives to innovate, intellectual property rights protection may affect economic growth in important ways. An important question for many countries is whether stricter enforcement of intellectual property is a good strategy for economic growth .This topic examines the role of intellectual property rights in economic growth, utilizing cross-country data on patent protection, trade regime, and country-specific characteristics. This suggests that intellectual property protection is a significant determinant of economic growth. These effects appear to be slightly stronger in relatively open economies and are robust to both the measure of openness used and to other alternative model specifications.

KEYWORDS: Intellectual property Rights, Patent Rights, Cross-National study.

AN INNOVATIVE APPROACH OF GREEN TECHNOLOGY IN ORGANIC FOODS FOR SUSTAINABLE DEVELOPMENT

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Organic food comprises of those agricultural food products that are not treated with chemical fertilizers, pesticides, herbicides and other synthetic chemical substances during its production, processing and storage. The growth and consumption of organic food has increased worldwide in the recent years mainly due to consumer perceptions of quality and safety. Environmental care is also a factor towards their increased demand. Conventional agricultural farming practices, along with irrational use of chemicals have caused many environmental hazards like loss of soil health, soil erosion, decreased ground water level, pollution due to fertilizers and pesticides, reduced food quality and increased cost of cultivation, rendering the farmer poorer year by year. Green Technology is the sustainable solution for these problems. Green Technology with organic agriculture enhances soil fertility which leads to production of organic food of high quality in sufficient quantity. Green Technology promises to increase farm profitability while reducing environmental degradation and conserving natural resources. Green Technology is an alternative to improve the national economy without harming the environment and increasing organic agricultural productivity. This type of organic cultivation is attracting farmers' world over due to its various advantages over conventional agricultural practices. Keeping in consideration the scope and importance of organic food products, this paper intends to review information about different technologies which can be helpful in the overall production and sustainable development

Keywords: Green Technology, Organic Food, Sustainable Development

GREEN SYNTHESIS OF HEMATITE (A-Fe₂O₃) NANOPARTICLES USING AQUEOUS ALOE VERA LEAF EXTRACT AND THEIR ANTIBACTERIAL AND ANTIBIOFILM ACTIVITIES

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Besides the exciting medicinal and cosmetics applications of *Aloe vera* (*Aloe barbadensis* Miller), such as immunomodulatory, anti-inflammatory, UV protective, antiprotozoal, and burn-healer due to its 75 potentially active constituents: vitamins, enzymes, minerals, sugars, salicylic



acids, lignins, saponins, and amino acids etc., the extract of *Aloe vera* plant has also been successfully used to synthesize crystalline gold, silver, copper oxide and zinc oxide nanoparticles by allowing the extracts of *A. vera* (ALE) with aqueous solution of metal ions. This has prompted us to investigate the biosynthesis of iron oxide nanoparticles using ALE. In the present study, an in-house one pot protocol for *Aloe vera* leaf extract (ALE) mediated biosynthesis of hematite nanoparticles (ALE- α -Fe₂O₃NPs) was developed. The biogenesis of low cost, eco-friendly ALE functionalized ALE- α -Fe₂O₃NPs was achieved by adding ALE to 0.1 M ferric (III) chloride. After 3h of rigorous mixing at 80°C using magnetic stirrer, the color of reaction mixture changed from yellow to intense brown indicating the formation of iron- nanoparticles. The ALE- α -Fe₂O₃NPs were characterized by UV-visible spectroscopy, XRD, TEM, SEM-EDX, and FTIR analyses. The size of ALE- α -Fe₂O₃NPs were determined to be in range of 1.0 - 20.0 nm with 6.78 ± 2.1 nm average particles size. FTIR analysis exhibited the capping of ALE- α -Fe₂O₃NPs with the ALE constituents. The antimicrobial activity of ALE- α -Fe₂O₃NPs were assessed by growth and biofilm inhibition of extended spectrum β -lactamase (ESBL) producing *Pseudomonas aeruginosa*, *Escherichia coli* and methicillin-resistant *Staphylococcus aureus* (MRSA) bacterial isolates. Significant biofilm inhibition was observed in case of *S. aureus* and *P. aeruginosa*, respectively. Overall, the results elucidated, a cost-effective and convenient method for ALE- α -Fe₂O₃NPs synthesis, for possible applications as nanoantibiotics.

EFFICACY OF PLANT EXTRACTS AGAINST ALTERNARIA ALTERNATA CAUSING LEAF SPOT OF BRINJAL

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Brinjal (*Solanum melongena* L.) also known as egg plant, belongs to family *solanaceae*, is an important vegetable crop. The crop suffers from many diseases, among these *Alternaria* leaf spot is an important disease of brinjal. Disease management with chemicals is economically not viable and also not safe for the environment. Therefore, the present investigations aimed to carry out the test of plant extracts (neem, garlic, siris, tulsi and ashok) against *Alternaria alternata* under *in vitro* and *in vivo* conditions. Among plant extracts, garlic clove extract was found most effective in inhibiting mycelia growth (75.53 and 86.00 %) of *Alternaria alternata* at 5 and 10 per cent, respectively followed by neem leaf extract (60.74 and 74.26 %) over control. The plant extracts were tested *in vivo* as foliar application @10 % at 80 DAS with susceptible local cultivar of brinjal. Among these, garlic clove extract was found most effective in reducing the disease intensity (45.48%) followed by neem 32.35 %, respectively.

EFFECT OF NANOCHITOSAN ON MAIZE PLANT GROWTH AND BACTERIAL POPULATION UNDER FIELD CONDITION

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Nanoparticles are materials with a particle size of 1- 100 nm. Nanotechnology have led to the creation of various chitosan based nanoparticles. Chitosan have several advantage which are not properly expressed in its bulk size, so nanochitosan is preferable to be used instead of chitosan. Nanochitosan will have essential role in the controlled release of agrochemicals for protection against pests and pathogens, soil fortification, drought tolerance and plant growth. Nanochitosan can also efficiently enhances photosynthesis, promotes plant growth, increases nutrient uptake and seed germination rate. In this study, effect of Nanochitosan was evaluated on plant growth parameters and soil bacterial population. It was observed that Nanochitosan not only enhanced rate of seed germination upto 24 percent over control but all other parameters like root length, shoot length, fresh weight and dry weight, chlorophyll content and protein content of plants were also showing hike by two fold over control. For the soil health assessment Colony Forming Unit was done on Nutrient Agar and Aleksandrow Agar media which showed two fold increase, whereas soil protein was enhanced by 1.5 fold over the control. The above results suggests important applications of Nanochitosan in agriculture which was found to be not only beneficial for the crop productivity but also maintain soil health.

PATHOGENICITY OF ROOT- KNOT NEMATODE, MELOIDOGYNE INCOGNITA ON TRIGONELLA FOENUM GRAECUM

Chanchal Chaudhary*, Mohd Danish, Yasar Nishat, Atirah Tauseef, Hisamuddin.

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A glasshouse experiment was carried out to study the effects of *Meloidogyne incognita* at different inoculum levels viz., 50 J₂, 500 J₂, 1000 J₂, 2000 J₂, 5000 J₂ on *Trigonella foenum graecum*. The pots were arranged in complete randomized block design. The result of experiment indicated that significant decrease in all growth and yield parameters of plant when inoculum levels were increased. The highest and significant reduction was observed at 5000 J₂, in comparison to control plants. Decrease in amount of chlorophyll a, b, and carotenoid contents was noticed at all the inoculum levels, when compared with the control plant. The number and size of galls were higher at higher inoculum levels. Theroot and the soil populations of second stage juveniles indicated that *M. incognita* reproduced efficiently on the roots of *Trigonella foenum graecum*.

Keywords: Pathogenicity, *Meloidogyne incognita*, Fenugreek.

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STUDIES ON EFFECT OF COCONUT WATER AND LISTERINE ON VASE LIFE OF CUT ANTHURIUM DREANUM LINDEN.

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The experiment was carried out to investigate the effect of coconut water and listerine on keeping quality on vase life of cut anthurium flowers. In this study, the different concentration of coconut water is used in various treatments; such as T₁ (100% distilled water), T₂ (10% coconut water + 0.2% listerine), T₃ (20% coconut water + 0.2% listerine), T₄ (30% coconut water + 0.2% listerine), T₅ (40% coconut water + 0.2% listerine), T₆ (50% coconut water + 0.2% listerine), T₇ (60% coconut water + 0.2% listerine), T₈ (70% coconut water + 0.2% listerine), T₉ (80% coconut water + 0.2% listerine), T₁₀ (90% coconut water + 0.2% listerine), T₁₁ (100% coconut water + 0.2% listerine). The analysis was carried out in a complete randomised design (CRD). The vases along with flowers were placed at room temperature. The recorded traits include acceptability, changes on fresh weight, water uptake, water loss, changes on 50% fading of spathe, and analysis of biochemical constituents, such as anthocyanin, betacarotene, protein, starch, total sugar, reducing sugar and non-reducing sugar. The result showed that the treatment containing solution of 50% coconut water + 0.2% listerine + sucrose + citric acid recorded the longer vase life of cut anthurium flower (up-to 32 days). The minimum vase life of cut anthurium was observed in 100% distilled water (up-to 10).

Keywords: Anthurium, coconut water, Listerine, sucrose, citric acid.

DIFFERENTIAL EXPRESSION ANALYSIS OF NAC TRANSCRIPTION FACTOR FAMILY GENE IN MINOR MILLET UNDER WATER STRESS

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Drought stress is one of the abiotic stresses and it may alter plant growth, metabolism and yield. Millets are resilient to extreme environmental conditions especially to inadequate moisture and are rich in nutrients. The NAC (NAM, AFAT 1/2, and CUC2) transcription factors are in a plant specific protein family. These proteins were known to function in important roles in various biological processes, including growth and development, cell division, senescence and both biotic and abiotic stress responses in plants. The aim of this research was to analyze the differential expression of NAC transcription factor family gene in minor millets under drought stress by using semi-quantitative RT-PCR. 43 NAC transcription factors protein were identified from five cereals genome. The proteins were phylogenetically clustered into six distinct type of subfamily. The gene structure and motif composition of NAC transcription factors genes were similar in each subfamily. These results suggested that NAC transcription factors genes in the same subfamily may possess conserved function. We could design gene specific primers for the characterization of expression pattern of NAC transcription factors genes in minor millets under water stress. Analysis on the expression profiling of genes revealed that the expression of genes was up regulated by water stress treatment, suggesting that they may involve in the drought tolerance of the crop. Further efforts in validation of identified genes could be explored in development of tolerant lines by MAS as a functional marker and can also be used as candidate genes for development of water stress tolerant transgenic in other related crops.

Keywords: Drought, NAC Transcription factor, semi-quantitative RT-PCR.

IMPACT OF ZINC NUTRIENTS ON CROP GROWTH

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Zinc is one of the important essential micronutrients for plants growth and its development. The zinc uptake is facilitated as diffusion through membranes specific for zinc ion; lateral movement of zinc is highly dependent upon the soil moisture. Zinc is sometimes applied broadcast to correct the zinc level in soils in one treatment. Zinc sulphate must be sprayed as foliar application or applied to the soil. Zinc oxide should always be applied through the soil application in crops. The excess amounts of zinc sulphate can cause severe leaf damage. Zinc is dissolved in the soil solution in ionic or complex form and may be found on the exchange sites of clay minerals and organic matter. Zinc can also be found as adsorbed divalent cation, zinc hydroxide, or zinc chloride. The solubility of zinc is highly dependent upon soil pH. Presence of calcium carbonate decreases the availability of zinc due to higher soil pH. Zinc is transported in the xylem tissues from the roots to the shoots. However, high levels of zinc have been detected in the phloem tissue, which indicates that zinc moves through both transport tissues, and maybe remobilization of zinc towards the grain during ripening. Substantial translocation of zinc takes place from the older leaves to the younger ones during grain development phase. Zinc has received a great deal of importance in crop production especially in a rice-wheat cropping system during the last few years. Various factors associated with Zn deficiency are acid sandy soils low in total zinc, neutral or alkaline soils having higher amount of fine clay, silt and available phosphorus, organic soils etc. Intensive cultivation and growing of exhaustive crops have made the soil deficient in macro as well as in micronutrients. Now a day the use of only nitrogenous and phosphatic fertilizers also create nutrient imbalances



particularly of Zn in soils. The problem seems to be more acute for rice and other crops area found to be severely affected by Zn deficiency. Zinc application plays an important role in different plant metabolism processes like development of cell wall, respiration, photosynthesis, enzyme activity, auxin synthesis, protein synthesis, and other bio chemical and physiological functions of the plant and its effective activities responsible for better crop growth and development.

PGPR BIOFORMULATION FOR SUSTAINABLE AGRICULTURE

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Soil is dynamic living matrix and it is not only a critical resource in agricultural and food security but it is also towards maintenance of all life process. Pathogenic microorganisms along with chemical fertilizers affecting plant health and environment are a major and chronic threat to sustainable agriculture and ecosystem stability worldwide. The practice indiscriminate use of chemical fertilizers in the agriculture to increase yields, kill pathogens, pests, and weeds, have a harmful impact on the ecosystem. Because of current public concerns about the side effects of agrochemicals, PGPR have gained a supreme attention in field of agriculture for plant growth promotion along with their environment friendly nature for sustainable agricultural practices. The use of plant growth promoting Rhizobacteria bioformulation in agriculture is a better alternative to resolve this ongoing problem. PGPR play an important role in direct or indirect way to increase in soil fertility, plant growth promotion, and suppression of phytopathogens for development of ecofriendly sustainable agriculture.

PHYTOREMEDIATION

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Phytoremediation can be defined as “the efficient use of plants to remove, detoxify or immobilise environmental contaminants in a growth matrix (soil, water or sediments) through the natural biological, chemical or physical activities and processes of the plants”. Plants have remarkable metabolic and absorption capabilities that can take up nutrients or contaminants selectively from the growth matrix. Phytoremediation involves growing plants in a contaminated matrix, for a required growth period, to remove contaminants from the matrix. Some examples are: *Thlaspi caerulescens*: Cd, *Thlaspi rotundifolium*: Pb, *Sebertia acuminata*: Ni, *Ipomoea alpine*: Cu. Phytoremediation can be used to clean up metals, pesticides, solvents, explosives, crude oil, polyaromatic hydrocarbons, and landfill leachates. There are various phytoremediation techniques available: **Phytosequestration**, **Rhizodegradation**, **Phytohydraulics**, **Phytoextraction**, **Phytovolatilization** and **Phytodegradation**. There are some of the best plants for phytoremediation: Indian mustard (removes Cd, Pb, Se, Zn, Hg, Cu and Cs137), Willow (removes Cd, Ni and Pb, and mixed heavy metals), Poplar tree (degrade petroleum hydrocarbons), Indian grass (detoxify pesticides and herbicides), and Sunflower (remove Pb, Zn and radioactive metals). Phytoremediation is much cost effective and doesn't require procurement of huge equipments. Apart from its benefits phytoremediation also makes site pleasing to the eyes and can be easily grown and monitored. It has some limitations also: the contaminating material should be present within the root zone, site must be large enough to grow plants, and this is a slower process. However this approach is being researched to make it more refined and improvised by applying the tools of biotechnology. One example is the development of genetically engineered transgenic *Arabidopsis thaliana* which is widely applied in the phytoremediation of mercury. Tata Energy Research Institute India, applies Phytoremediation to control problems caused by Flyash. Phytoremediation, in combination with burning the resulting biomass to produce electricity and heat, could become a new environmentally friendly form of biotechnology.

PHYTOREMEDIATION: A GREEN TECHNOLOGY TO CLEAN UP POLLUTANTS

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The term phytoremediation has been derived from the Ancient Greek word *phyto* meaning “plant” and the Latin word *remedium* meaning “restoring balance.” Phytoremediation is an emerging technology that exploits the genetic potential of selected plant species to remove, degrade, metabolize, or immobilize a wide range of contaminants. It utilizes a variety of plant biological processes and the physical characteristics of plants to aid in site remediation. Phytoremediation has also been called green remediation, botano-remediation, agroremediation, and vegetative remediation. Contamination of the soil with heavy metal and petroleum hydrocarbon is an alarming situation of the world. Decontamination of the soil particularly with green technology is a great challenge for us. Phytoremediation of the contaminated soil is one of the biological clean up method which has no adverse consequence. Phytoextraction, phytodegradation, rhizofiltration, phytovolatilization and phytostabilization are the major phytoremediation approaches used to clean contaminated sites. Major advantages of phytoremediation are the physical removal of toxicity, no or marginal accumulation in the edible parts of hyper accumulating plants and it is also less disruptive to the remediation site thus keeping consumers safe. In order to develop successful phytoremediation techniques, there is an urgent need for plant physiologists, biotechnologists, geneticists, agronomists, and soil scientists to work together. There is a need to enhance research efforts on this emerging and environmentally friendly “green” technology.

Keywords: Phytoextraction, phytodegradation, rhizofiltration, phytovolatilization, hyperaccumulator.



FLY ASH AMENDMENT TOGETHER WITH POTASSIUM FERTILIZER IN THE REGULATION OF GROWTH BIOMARKERS AND YIELD ATTRIBUTES OF MUSTARD (*BRASSICA JUNCEA* L.).

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Agricultural soil supplemented with flyash (FA) affects the status of soil and improve the crop productivity. Potassium (K) as a source of one of the essential nutrient is effective in promoting the crop yields. In order to evaluate the effects on growth biomarkers and yield attributes of mustard (*Brassica juncea* L.) cv. Varuna and Pusa Bold under interactive application of FA and K, the present study was carried out with various levels of FA (FA₀, FA₂₀, FA₄₀, and FA₆₀) together with potassium fertilizer (K₀, K₃₀ and K₆₀). Growth parameters were assessed at 35, 70 and 105 DAS while yield characteristics were assessed at harvesting. The results showed that FA₄₀ proved to be the best treatment in enhancing the root length, shoot length, fresh weight, and dry weight, leaf area and leaf area index. Further, the yield attributes (1000-seed weight, biological yield, seed yield, oil content and oil yield) also increased by the application of FA₄₀ together with K₆₀. However, high FA (FA₆₀) reduced the growth and yield parameters. Thus, the treatment of FA up to 40 tonnes ha⁻¹ may be used in the soil for maximally benefitted the mustard plant.

Keywords: *Brassica juncea*; flyash; potassium fertilizer; oil yield; seed yield.

ROLE OF GROUNDWATER RECHARGE IN AGRICULTURE

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Water is most serious global concern as our country India now focus around 14% high to extremely high water stress. More than 100 million people live in the areas of poor quality water. The ground water recharge by storage play a major role for future needs. Indiscriminate use of water by the human being as well as in agriculture for irrigation proposes was noticed. The declining of ground water due to inefficient use in industry, agriculture and in daily needs of human being increment in demand and constant/slightly decrement of water resources therefore may lead to water scarcity in the world. The climate change delayed monsoon, fluctuation in temperature, drought, and flood are situation rapidly happening in the world, so that groundwater recharge is very much essential for sustaining life on the earth to come back the present and future scenario. Saving of water using precise technology in irrigation like drip irrigation, sprinkler irrigation, and micro-jet irrigation. Can very much effective to revive the old storage capacity of water catchment area which also lead in possible groundwater. Without groundwater it is not possible of agricultural practices and in human. The government of India is dedicated conserve and its effective management practices. To this effect Pradhan Mantri Krishi Sinchayee Yojana has been formulated with the dream of extend the coverage of irrigation 'Har Khetkopani' and improving water use efficiency 'More crop per drop' in an attentive manner to solve the problem of water scarcity in the world.

PEST INCIDENCE AND PREVALENT CONTROL STRATEGIES IN SOME APPLE ORCHARDS OF CENTRAL KASHMIR IN VOGUE DURING BLOOM AND POST BLOOM.

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This study seeks to describe the pest incidence and control techniques employed by the farmers for controlling these pests during the bloom and post-bloom season of apples. In the bloom period there was a low incidence of apple scabies, red mites and San Jose scale. During the post bloom season which extends from May to September and also includes the harvesting season the incidence of red mites and scabies grew due to increase in temperature and moisture content. The data for red mites was collected using binomial method of sampling and calculating cumulative mite days while as for San Jose scale hand lenses were used to count the number of eggs and other immature stages. Apples grown in these orchards belong to different varieties and have different market values. The main outcome of our study was that the farmers work with chemicals rather than relying on biological or cultural control methods. The prevalence of such method of control is attributed to their cost effectiveness and their flexibility of usage. Farmers mainly apply contact and systemic fungicides to control scabies while as to control San Jose scale, farmers use orchard oils, acting as lubricants, to arrest the further development of the insect.

Keywords: Apples, orchard oils, scabies, fungicides, San Jose scale.

PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY)

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Pradhan Mantri Krishi Sinchay Yojana (PMKSY) is a national mission to improve farm productivity and ensure better utilization of the resources in the country. The budget of Rs. 500 billion in a time span of five years has been allocated to this scheme. The Cabinet Committee on Economic Affairs chaired by Hon'ble Prime Minister has accorded approval of Pradhan Mantri Krishi Sinchay Yojana (PMKSY) in its meeting held on 1st July, 2015. The primary objectives of PMKSY are to attract investments in irrigation system at field level, develop and expand cultivable land in the country, enhance ranch water use in order to minimize wastage of water, enhance crop per drop by implementing water-saving technologies and precision irrigation. The plan additionally calls for bringing ministries, offices, organizations, research and financial institutions occupied with creation and recycling of water under one platform so that an exhaustive and holistic outlook of the whole [water cycle](#) is considered. The goal is to open the doors for optimal water budgeting in all sectors. Tagline for PMKSY is "more crop per drop". Government of India is



committed to accord high priority to water conservation and its management. To this effect Pradhan Mantri Krishi Sinchai Yojana (PMKSY) has been formulated with the vision of extending the coverage of irrigation 'Har Khet ko pani' and improving water use efficiency 'More crop per drop' in a focused manner with end to end solution on source creation, distribution, management, field application and extension activities. PMKSY has been formulated amalgamating ongoing schemes viz. Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation Integrated Watershed Management Programme (IWMP) of Department of Land Resources and the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC). PMKSY has been approved for implementation across the country with an outlay of Rs. 50,000 crore in five years. For 2015-16, an outlay of Rs.5300 crore has been made which includes Rs. 1800 crore for DAC; Rs. 1500 crore for Department of Land Resources; Rs. 2000 crore for Ministry of Water Resources (Rs. 1000 crore for AIBP; Rs. 1000 crores for PMKSY).

EFFECT OF ARTIFICIAL LIGHT AND CHEMICAL TREATMENT ON FLOWER INDUCTION IN POTATO (*SOLANUM TUBEROSUM* L.) GENOTYPES UNDER PLAINS AND HILLY CONDITIONS

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Potato breeding is restricted to high elevations due to lack of ability of several genotypes to either flower or form fertile flowers under short day conditions in northern plains. Genotypes, day length and temperature are the major factors which determine flowering and fruiting behavior in potato. In the current study, flowering was induced in 19 potato genotypes under two locations like Punjab Agricultural University, Ludhiana and Keylong, Himachal Pradesh. Under short day conditions, flowering was induced through artificial photoperiod enhancement (PE) and foliar application of Silver thiosulphate (STS) @ 0.02mM concentration. 26.31% genotypes did not flower under plain condition and 42.1% genotypes did not produce berries. The genotype J-8-120, MP/04-816 had highest number of flowers while the genotype 2004/P-5, Kufri Chipsona-1 produced highest number of berries per plant. The STS treated plant showed better retention of flowers and berries and compared with control. The combined effect of extended photoperiod and STS treatment had additive effect on number of floral buds, flowers and berries per plant however, the extent increase varied with genotypes. EP and STS induced flowering in majority genotypes, except Kufri Surya, Kufri Jyoti, Lady Rosetta, FC-3, and Diamond. In the summer season 2016, same genotypes that included the genotypes those did not flower in the first experiment were evaluated at Keylong, Himachal Pradesh. All the 19 genotypes profusely flowered and had good berry setting without any treatment. The flowers of all the genotypes had viable pollens except K. Garima, K. Chandramukhi and K. Pukhraj had low pollen viability. Seeds (True Potato Seeds) obtained from these berries had normal germination. Overall, this experiment will be more useful under plains conditions of India to initiate breeding work on potato.

Keyword- Extended photoperiod (EP), day length, STS, True Potato Seeds

INFLUENCE OF FOLIAR APPLICATION OF UREA AND MICRONUTRIENTS ON GARLIC

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Nitrogen and micronutrients has played an important role for increasing growth, yield and quality of vegetables including garlic. Therefore, a field experiment was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *Rabi* season of 2014-15 with the objective to investigate the effect of different levels of urea in combination with micronutrients (zinc, copper, manganese and iron) on growth and yield parameters of garlic. The treatment consist of four levels of nitrogen, i.e., 0.5, 1.0, 1.5 and 2.0% and four micronutrients, i.e., 0.5% of zinc sulphate, iron sulphate, manganese sulphate and 0.2% copper sulphate, respectively. There were seventeen treatment combinations including control arranged in Randomized Block Design with three replications. The foliar application was done at 30, 45 and 60 days after planting along with the recommended dose of fertilizer. The sticker Tween 20 was also added in the spray solution each time. The cloves of garlic cv. HG-17 were planted at a spacing of 15x10 cm. The statistical analysis revealed that both urea and micronutrients significantly affected the growth parameter and yield of garlic. The foliar spraying of 0.5% zinc sulphate in combination with 1.5% urea gave the superior results than other treatments. The maximum plant height (36.38 cm at 60 days after planting), leaf length (28.17 cm) and bulb yield (155.51 q/ha) was recorded with foliar application of 1.5% urea + 0.5% zinc sulphate applied at 30, 45 and 60 days after planting along with the recommended dose of fertilizer.

Keywords: Garlic, foliar spray, urea, micronutrients, growth and yield.

POST HARVEST LOSSES FOR POTATO DURING TRANSPORTATION AND STORAGE

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Postharvest loss can be defined as the degradation in both quantity and quality of a food production from harvest to consumption. Loss of quality includes those that affect the nutritional value, the composition, acceptability and the edibility of the product. In developing countries qualitative and quantitative losses are generally occurs. The post harvest losses occurs on the different stages viz. harvesting, handling, brushing, drying, storage, primary processing, mixing, peeling etc. Potato is the very popular and nutritive tuber crop. During storage mechanical damage is the main properties. Mechanical damage to the potato tubers may occurs during transportation and harvesting. Mechanical damage to the potato tubers may occurs in the form of skin abrasion and bruises or dipper damage. Respiration, sprouting, water loss, relative humidity,



chemical composition and the development of storage diseases are all influenced by temperature. At the time of harvesting 12.0 storage 0.8%, handling 8.8%, sorting 15.6%, processing 2% and super marketing 25% losses of potato. At the production level, farmer practices engender heavy losses. Land preparation and soil management are poorly conducted, and pests and diseases are ineffectively controlled, leading to low yields. The financial assessment of potato damage and loss along the value chain exposes the economic impact of this low performance in potato production. Per season, 19 per cent of produce is damaged or lost. Extrapolating these losses to the national production level. Temperature is the single most important factor in the keeping quality of stored potatoes.

Key Word: Potato, Post Harvest losses, storage losses, temperature, Relative Humidity, Weight Loss

EFFECT OF NITROGEN APPLICATION METHOD ON POTATO

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To evaluate the effect of nitrogen scheduling on potato, an experiment was carried out during winter season of two consecutive years 2014-15 and 2015-16 at Vegetable Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar, U. S. Nagar, Uttarakhand. The experiment was laid out in randomized block design with three replications having ten treatments in each. During the study, observations for yield characters, nitrogen uptake, nitrogen use efficiency and apparent nitrogen recovery were analyzed. Pooled data of both the years indicated that among all the treatments, T₉ (25% N of RDF as basal + 50% top dressing at 25 DAP + one foliar spray of urea @ 3% at 40 DAP) was proved best with respect to tuber yield (31.53 t ha⁻¹). Maximum nitrogen uptake (166.06 kg ha⁻¹) was recorded with treatment T₉ (25% N of RDF as basal + 50% top dressing at 25 DAP + one foliar spray of urea @ 3% at 40 DAP) and minimum (78.59 kg ha⁻¹) was recorded with treatment T₁₀ (No application of nitrogen). However, maximum nitrogen use efficiency (112.5 %) and nitrogen apparent recovery (64.2 %) was recorded with treatment T₉ (25% N of RDF as basal + 50% top dressing at 25 DAP + one foliar spray of urea @ 3% at 40 DAP). Minimum nitrogen use efficiency (56.4 %) and nitrogen apparent recovery (32.3 %) was recorded with treatment T₅ (50% N of RDF as basal + 50% top dressing at 25 DAP + one foliar spray of urea @ 3% at 40 DAP).

IMPORTANCE OF ZINC BIOFORTIFICATION AND ITS APPLICATION AT DIFFERENT STAGES OF WHEAT ON THE BASIS OF ZADOK'S SCALE.

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Micronutrient deficiency particularly Zn is the most widespread problem (Wuehler *et al.* 2005) covers about one half of Indian soils (Welch *et al.*, 1991) and varied from 54-60% in different states (Nayyar *et al.* 2001). The low zinc content in soil leads to decrease in grain Zn concentration and reduces its bioavailability in humans (Hussain *et al.* 2012). Zinc has been found useful in improving yield and yield components of wheat and improve the water use efficiency of wheat (Bagci *et al.* 2007). Zinc involves many important physiological functions such as synthesis of auxin, catalyzes the photochemical reaction, stability of biological membranes, synthesis of nucleic acids, proteins and lipids, leads to improve wheat grain quality (Seilsepour, 2006). Zinc nutrition may affect plant water relations and alter stomatal conductance (Khan *et al.* 2003). Management of zinc fertilizer is to be most effective and profitable when applied at specific times during wheat development (phenological stage). The knowledge of timing of phenological events helps timely irrigation, fertilizer application and crop protection (Ruml and Vulić 2005). There are several scales or developmental codes for wheat that describe visible growth stages. However, Zadoks scale is the most comprehensive and easiest to describe the wheat development stage. Zadoks scale, a two-digit system and has 10 main growth stages, labelled 0 to 9, which describe the crop and each main growth stage can be further described using a second digit, labelled 0 to 9. Zhang *et al.* (2012) reported that foliar Zn application significantly increased the Zn concentration and bioavailability in both whole grain and flour of wheat.

FLY ASH AMENDMENT TOGETHER WITH POTASSIUM FERTILIZER IN THE REGULATION OF GROWTH BIOMARKERS AND YIELD ATTRIBUTES OF MUSTARD (*BRASSICA JUNCEA* L.).

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Agricultural soil supplemented with flyash (FA) affects the status of soil and improve the crop productivity. Potassium (K) as a source of one of the essential nutrient is effective in promoting the crop yields. In order to evaluate the effects on growth biomarkers and yield attributes of mustard (*Brassica juncea* L.) cv. Varuna and Pusa Bold under interactive application of FA and K, the present study was carried out with various levels of FA (FA₀, FA₂₀, FA₄₀, and FA₆₀) together with potassium fertilizer (K₀, K₃₀ and K₆₀). Growth parameters were assessed at 35, 70 and 105 DAS while yield characteristics were assessed at harvesting. The results showed that FA₄₀ proved to be the best treatment in enhancing the root length, shoot length, fresh weight, and dry weight, leaf area and leaf area index. Further, the yield attributes (1000-seed weight, biological yield, seed yield, oil content and oil yield) also increased by the application of FA₄₀ together with K₆₀. However, high FA (FA₆₀) reduced the growth and yield parameters. Thus, the treatment of FA up to 40 tonnes ha⁻¹ may be used in the soil for maximally benefitted the mustard plant.

Keywords: *Brassica juncea*; flyash; potassium fertilizer; oil yield; seed yield.



EFFECT OF GREEN LEAF CUTTINGS AND GROWTH REGULATORS ON SEED YIELD AND QUALITY OF CORIANDER (*CORIANDRUM SATIVUM* L.)**Pradeep Singh*, V.S. Mor, R.C. Punia and Sunil Kumar**

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Four genotype of coriander viz., DH-228, DH-246, DH-5 and DH-36 were evaluated for their performance for yield and different vigour, viability and quality parameters. The result revealed that among the genotypes, DH-5 was found the highest seed yielder followed by DH-228, DH-246 and DH-36. Whereas, DH-228 was found best for foliage yield production followed by DH-246, DH-36 and DH-5. Number of green leaf cuttings reduced the plant growth, seed yield and quality. The crop without cutting of foliage gave the maximum plant growth along with highest seed yield and quality which was followed by one cutting and lowest performance was observed after two cuttings. The application of Naphthalene acetic acid 50 ppm + without cutting resulted in maximum plant height (125.5 cm), number of branches per plant (7.47), number of umbels per plant (48.9), number of seed per umbel (50.0), number of seeds per umbellate (7.4) and maximum seed yield (22.9 q/ha) was obtained from two cutting of genotype DH-228 followed by DH-246, DH-5 and DH-36. Significantly higher value was obtained from the application of naphthalene acetic acid +without cutting for test weight (16.7 g), standard germination (91.67 %), seedling length (29.6 cm), seedling dry weight (0.38 mg), vigour index-I (2723.6), vigour index-II (34.52), dehydrogenase activity test (0.10), field emergence index (5.59) and seedling establishment (88.70 %) and higher value for electrical conductivity (0.21) after two green leaf cuttings. It can be concluded that DH-228 was found higher yielding variety for foliage and DH-5 was found best for seed yield. It can also be concluded that DH-246 was found highly viable and vigorous.

IN VITRO EFFICACY OF LEAF EXTRACT OF DIFFERENT PLANTS AGAINST *ALTERNARIA* LEAF SPOT OF SESAME**Naren Kumar¹, Prahlad Masurkar^{2*}, Prahlad¹**¹ Department Plant Pathology, Jawaharlal Nehru Krishi Vishwavidhyalaya, Madhya Pradesh, India 484004² Department of Mycology and Plant Pathology, Institute of agricultural Sciences Banaras Hindu University, Varanasi-221005

Sesamum is an oldest oilseed crop and well known to be its cover crop nature and for food (dry seeds), feed and also for medicinal use. Under *in vitro* conditions, the experiment was conducted in petri plates containing leaf extract amended PDA medium. Leaf extracts of seven plants viz. Neem, Khejri, Thuja, Babool, Gajar grass, Amarbel and Ashoka were evaluated at three concentrations (10, 20 and 30%) for their efficacy against *Alternaria sesami* using poisoned food technique. Leaf extracts of all the seven plants significantly reduced mycelial growth. The minimum mean mycelial growth of 46.7mm was observed on Babool leaf extract amended medium followed by 50.5 mm and 54.7 mm with Neem and Gajar grass leaf extract amended medium respectively at 10% concentration. Whereas, Babool leaf extract amended medium showed minimum mycelial growth (31.7 mm) and it was followed by Neem leaf extract amended medium (38.0 mm) and Khejri leaf extract amended medium (40.0 mm) at 20% concentration. At 30% concentration, Babool leaf extract amended medium exhibited minimum (24.5 mm) radial growth followed by Neem (28.3 mm) and Gajar grass (29.3 mm) against maximum (90.0 mm) in control. Remaining treatments were found significantly superior over control. Sporulation of *A. sesame* was poor at 30% concentration of Neem, Thuja, Babool, Gajar grass and Amarbel leaf extract amended media, whereas Ashoka and Khejri showed moderate sporulation. Spore germination was also significantly inhibited by leaf extracts of different plants at tested concentrations. On Gajar grass leaf extract it was minimum as 4.0, 7.5 and 19.0 per cent at 30, 20 and 10 per cent concentrations respectively. Whereas on Thuja leaf extract spore germination was 7.0, 9.5 and 20.0 per cent on 30, 20 and 10 per cent concentrations respectively.

Keywords: Leaf extract, PDA, Spore, Radial growth etc.

INTELLECTUAL PROPERTY RIGHTS ISSUES FOR AGRICULTURE GOODS AND SERVICES**Pratishtha Diwaker¹, Pushpanjali², Jitendra Singh Ranawat³, Ayush Kumar Diwaker⁴**^{1,2} SKN College of agriculture, Jobner, Agriculture University, Jobner, Rajasthan³ College of Horticulture and Forestry, Jhalawar, under Agriculture University, Kota, Rajasthan⁴ College of agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan)

Intellectual property right plays a vital role in research innovations and economy of the country. IPR is the ideas when converted to tangible forms can be protected. IPR are intended to promote research and development by providing incentives for investment in creating and encourage access to inventions produced elsewhere. The main ways to protect our intellectual property rights included copyright, trade mark, trade secrets, plant breeder's right and patents (Binenbaum *et al.*, 2000). Patents, plant breeder's right and trade mark awarded by national government and protection is valid only in countries in which they are issued. On the other hand copyright and trade secrets are not country specific. Patents are granted to animal inventions & human's gene sequence and important IPR today for agriculture goods & services and it prevents third parties from making, using or selling the patented product or process. Trademarks are used to worked seeds or spraying services and it distinguish the goods & services of our enterprise from another. Geographical indications used in case of wine and spirits. Trade secrets protection can be used to protect hybrid plant varieties. Some developed countries protect test data submitted for obtaining marketing approval of agricultural chemicals from use by third parties for a limited period of time, generally 5-10 years. Such protection gives exclusive marketing right. Crop grown for subsistence use in developing countries and the technologies used to develop such crops are little commercial interest to the private sector. Thus, donating proprietary technologies to develop to such crop is a realistic possibility. Developing countries scientist must remember that technology transfer involves signing a license of a material transfer agreement for a product. Technology donor and recipient must be aware of the IPR issues involve in the technology and there will often be a need for partnerships in which there is mutual trust among all parties (Kratigger, 2002).



Keywords: Intellectual property right (IPR), Plant breeder's right (PBR), Patents, Technology Transfer, Geographical indications (GI).

"EFFECT OF BORON AND MOLYBDENUM APPLICATION ON YIELD COMPONENTS AND QUALITY PARAMETERS IN MUNGBEAN (*VIGNA RADIATA* L. WILCZEK)."

Praveen Kumar* Dheeraj Yadav*, Satish Yadav* and Sharvan Kumar*

Mungbean [*Vigna radiata* (L) Wilczek] is one of the most nutritious amongst all season legumes, and belonging to family, *leguminosae* and sub-family *papilionaceae*, genus- *Vigna* and species- *radiata* with chromosome number $2n = 24$. Green gram has been cultivated in India since ancient times. Numerous varieties are found in different parts of the country, but this plant is not known in the wild state. The closest related species is *Vigna radiata* var. *sublobata* which grows wild in India and Indonesia and may be progenitor of moong. According to Vavilov (1926) Green gram is a native of India and Central Asia. It has been grown in these regions since prehistoric times. In Africa, it is probably recent. It is now spreading in many other Asian and African countries.

The present study were carried out in the Department of Genetics and Plant Breeding, N. D. University of Agriculture and Technology, Kumarganj Faizabad during *kharif* season 2016 entitled "Effect of boron and molybdenum application on yield components and quality parameters in Mungbean (*Vigna radiata* L.) Wilczek)." The objective of the study was To standardize the appropriate doses of boron and molybdenum and To determine best combination of boron and molybdenum for seed yield and its quality parameters. The 10 treatments of micronutrient boron and molybdenum for variety (NDM-1) was evaluated following 15 quantitative characters viz., days to 50 (%) flowering, days to maturity, plant height (cm), number of clusters/plant, number of pods/plant, number of nodules/ plant, number of seeds/plant, length of pod (cm), biological yield/plant (g), harvest index (%), 100 seed weight (g), germination (%), seedling length (cm), vigour index, seed yield/plant (g). The treatment T_9 ($B_2 = 2.50\text{kg/ha} + M_3 = 0.75\text{kg/ha}$) was found best in, all the treatments. Maximum number of pods per plant (25.78) and seed yield/plant (10.08g) was recorded with T_9 ($B_2 = 2.50\text{kg/ha} + M_3 = 0.75\text{kg/ha}$).

The experiments were conducted in factorial RBD design with three levels of boron and molybdenum on yield components and soil application in mungbean variety (NDM-1), result revealed that treatment T_9 ($B_2 = 2.50\text{kg/ha} + M_3 = 0.75\text{kg/ha}$) significantly improved number of clusters per plant, number of pods per plant, number of seeds per plant, length of pod, harvest index, 100- seed weight, seedling length, vigour index and seed yield per plant. Overall the treatment of T_9 ($B_2 = 2.50\text{kg/ha} + M_3 = 0.75\text{kg/ha}$) with soil application produced higher seed yield in year.

PRECISION FARMING: A PERSPECTIVE OF AGRICULTURAL DEVELOPMENT

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"Precision farming could be defined as application of holistic management strategy that uses information technology to bring data from multiple sources to ear decision associated with agricultural production, marketing, finance, etc." (Singh *et al.*, 2002). Precision farming involves the application of technologies and principles for improving crop performance and environment quality to produce more yield by using efficient management of resources. Population of India increasing day by day which results in decreasing land holding per capita. The increased value of inputs such as seeds, fertilizers, pesticides, water, etc. is making farmers condition more poor. Thus, there is need to increase the yield of the crops per unit area and in 21st century, precision farming will be answer to this problem.

In precision farming, different technologies are used under Mobile Mapping System. This system helps to collect data and process it to give meaningful information. This information is then used for decision making. With the help of Mobile Mapping System very precise information can be taken regarding field conditions anywhere and at any time. Component of mobile mapping system are as follows -

1) Hand Personal Computers (HPC), 2) Application Software, 3) Global Positioning System (GPS), 4) Geographic Information System (GIS), 5) Remote sensing.

Precision farming is currently being used in developed countries and in the near future, we expect it to make its impact on India. This technology will help to bring "Evergreen Revolution" in India.

ASPECTS OF PRECISION AGRICULTURE IN BANANA

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For a long time, precision agriculture has been related with high-tech systems in the developed countries. However, also in tropical regions there is an increasing call for higher input use efficiencies and a reduction of emissions to the environment. Refining agricultural management in space and time may play a key role in reaching these objectives. Due to the different character of tropical cropping systems, the basic procedures need to be adapted. In this paper, we present an integrated system for precision agriculture developed for an Indian banana plantation. The system allows farmers to determine soil fertility and disease related problems through the monitoring of banana yields in space and time and by linking them with a soil database. As a result the system is able to highlight specific locations in the plantation where productivity is relatively low given the specific soil conditions, or where productivity is declining. The low-tech character of this specific application is reflected in the absence of GPS technology (too expensive) and crop growth simulation models (not available). GPS technology is replaced by the usage of the intensive cable system in the plantation. Instead of simulation models, the system uses expert knowledge of the farmer. As a result the investment for the implementation of the system is low. The system has been fully operational for two years and has been used to study the reduction of fertilizer and nematicide applications and for the identification of areas that need a renewal of plant material.



A REVIEW: STUDIES ON VALUE ADDED FENUGREEK PRODUCTS

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Fenugreek (*Trigonella Foenun-graecum*) is a legume and it has been used as spice throughout the world. To enhance the sensory quality of food. It is known for medicinal qualities such as antidiabetic, anticarcinogenic, antioxidant. It is also used as stabilizer, adhesive & emulsifying agent & used for healthy & nutritious bakery and bakery products. The seeds are rich in protein, and contain the unique amino acid 4-hydroxyisoleucine which is one of the active ingredients for blood glucose controlled by inducing insulin release in human. Fenugreek seed flour has been incorporated into the wheat based biscuits; formula resulted in improving their chemical and nutritional quality. Fenugreek seeds are rich source of natural dietary fiber. Adding fenugreek fiber to refined flours helps to fortify with a balance of soluble and insoluble fiber has been used to prepare bakery foods. Dietary fiber of fenugreek seeds is about 25% which changes the texture of food.

Keywords: - Fenugreek (*Trigonella Foenun-graecum*), fenugreek seeds, Dietary fiber, fenugreek products.

PREVALENCE OF URINARY TRACT INFECTION AMONG PREGNANT WOMEN

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After Anemia, UTIs are the second common complications among pregnant women. Various physiological and hormonal changes occur in female body during the period of pregnancy. It can be symptomatic or asymptomatic. Asymptomatic bacteriuria can lead to the development of cystitis or pyelonephritis. Gram positive as well as gram negative bacteria like *E.coli*, *Proteus mirabilis*, *Klebsiella* spp, *Staphylococci* and *Streptococcus agalactiae* are the most common etiological agent in both symptomatic and asymptomatic urinary tract infection. Untreated urinary tract infections can lead to significant maternal and perinatal morbidity and mortality. Untreated UTI may lead to several serious complications like intrauterine growth, restrictions, pre-eclampsia, preterm deliveries and caesarean deliveries. UTI has a conspicuous role in increasing the number of still birth deliveries. Antibiotics like Nitrofurantoin, Trimethoprim or cephalexin are appropriate drug of choice for the treatment, but increasing resistance among microorganisms towards the commonly used antibiotics is the most challenging problem facing by world today. So, it is better to confirm complete eradication of pathogen before quitting the antibiotic therapy. Proper hygiene and various precautions may also help in preventing its occurrence.

KEYWORDS: Urinary tract infections, symptomatic bacteriuria, asymptomatic bacteriuria

CHLOROPHYLL STATUS OF ISOPROTURON RESISTANT *PHALARIS MINOR*

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Herbicide-resistant weeds are a serious challenge for farmers and the agriculture industry. It is now widespread amongst many problematic weed species, encouraged by the increasing dependence upon a limited number of active ingredients (Heap, 1997; Moss *et al.*, 2011). The pot experiments were conducted during the winter season of 2016-17 at the department of Plant Physiology, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar. The present study was undertaken to study the chlorophyll status of isoproturon resistant *Phalaris minor*. In this experiment, isoproturon resistant *Phalaris minor* were sown in pots with three replications and eleven treatments. It includes two pre-emergence treatments (pendimethalin@750 g a.i. ha⁻¹ and metribuzin@210 g a.i. ha⁻¹), eight post-emergence treatments; Clodinafop-propargyl 1.0X@60 g a.i. ha⁻¹, Clodinafop-propargyl 1.5X@60 g a.i. ha⁻¹, Clodinafop-propargyl 2.0X@60 g a.i. ha⁻¹, Pinoxaden@50 g a.i. ha⁻¹, Sulfosulfuron 1X@25 g a.i. ha⁻¹, Sulfosulfuron 1.5X@25 g a.i. ha⁻¹, Metribuzin@210 g a.i. ha⁻¹, Halaxifen methyl +Pyroxulam@60 g a.i. ha⁻¹ and one for control. Pre- and post-emergence herbicides were applied at 1 and 40 days after sowing respectively.

It was observed that germination of isoproturon resistant *Phalaris minor* was inhibited under pre-emergence treatment of herbicides. Among the post emergence herbicide treatments, metribuzin was found effective to control the resistant weed and the treated plants had less chlorophyll content and chlorophyll fluorescence as well whereas Halaxifen methyl +Pyroxulam was found ineffective to control the weeds.

BIOTIC AND ABIOTIC STRESS IN CROP PRODUCTION AND THEIR MANAGEMENT

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Crops experience an range of environmental stresses which include abiotic viz., drought, water logging, salinity, extremes of temperature, high variability in radiation, subtle but perceptible changes in atmospheric gases and biotic viz., insects, birds, other pests, weeds, pathogens (viruses and other microbes). The ability to stand or adapt and overwinter by effectively countering these stresses is a very complex phenomenon. In addition, the inability to do so which renders the crops susceptible is again the result of various exogenous and endogenous interactions in the ecosystem. Both biotic and abiotic stresses occur at various stages of plant development and frequently more than one stress concurrently affects the crop. Stresses result in both universal and definite effects on plant growth and development. One of the imposing tasks for the crop



researchers globally is to distinguish and to diminish effects of these stress factors on the performance of crop plants, especially with respect to yield and quality of harvested products. In order to enhance and sustain the crop production, system needs adoption and refinement of low cost agronomic practices. 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/ 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 farmers. Better crop management practices like nutrient, water and weed management, insect-pest and disease management are essential to withstand these stresses. Climate-resilient crop varieties along with other suitable adaptation and mitigation strategies will help overcome the adverse impact of climate change by lowering the yield losses under stress condition.

EFFECT OF NUTRACEUTICAL ON FINGERLINGS OF INDIAN MAJOR CARP *LABEO ROHITA*

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Nutraceuticals using plants and animal extracts can be considered as a novel trend for control of fish diseases and to overcome the problem of antibiotic resistance. The alternative herbal bio-medicinal products in the aquacultural operations have the characteristics of growth promoting ability and tonic to improve the immune system. The present study was carried to evaluate growth promoting and immunostimulatory potential of commercial nutraceutical Stimulin on the fingerlings of Indian major carps (*Labeo rohita*). Fifteen fingerlings with average weight of 7.203 ± 2.00 g were stocked into each of four treatment groups T1, T2, T3 and T4. Iso-nitrogenous experimental diets were prepared by mixing rice bran, deoiled mustard oil cake, deoiled soybean cake and vitamin mineral mixture. The nutraceutical Stimulin was incorporated into diet D2 @ 0.5%, D3 @ 0.75%, D4 @ 1.00%. In control diet D1, Stimulin was not incorporated. T1 group fishes were fed with D1 diet, T2 with D2, T3 with D3 and T4 with D4 @ 5% body weight per day for 90 days. The water quality parameters were regularly monitored. Fingerlings fed with diet D4 achieved significantly ($P < 0.05$) better specific growth rate (0.623%), feed conversion ratio (3.119) and gross conversion efficiency (0.294) as compared to other treatments. T4 group of fishes showed significantly ($P < 0.05$) higher value of total leukocyte count ($33.646 \times 10^3/\mu\text{l}$), total erythrocyte count ($3.26 \times 10^6/\mu\text{l}$), haemoglobin concentration (9.9 g %), total serum proteins (8.80 g/dl), albumin (1.445 g/dl) and globulin (7.358 g/dl) as compared to control and other treatments. The obtained results indicated that T4 was the best treatment which realized significant ($P < 0.05$) increase in growth performance, haematological and biochemical parameters. The results indicated that Stimulin has very good growth promoting and immunostimulatory potential in raising *Labeo rohita*. It can be incorporated in fish feed @ 1.0% without any deleterious effect on water quality and health of fish.

PRECISION FARMING: AN APPROACH FOR SUSTAINABLE AGRICULTURE AND PRODUCTION

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The increasing demand for the agricultural production along with a decrement in the net farming lands in India, the use of chemical fertilizers and other agrochemicals has aggravated the situation leading to the unsustainable ecosystem. Thus, biggest challenge for today's agriculture is mitigating poverty of the people producing food with less environmental degradation. Hence there should be more emphasis on optimizing yield per unit input use and maintaining ecosystem resilience. To attain these objectives precision farming is a feasible approach for sustainable agriculture optimising agricultural outputs using digital techniques for monitoring. This helps in accessing actual crop requirement so that on-time need based input application can be made. Application of geospatial techniques and sensors (e.g., geographic information systems, remote sensing, GPS) to identify variations in the field and to deal with them using alternative strategies. High-resolution satellite imagery is commonly used to study these variations for crop and soil conditions. Precision Agriculture uses techniques for information collection about the spatial and temporal variability of soil that reduces the need for expensive and intensive sampling. For effective decision making one should have high quality information regarding different aspects of field variability to estimate the exact level of input application e.g. On site fertilizer application, seed rate etc. Precision farming employs object identification, georeferencing, measurement of specific parameter by means of remote sensing, geographical information system (GIS), global positioning system (GPS), geoinformatics etc. This contributes significantly to food security and safety, accelerates bridging socio-economic growth and promotes sustainable way of farming. Precision farming maintains and improves quality and quantity of agricultural output, saving input and energy investment, uniform crop growth, decreasing environmental degradation and loss of biodiversity.

Keywords: georeferencing, geoinformatics, ecosystem resilience, GPS

ADVANCES IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT

The Earth's biological diversity has suffered massive losses in recent decades, putting the resources vital to life on the planet at great risk. The Convention on Biological Diversity (CBD), which was adopted at the 1992 UNCED Earth Summit and to which some of the main goals: Conservation of biological diversity; Sustainable use of its components;

Fair and equitable sharing of benefits arising out of the utilisation of genetic resources. Develop national strategies programmes and plans for the conservation and sustainable use of biological diversity; Integrate the CBD goals into their sectoral policies. definition of Agricultural Biodiversity Biodiversity refers to the Earth's diverse life forms, ecosystems and species, and genetic variability within species. It plays a pivotal role in the life-giving systems that make up the biosphere (climate regulation, water replenishment and soil formation for example) and is thus vital to human survival. It is also indispensable in the processes of evolution and adaptation to changing conditions. Primarily, agricultural biodiversity is understood to be the diversity in life forms used or able to be



used directly or indirectly by humankind in efforts to secure the resources vital to survival: crops (including their wild relatives), forest plants, livestock, wildlife that can be hunted or otherwise made use of, fish and other aquatic life forms, microorganisms used in food technology and other processes, and other small life forms. Given that their traits are genetically prescribed and, as a result of breeding, can affect changes in the traits of whole populations, they are also described as genetic resources for food, agriculture, forestry and fisheries². For reasons of simplicity, the term 'genetic resources for food and agriculture' is used throughout. Although only a relatively small part of the entire species spectrum is used in breeding, human activities that involve animal and plant breeding have resulted in tremendous diversity of varieties, breeds and lines within the species in question. The use of these life forms in agriculture, forestry and fisheries, hereafter described as 'agricultural practice', manifests itself in management systems which involve many different actors ranging from producers to consumers.

SCREEN VARIETAL SUSCEPTIBILITY OF CHICKPEA CULTIVARS AGAINST *C. CHINENSIS* (LINN)

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The present investigations entitled Screening of chickpea cultivars against pulse beetle, *Callosobruchus chinensis* (Linn.) in chickpea seeds was conducted in the laboratory, Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut-250110 (UP). Twenty five chickpea varieties viz., Sadbhavna, Surya, WCG-3, WCG-10, PUSA- 1108, PUSA-5053, PUSA-1053, PUSA-1105, PUSA-547, PUSA-2024, PUSA-1003, PUSA-372, DGP-92-3, RSG-931, RVG-203, PUSA-1088, WCG-9550, CSJK-6, RSG-895, JG-14, RSG-991, RSG-963, PUSA-5023, JSC-35 and JK-130 were screened with four parameters i.e. ovipositional preference, number of adults emerged, per cent seed damage and weight loss Chickpea cultivars PUSA- 2024, showed least susceptible with minimum ovipositional preference (110 eggs/10g seeds), adult emergence (20.67 adults), seed damage (2.7 %) and weight loss (3%) and RSG-963 showed highly susceptible variety with maximum ovipositional preference (223.33 eggs/100 g seeds), adult emergence (60.67 adults), seed damage (35.45 %) and weight loss (26.07%). No cultivar possessed complete resistance to the attack of pulse beetle *C. chinensis*. Among twenty five chickpea cultivars were screened the variety PUSA-2024 was found least susceptible with minimum oviposition (110 eggs/100g seeds), number of adults emerged (20.67), seed damaged (2.7%) and weight loss (3.00%) after 90 days of adults released.

EFFECT MOISTURE USE AND MOISTURE EFFICIENCY OF MUSTARD 'BASANTI' UNDER DIFFERENT DATE OF SOWING AND MOISTURE CONSERVATION PRACTICES UNDER RAINFED ECO-SYSTEM OF CENTRAL UTTAR PRADESH

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An experiment was conducted on "Responses of mustard 'Basanti' under different date of sowing and moisture conservation practices under rainfed eco-system of central Uttar Pradesh" during *rabi* 2011 on Soil Conservation and Water Management Farm, C.S.A. University of Agriculture & Technology, Kanpur on mustard 'Basanti' with three date of sowing i.e. D₁ (20th October), D₂ (28th October) and D₃ (05th November) with four levels of moisture conservation practices viz; M₀ (Control), M₁ (Paddy Straw Mulch), M₂ (Dust Mulch) M₃ (Kaoline @ 6% Spray). On the basis of results it can be concluded that the date of sowing D₁ (20th October) as water use 191.86 (mm) & water use efficiency 8.03 (kg ha⁻¹ mm⁻¹) and M₁ (Paddy Straw Mulch) as water use 180.21 (mm) & water use efficiency 9.89 (kg ha⁻¹ mm⁻¹) was found better in respect as compared to other combinations of fertility management in respect of water use & water use efficiency ended that growing of mustard crop in *rabi* season was found most suitable and remunerative in central plain zone of Uttar Pradesh in Kanpur.

APPLICATION OF REMOTE SENSING & GIS IN WATERSHED LANDUSE DEVELOPMENT

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The global awareness regarding the over - exploitation of the limited resources, at the expense of causing severe damage to the ecological system and environment degradation resulted in evolving methodology for optimum land and water utilization. This necessitates an integrated approach for the optimal development of available resources minimizing hazards to environment. Uniqueness of a watershed in its characterizes as well as problems, the interrelated nature of land and water resource invariably call for the integrated development of the total resources available in a sustainable manner with watershed as a basic hydrological unit for development planning. A watershed is a natural and complete topographical and hydrological entity that collects and converges, all the rainwater falling on it to a common outlet. Therefore, it turns out to be an ideal unit for management and sustainable development of its resources i.e. exploration, exploitation and conservation of all these resources. Agricultural development has become a major aspect in any watershed management. Agriculture encompasses the evaluation of all the resources in the watershed. This thesis deals with the application of Geographical Information System and remote sensing to two the major four problems identified for the sustainable watershed management viz. runoff estimation and soil erosion assessment. A study area in semi-arid tropic with low rainfall associated with high intensity rains, where excessive runoff and soil erosion takes place is to be considered. Adoption of soil & water conservation measures is necessary for the optimal utilization of natural resources and to increase the productivity on the sustainable basis. Therefore, an attempt is made to apply, Remote Sensing and GIS techniques for generation of development plans for the watershed area in consonance with the production potential and limitations of terrain resources and for assessing the impact of the measures undertaken



before their implementation in the field. Soil and Water conservation measures are suggested to the watershed to evaluate the hydrologic response of the measures undertaken. The Soil Conservation Service Curve Number (CN) Method is used for computing the runoff. In the present study, soil loss is predicted employing USLE method and an integrated analysis in GIS is carried out for soil conservation and for delineation of suitable conservation units. Satellite and other collateral data are used to identify the problems and potential in the watershed and measures for soil and water conservation are accordingly recommended. Computing runoff under alternative land use and management practices assesses the impact of these measures.

CONSERVATION OF NATURAL RESOURCES LAND DEGRADATION AND SOIL EROSION FOR SUSTAINABILITY CONDITION OF INDIA

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Conservation of natural resources is a very important issue for sustainability of food security. Shrinkage and deterioration of natural resources like land degradation and soil erosion, sustainability of our food and nutritional security. Further, Indian agriculture is largely weather dependent, and hence is full of uncertainties. In India, about 68.4% (83 million ha) of total degraded land (121 million ha) is affected by water erosion of moderate ($>10 \text{ t ha}^{-1} \text{ yr}^{-1}$) to very severe ($>80 \text{ t ha}^{-1} \text{ yr}^{-1}$) intensities, followed by chemical degradation (25 million ha), wind erosion (12 million ha) and physical degradation (1.1 million ha) (ICAR and NAAS, 2010). Water erosion is the major threat to soil quality and quality of runoff water. It results in loss of organic carbon, nutrient imbalance, compaction, decline in soil bio-diversity, and contamination with heavy metals and pesticides. As per recent estimates by IISWC, annual soil loss rate in our country is about 15.35 t ha^{-1} , resulting in loss of 5.37 to 8.4 million tonnes of nutrients, reduction in crop productivity, occurrence of floods/droughts, reduction in reservoirs capacity (1% to 2% annually), and loss of biodiversity. Conversion from natural to managed ecosystems, and extractive farming practices based on low external input and soil degrading land use tend to deplete the terrestrial C pools. The soil pool loses 1.1 Pg C into the atmosphere as a result of soil erosion and another $0.3\text{--}0.8 \text{ Pg C yr}^{-1}$ to the ocean through erosion-induced transportation to aquatic ecosystems (Lal, 2011). Therefore, research and development need to focus on accurately assessing and mapping of erosion hazards, soil fertility loss, water pollution and prioritizing the erosion risk areas, for in depth assessment of the status of land degradation due to water erosion to help in planning of precision conservation measures at watershed, region and country levels.

STUDIES ON THE RESPONSE OF POTASSIUM LEVELS ON DIFFERENT VARIETIES OF CHICKPEA

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An experiment entitled “Studies on the response of potassium levels on different varieties of chickpea (*Cicer arietinum* L.)” was conducted during rabi season of 2013 -14 at Student Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Twelve treatments were tested in Randomized Complete Block Design with Three Replication and Four levels of Potassium K_1 , K_2 , K_3 and K_4 (0, 30, 60 and 90 Kg/ha^{-1}) with three Varieties (Udai, Avarodhi and KWR-108). On the basis of experimental results, It was found that significantly highest grain yield (18.66 qha^{-1}), was received in Potassium level K_4 ($90 \text{ Kg potassium/ha}$) followed by (14.99 qha^{-1}) in Potassium level K_3 ($60 \text{ Kg potassium/ha}$). The net profit was also significantly highest (Rs.29032 /ha) in the treatment K_4 ($90 \text{ Kg potassium/ha}$) followed by (Rs.17434 /ha) was recorded in treatment K_3 ($60 \text{ Kg potassium/ha}$). The minimum grain yield (11.60 qha^{-1}) and net profit (Rs.9535 /ha) was received in control treatment K_1 ($0 \text{ Kg potassium/ha}$). The B: C ratio was also significantly highest (2.00) in treatment K_4 ($90 \text{ Kg potassium/ha}$) followed by (1.61) was recorded in treatment K_3 ($60 \text{ Kg potassium/ha}$) and (1.54) in K_2 ($30 \text{ Kg potassium/ha}$) and the minimum (1.36) in control K_1 ($0 \text{ Kg potassium/ha}$).

STUDIES ON THE EFFECT OF FYM ON POTASSIUM REQUIREMENT OF CHICKPEA (*CICER ARIETINUM* L.)

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An experiment entitled “Studies on the effect of FYM on Potassium requirement of chickpea (*Cicer arietinum* L.)” was conducted during rabi season of 2011 -12 at Student Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Ten treatments were tested on Factorial based Randomized Complete Block Design with Three Replication. Five level of Potassium K_0 , K_1 , K_2 , K_3 and K_4 (0, 20, 40, 60 and 80 Kg/ha^{-1}) with FYM (10 tonnes/ha) and without FYM were tested. On the basis experimental results, It was found that highest grain yield (25.43 qha^{-1}), was received at Potassium level K_3 (Potassium @ 60 Kg/ha) followed by (23.84 qha^{-1}) at Potassium level K_4 (Potassium @ 80 Kg/ha) which was significantly at par while net profit was highest (Rs.35066/ha) in the treatment K_3 (Potassium @ 60 Kg/ha) followed by (Rs.33969/ha) was recorded in treatment K_4 (Potassium @ 80 Kg/ha) Which was also significantly at par. The minimum grain yield (18.86 qha^{-1}) and net profit (Rs.21060/ha) was received in control. B: C ratio was also highest (1.98) in K_3 (Potassium @ 60 Kg/ha) followed by (1.91) was recorded in treatment K_4 (Potassium @ 80 Kg/ha) and (1.86) in K_2 (Potassium @ 40 Kg/ha) and minimum (1.610) K_0 (Control). However, Potassium levels didn't show any significant effect with FYM application.



“STUDY ON THE BIOLOGY OF PULSE BEETLE (*callosobruchus chinensis* L.) ON GRAM (*cicer arietinum* L.) AND ITS SAFER AND EFFECTIVE MANAGEMENT WITH SOME BOTANICALS”**Jaswant Kumar*, R.K. Dwivedi* and Raj Kumar****

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Various experiments were conducted to evaluate the biology of *C. chinensis* on gram variety (Radhey) with the use of some botanicals like *neem* seed kernel extract 5% @15 ml/kg, mustard oil, castor oil and linseed oil @ 3ml/kg of seed and *neem* leaf powder, tobacco leaf powder and *datura* leaf powder @15 g/kg of seed for the safer and effective management of *Callosobruchus chinensis* Linn. Out of them, the results on management of *Callosobruchus chinensis* L. showed that the application of *neem* seed kernel extract 5% @ 15 ml/kg of grain and *neem* leaf powder @ 15 g/kg of grain provided reduced fecundity by giving 9.30 and 10.90 eggs/female in comparison to 44.90 eggs in control. Hatching percent eggs was also decreased up to 15.10 and 15.48 percent in seeds treated with *neem* seed kernel extract 5% @ 15 ml/kg of seed and *neem* leaf powder @ 15 g/kg seed as compared to 85.30 percent in control. Incubation period was maximized through the application of *neem* seed kernel extract 5% @ 15 ml/kg of seed, *neem* leaf powder @ 15 g/kg of seed and Castor oil @ 3 ml/kg of seed i.e. 8.10, 7.60 and 7.35 days, respectively, as compared to untreated check (4.6 days). Larval period was also increased due to application of *neem* seed kernel extract 5% @15ml/kg seed, *neem* leaf powder @ 15 g/kg of seed and castor oil @ 3ml/kg of seed i.e. 23.30, 22.75 and 21.30 days, respectively, as compared to control (17.80 days). Normal pupation 75.35 percent was reduced up to 10.19 % by application of *neem* seed kernel extract 5%. Pupal period was maximized the seed treated with *neem* seed kernel extract 5% @ 15 ml/kg of seed and *neem* leaf powder @ 15 g/kg seed i.e. 9.70 and 9.40 days, respectively, in comparison to control (7.00 days). Total developmental period of pulse beetle was also increased by seed treated with *neem* seed kernel extract 5% @ 15ml/kg of seed and *neem* leaf powder @ 3 ml/kg seed i.e. 41.10 and 39.75 days, respectively, as compared to control (30.00 days). The minimum 1.52 percent adult emerged in application of *neem* seed kernel extract 5% as compared to 65.20 percent in control. The minimum 2.12 % seed damage was recorded in *neem* seed kernel extract 5% followed by 4.17 % seed damage in *neem* leaf powder @15 g/kg seed as compared to 67.90 percent seed damage in control. The indigenous plant products have non hazardous effect from all point of view and easily available which can be used for safe storage. The *neem* seed kernel extract @ 15 ml/kg of seed, *neem* leaf powder @15 g/kg seed and castor oil @ 3 ml/kg seed were found most effective in minimizing the fecundity, hatching of eggs, pupation percent, adult emergence, percent damaged and weight loss of seeds and maximizing the incubation period, larval period, pupal period and developmental period. Thus the *neem* seed kernel extract @ 15 ml/kg seed, *neem* leaf powder @ 15 g/kg seed and castor oil @ 3 ml/kg seeds can be recommended to protect the pulses from the infestation of this noxious beetle

EFFECT OF PHOSPHORUS, SULPHUR AND FYM ON GROWTH AND YIELD OF CHICKPEA IN CENTRAL PLAIN ZONE OF UTTAR PRADESH**Upendra Verma*, Ram Pyare and Raj Kumar****

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This study was carried out to determine the effect of phosphorus, sulphur and FYM for chickpea variety KWR-108 with 3 replications in split plot design was conducted during *Rabi* season of 2013-14. Result revealed that the application of phosphorus up to 60 Kg/ha was significantly higher in respect to growth attributes viz; plant height at 60 DAS and maturity stage, branches/plant at flowering stage, fresh weight at maturity stage, dry weight at 60 DAS and maturity stage, yield attributes viz; pods/plant, grain/plant, pod weight/plant, grain weight/plant, test weight, yields viz; biological yield, grain yield, protein yield and N uptake in straw, P uptake in grain and straw, K uptake in straw and economics as gross and net income and B:C ratio. Use of Sulphur up to 30 Kg/ha was statistically significantly improved plant height at 60 DAS and maturity stage, branches/plant at flowering stage, Fresh and dry weight, pods/plant, grain/plant, grain weight/plant, test weight, biological yield, grain yield, protein percentage and yield, N and P uptake in grain and straw, K uptake in grain and economics as gross and net income and B:C ratio. All growth and yield attributes, yields, quality parameter and economics were found significantly higher due to application of 5 tonne/ha FYM in present investigation.

CURRENT STATUS OF RED ROT DISEASE OF SUGARCANE IN UTTAR PRADESH**Rajani Bala¹, Y.P. Bharti², S.K. Singh³**¹Mewar University, Chitaurgarh, (Rajsthan), India³Chootu Ram Post Graduate College, Muzaffarnagar (UP), India²Genda Singh Sugarcane Breeding Research Institute, Seorahi, Kushinagar (UP), India

An extensive survey of sugarcane red rot disease during last decade 2016-2017 in Uttar Pradesh was conducted at various farmers field. The motto against red rot disease survey was adjudging the behavior of different sugarcane cultivars. The inference drawn from the results of disease survey that red rot was reported at Saharanpur, Muzaffarnagar, Meerut, Bagpat, Bareilly in the western UP on cultivars namely (CoSe 93232-incidence 18%, CoSe 95422- incidence 16%, CoLk 8102-incidence 14%, Co 1148-incidence 08%, CoS14232-incidence 04%), in the central UP as Shahjahanpur, Hardoi, Lucknow, Barabanki, Balarampur on cultivars namely (CoJ 88- incidence 16%, CoJ 85-incidence 14%, CoS 8436-incidence 12%, CoS 88230-incidence 06%, and Co 0238-incidence 02%) and eastern UP as Gonda, Faizabad, Basti, Grakhpur and Kushinagar in the cultivars namely (UP 9530-incidence 20%, CoSe 92423-incidence 15%, CoJ 85- incidence 12%, CoSe 95422- incidence 08% and



CoS 07250-incidence 05%) were observed in the natural occurrence. Its incidence varied 05 to 20 percent depending open variety and locality in the farmers field in the natural condition. The results revealed that maximum incidence was observed in Eastern followed by Western and Central Uttar Pradesh. A total 15 highly infected cane varieties were collected, brought to the laboratory and left upto 5 days for drying. The dried canes were scrapped by knife and surface sterilized by 95% ethanol. These were then split open with the help of sterilized knife on a laminar flow bench and the infected tissue of the pith region was taken out with the help of a sterilized cork borer and aseptically transferred to petri-plates (90 mm diam) for pure cultures, thus obtained, were maintained on (OMA) slants and stored in refrigerator for further pathological and molecular studies.

Keywords: Red rot, *C. falcatum* incidence, sugarcane.

INTEGRATED PEST MANAGEMENT FOR STORAGE INSECT-PESTS

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Nearly 1000 sp. have been associated in storage insect-pest. In India 12 of them are most important. Majority belongs to Coleoptera & Lepidoptera. The losses caused by the storage pests which includes insects, fungi, weeds, rodents and abiotic factors is to the tune of 10% (FAO, 1978). Grains produced stored for periods of a few weeks to a few years before they are fed or processed. The harvest and storage of grain do not signal an end to the possibility of losses caused by insects and pathogens. Successful management of stored-grain insects is possible only when proper storage practices are implemented. Insecticides and fumigants should be viewed as supplements to, not replacements for, sound storage methods. When used properly, insecticides and fumigants limit insect losses in stored grains without endangering the pesticide applicator or resulting in excessive pesticide residues that threaten the health of consumers of treated grain or grain products. This chapter provides recommendations for cultural and chemical control of stored-grain insects. It is revised annually; always use the current year's handbook. Changes in registration that occur between revisions will be announced to appropriate media sources and to Extension offices. A holistic guiding principle that includes all the activities from selection of crop to the harvest and storage. Integrated pest control may be defined as a system that in the context of the association environment and the population dynamics of pest species, utilizes all suitable techniques and methods in as compatible a manner as possible & maintains the pest population at level below those causing economic injury.

EFFECT OF CROP ESTABLISHMENT METHODS AND MOISTURE CONSERVATION TECHNIQUES ON PERFORMANCE OF RICE

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Hydrogel is a synthetic polymer, which is able to absorb and hold 80-180 times its volume of water for long time (Wang and Gregg 1990). Hydrogel acts as a reservoir to store and release a steady stream of water and nutrients which plants need to grow. Plant roots are able to absorb water from the crystal bead of hydrogel. Application of pusa hydrogel improved the soil moisture contents as compared to noapplication. As a consequence of more emergence and better stand establishment and yield components were also improved, increasing the yield of rice in hydrogel amended soil as compared to non-treated soil. Gupta, R.K. *et al.* (2007) Water shortage is becoming severe in many rice-growing areas in the world, prompting the introduction of water-saving aerobic rice, which is direct-seeded in non-puddled, non-flooded aerobic soil, aerobic rice systems can reduce water use in rice production by 50%.

EFFECT OF DEFORESTATION ON AGRICULTURAL PRODUCTION

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Rapid depletion of forests resources have serious effect on Agricultural production activities. Loss of the forest is one of today most publicized, issue, some article give the impression that the destruction is so rapid that by the end of the century there will be only scattered remnants forest. The objective of study of deforestation is to evaluate and access the effect of deforestation on Agricultural production activities, from the point of view of crop production, livestock farming, wild fruit gathering, marketing of forest resource, fuel, wood and charcoal production. Deforestation is driving changes in the climate that threaten to impact global food production, according to a new study. Forests currently cover around 30% of the Earth's land surface, but are being lost at an "alarming rate" (FAO, 2010). Deforestation is highest in the tropical areas of South America, central West Africa, and South and Southeast Asia, with 13 million hectares of global forest lost each year (FAO, 2010). Forests are a vital constituent of the global water cycle, as they have a high evaporation rate, contributing to atmospheric moisture circulation. 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.

Keywords: Forest, uneven rainfall, deforestation, crop production



CONSERVATION AGRICULTURE (CA) IN MAIZE BASED CROPPING SYSTEMS**R. N. Maurya^{1*}, Jay Kumar Yadav¹, Rajmani³, U. P Singh¹, and Girish Goyal¹**¹Department of Agronomy, C.S. Azad University of Agriculture & Technology, Kanpur – 208002²Department of Plant Pathology, N.D. University of Agriculture & Technology, Kumarganj, Faizabad – 224229³Department of Agricultural Extension, C.S. Azad University of Agriculture & Technology, Kanpur – 208002

Traditionally, maize, wheat and other crops in maize based crop sequence are grown either in row geometry or by random broadcasting, mostly after thoroughly tilling the field till proper tilth is obtained for good seedling emergence. At present, the real challenge in Indian Agriculture is to produce more quality food for burgeoning population from the same land and water resources, besides sustaining soil health and environmental quality. India alone needs to produce additional 64 million tonnes of food over the next decade to achieve targeted 294 million tonnes by 2020. Incidentally these are the areas where single cross maize hybrid based technology in combination with improved natural resource management practices viz., conservation agriculture based resource conservation technologies (RCTs) act as a driver in enhancing the crop productivity and farm profitability. The efforts by researchers made since mid 1990's on developing, refining, accelerating and enhancing the adoption of CA technologies in the India has brought a "Revolution in tillage techniques. Conservation agriculture (CA) are three basic principles: minimal soil disturbance, permanent soil cover and suitable crop rotations. It is a way to combine profitable agricultural production with environmental concerns and sustainability and it has been proven to work in a variety of agro-ecological zones and farming systems. The benefits of maintaining crop residue on the soil surface are well documented and include reduced soil loss as a result of water or wind erosion, as well as increased infiltration of water and soil water storage efficiency. Other benefits of conservation tillage (CT) systems include reduced labour, fuel, and machinery wear, improved soil tilth, increased soil organic matter, improved water and air quality, and increased biodiversity.

ROLE OF INTEGRATED NUTRIENT MANAGEMENT IN OPTIMIZING THE FARM INCOME**RAM RAJ KARWASARA^{1*} AND DINESH KUMAR²**^{1*}M.Sc. (Agronomy), ²Ph.D. Scholar (Agronomy)

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The introduction of green revolution in 1966-67 has resulted in phenomenal increase in the production of agricultural crops especially in food-grains. Due to indiscriminate uses of inorganic fertilizers in the post green revolution era, the reduction in soil fertility, soil health, soil organic carbon, beneficial microbial population and increment in the micronutrient deficiency in soil have become the serious issues of concern for crop production sustainability as well as soil health. Besides above, the faulty techniques as well as excess use of nutrients not only pollute the soil but also increase the cost of cultivation. Integrated nutrient management (INM) plays a crucial role in sustainable crop production with improving soil health at lower cost. INM comprises all the nutrient management practices, i.e., use of inorganic fertilizers, organic manures, green manuring, inclusion of legume crops in cropping system and application of microbial inoculants at an optimum level for sustaining the desired productivity through optimization of the benefits in an integrated manner. It enhances the availability of applied as well as native soil nutrients, synchronizes the nutrient demand of the crop with nutrient supply from native and applied sources, provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance, improves and sustains the physical, chemical and biological functioning of soil, minimizes the deterioration of soil, water and ecosystem by promoting carbon sequestration, reducing nutrient losses to ground and surface water bodies and to atmosphere. With the adoption of INM practices, there is a definite scope for reduction in cost of cultivation specifically towards fertilizers and additional income due to increase in crop yield.

Keywords: Green revolution, Inorganic fertilizer, Soil health, Soil fertility, Cost of cultivation

BEES DIVERSITY IN AGRO-ECOSYSTEM OF AROUND PUNE, MAHARASHTRA**Ramnath Andhale*, Vishal Pathare*, Kalpana Pai*, Aswini Pai# and R. S. Pandit***

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Bees pollinators are essential for agro-ecosystem development, which providing important benefit to enhanced agricultural outcomes. Lack of information, about bees diversity in agro ecosystem of India. In this study we examine the interaction of bees and agricultural practices. Field experiment is impact on agriculture landscapes on abundance of native bees and its diversity. Native bees were monitored on a monthly basis from 10th February 2015 – 10th October 2016 using net sweeping and color pan traps deployed for 8 hours in agriculture field of Pune, Maharashtra, India. 825 bees comprising 23 species were collected during the 2015-2016 field season. We observed that Organic farm high abundance of native bees as compare to conventional farm. Weed and grassy area in field and uncultivated land around the field were positively related of bees abundance in field. We determined that crop landscape develop floral patches could be have enhance yield than homogenously agriculture landscapes. The dominance distribution of the bee community was highly skewed, as the top five species accounted for nearly 68% of the total bees captured. The structure of the Pune bees community was typical of insect communities in highly disturbed habitats: low species richness and relatively few species dominating in abundance. These data can be use to designed agro ecosystem that helpful to increase crop production, plant and bees conservation.

Keywords: Agro-ecosystem, Conservation, Bees pollinators, Diversity, Organic farm.



DETAILED TAXONOMIC ILLUSTRATION OF *MAIESTAS DORSALIS* (MOTSCHULSKY) (HEMIPTERA: CICADELLIDAE) WITH MOLECULAR CHARACTERIZATION**Ramya. N and Naresh M. Meshram**

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Rice has been a staple food of India from thousands of years. It is infested by many number of insect pests among which leafhoppers constitute a major pest species. Leafhoppers are wedge shaped small insects with various form, colour and size and can be easily distinguished by presence of one or more rows of spines along the length of hind tibia. Of the leafhopper complex, zig-zag leafhopper *Maiestas dorsalis* (Motschulsky) is one of the potential pest of rice. It inhabits rice and other graminaceous plants cause direct damage by sucking sap. It also reported as vector for important rice diseases like tungro virus, orange leaf virus and rice grassy stunt diseases virus. It can be identified by pale coloured Pronotum and normal translucent wings with zig-zag marking on the forewing. Formerly it was known as *Recilia dorsalis*, after the revision of Deltocephalini tribe by Webb and Viraktamath in 2009 it was renamed as *Maiestas dorsalis* (Motschulsky). After the revision and renaming there is no comprehensive work has been done for easy identification of this species. Taxonomic studies so far focused on the male genitalia characters only and there is no comprehensive handy illustration for identification of *Maiestas dorsalis*. Hence, the present study was conducted to develop photographic illustrations to identify pests even by non-specialists also and confirmation of the species with molecular characterization. Zig-zag leafhoppers were collected from rice fields through sweep net and light trap from various rice growing regions of country, namely, Arunachal Pradesh, Chhattisgarh, Delhi, Karnataka, Kerala, and Meghalaya during 2015-16. For redescription we selected the characters like head, pronotum, wing and measurements were taken, main emphasis was laid on male genitalia characters variation to delineate the species. Well illustrated photographic plates are prepared which includes habitus, head, face and genitalia photographs, which help for easy identification. The species identity is confirmed with molecular characterization of mitochondrial cytochrome oxidase – I gene.

SORGHUM (*SORGHUM BICOLOR* L.) BASED INTERCROPPING SYSTEM UNDER RAINFED CONDITION**Ranjeet Kumar, U.D. Awasthi, S.K. Uttam and Raj Kumar**

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A field experiment was conducted during *Kharif* season of 2016 at Soil Conservation and Water Management Farm of the C.S. Azad University of Agriculture and Technology, Kanpur to find out effect of intercropping systems on growth, yield and splash loss of crops under rainfed condition. The treatments comprised of 10 intercropping systems i.e. (i) Sorghum sole, 45 cm a part (ii) Moong sole, 45 cm a part (iii) blackgram sole, 45 cm a part (iv) Soybean sole, 45 cm a part (v) Sorghum + moong (2:1) (vi). Sorghum + blackgram (2:1) (vii). Sorghum + soybean (2:1) (viii). Sorghum + moong (3:1) (ix). Sorghum + blackgram (3:1) and (x) Sorghum + soybean (3:1) were tested in Randomized block design with 3 replications. Results obtained that yield of sorghum, moong, blackgram and soybean were highest in their sole stands. The yield of sole and intercropped moong, blackgram and soybean in terms of sorghum equivalent grain yield showed significant variation, whereas sorghum + blackgram (2:1) brought out significantly the highest production as compared to other cropping systems. Moreover, the land equivalent ratio was also found to be the highest simultaneously, maximum splash loss was observed under sole maize and minimum under blackgram treatment.

ADVANTAGES OF TRADITIONAL AND MODERN TECHNOLOGY IN AGRICULTURE AND BIODIVERSITY CONSERVATION FOR SUSTAINABLE DEVELOPMENT**Ranjeet Rawat**

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Babasaheb Bhimrao Ambedkar University,

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The only instance in which traditional farming is better than modern agricultural technology is that it produces high quality product in smaller quantities. Whereas, the produce obtained from modern agriculture technology produces big quantity but compromises in quality. In terms of fertilizers and pesticides, traditional technologies use fertilisers and pesticides that do not pollute the soil. Modern agricultural technologies have developed these chemicals in a way that they wipe out pests and herbs but also prove to be harmful to the environment, polluting land and water. Traditional methods use biological pesticides and insecticides and the produce is healthier. Harvested products are grouped under the category of organic produce. Which is sold at high prices resulting in better profits than the produce of modern technologies. On the other hand, the main advantages of modern agricultural technology lie in its predictability. The technology make sure that the farmers have crops to harvest and sell. There is very less chance of the crop being lost to environmental factors like drought, floods, plant diseases or low yield. The modern agricultural technology make sure that the agricultural sector gains profit every harvest season with very less crop losses.

Keywords-Modern agriculture technology, High quality product.

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Keywords-Modern agriculture technology, High quality product.

AGRO-WASTE DERIVED PRODUCTS FOR COMMERCIAL APPLICATIONS: A REVIEW

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Agro-industrial wastes such as rice bran, wheat bran, wheat straw, sugarcane bagasse, pea peels and corncob are readily available, less expensive and have large quantities of natural carbon source. This carbon source, in turn, acts as a reservoir for the production of value added products such as enzymes, single cell protein, natural antioxidants, ethanol, organic acids, polysaccharides, dietary fibres, biofuel and prebiotics. Agro-industrial wastes are organic in nature and easily assimilated by the microorganisms which make such wastes very appropriate for the production of value added products. Lignin, cellulose, phenolic compounds and hemi-cellulose are the main constituents of agriculture wastes which are good source of carbon utilized by fungi and bacteria as a substrate. Utilization of agro-industrial wastes offers great potential for reducing the production cost and increasing the use of bio-compounds for industrial purposes. The application of agro industrial by-products in bioprocesses offers a wide range of alternative substrates, thus solving problems pertaining to pollution caused by improper waste disposal. Attempts have been made to use agro-industrial waste to generate several value-added products. The present work focuses on reviews related to utilization of agro-industrial wastes for the production of enzymes and their industrial applications.

USAGE OF NANOTECHNOLOGY IN AGRICULTURE AND ITS ROLE IN INSECT-PEST MANAGEMENT

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Nanotechnology in Agricultural research has emerged as an interdisciplinary science. Nanoparticles are materials those are small enough to fall within the nanometric range which release pesticides or fertilizers at a specific time and targeted location. The application of nanomaterials in agriculture aims to reduce applications of plant protection products, minimize nutrient losses in fertilization, and increase yields through optimized nutrient management and holds a significant promise in the field of insect pest management. Nanoparticles, Nanocapsules, Nanoemulsions, encapsulations are widely used nowadays as insecticides, repellents, herbicides. Nanoparticle mediated gene transfer in plants are useful in development of insect resistant varieties. Therefore, nanotechnology would provide green and efficient alternatives for the management of insect pests in agriculture without harming the nature. Therefore, modern approaches of nanotechnology would provide efficient and ecofriendly alternatives in crop protection.

Keywords: Nanotechnology, Nanoparticles, Management, Ecofriendly.

PRESERVATION OF CAULIFLOWER BY DEHYDRATION TECHNIQUE FOR ENSURING EXTENDED SHELF LIFE AND HIGHER RETURN TO RURAL WOMEN FOLK OF KHAGARIA DISTRICT

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Cauliflower (*Brassica oleracea* var. *botrytis*) is the major vegetable crop of Bihar accounting for 17 % of total cauliflower production of India. In Khagaria district this is being cultivated in more than 1300 ha area with the production of approx. 23.5 thousand MT. Although production of fruits and vegetables is high, post harvest losses are more than 25 percent (Radha Krishnan 1999). Situation in Khagaria district is not very different as significant proportion of vegetables gets wasted in the peak production time due to poor storage and transportation facilities. Apart from it farmers don't get proper price of their produce in the peak season due to prevailing low price in markets. Hence, enhancing shelf life of the vegetables through proper processing technique will add to farmer's income and reduce wastage of vegetables. Under the background a study was made on preservation techniques of cauliflower to get better shelf life, organoleptic qualities and economic return to farmers.

Two processes of preservation namely sun drying and oven drying were compared. For the purpose, cauliflower purchased from local market were undergone processes of drying at normal room temperature, weighing and cutting into 3-4 cm long pieces, blanching and removing of excess water. Afterwards, the samples of blanched cauliflower were sundried at 30-35⁰ C and oven dried at 50-60⁰ C separately. The dehydrated



samples were then analyzed for proximate composition such as moisture, ash, fat, crude fiber, crude protein and carbohydrate content. For sensory evaluation cauliflowers recipes from oven dried and sundried samples were prepared.

Unit cost of processed cauliflower in case of dehydration by sun drying was Rs. 68.50 compared to oven dried as Rs.70.70 per kg. Rehydration ratio of sun dried was 5.9:1 where as in oven dried sample was 5.8:1. The moisture content was found to be higher in sundried sample (5.5%) as compared to oven dried sample (5.0%). Ash content (7.75%) was higher in oven dried sample compared to 7.25% in sun dried sample. As regards proximate composition of dehydrated cauliflower, fat content was observed to be similar in both methods of drying where as crude fiber content were 12.0% and 10.0% in oven dried and sun dried samples respectively. Crude protein contents were found to be 12.75% and 13% in oven dried and sun dried samples respectively where as carbohydrate contents were 60.50% and 62.25% respectively. Organoleptic properties such as colour, flavor, texture and taste of the recipes prepared from the dehydrated cauliflower were found to be in highly preferable range of 30 respondents upto 6 months period of dehydration. As investigated from the above facts, shelf life, organoleptic qualities and nutrient composition of sundried and oven dried cauliflower samples were observed to be almost similar. Adding to this sundrying can be done easily by rural women folk, hence this method can be advocated as preferred technique for the farmers of Khagaria district. Women folk earned substantial benefit by marketing of sundried cauliflower.

EFFECT OF NPK AND SILICA GROWTH AND POD YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L.)

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Silica is the most abundant mineral in the earth's crust. It's another name for the chemical compound silicon dioxide. Each unit of silica includes one atom of silicon and two atoms of oxygen. Field experiments were conducted to study the influence of different level of silica and NPK. The experiments were conducted in the randomized block design replicated thrice with eight treatments involving different level of silica and NPK. Eight different treatment of silica micro nutrient and NPK RDF viz. T1(100% RDF), T2(100% RDF+1ml Si), T3(100% RDF+1.5ml Si), T4(100% RDF+2ml Si), T5(Control), T6(1ml Si), T7(1.5ml Si), T8(2.0ml Si) were applied and the growth of plant height, more leaf growth and pod yield higher were studied. The length of plant no. of leaves and maximum no. of pod at T4. Weight, Length, and Diameter per fruit and yield per plant were the highest at T4. Such result suggested that the total growth, flowering and pod yield are being increasing to the use of its. The aim of this study was to study the performance of growth flowering and pod yield.

EFFECT OF NPK AND SILICA GROWTH AND POD YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L.)

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RECONCILING BIODIVERSITY CONSERVATION AND FOOD SECURITY: SCIENTIFIC CHALLENGES FOR A NEW AGRICULTURE

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Production ecology and conservation biology have long focused on providing the knowledge base for intensive food production and biodiversity conservation, respectively. With increasing global food insecurity and continuing biodiversity decline, we show that the largely separate development of these fields is counterproductive. Scenario analyses suggest that feeding the world is possible without further encroachment of agriculture into natural ecosystems. Without ignoring the necessary demographic, socio-economic, institutional and governance requirements, we make the case for a science that develops the best ecological means to produce food in a way that has substantially less negative effects on biodiversity and associated ecosystem services and, indeed, should be able to contribute to their persistence and enhancement. Recent developments in trait-based ecology should soon make it possible to adapt and (re-)design agro ecosystems to meet both goals of biodiversity conservation and food security. However, there are real tensions between, on the one hand, the opportunity costs of biodiversity conservation (for direct use and for conversion to agriculture) and on the other hand, the ecosystem service values and option values associated with biodiversity. I want to elaborate the management of plant genetic resources as a metaphor of the tensions between such values of biodiversity and ecosystem services in general. I conclude that significant changes in policies, institutions and practices are necessary to make advances in ecology work for reconciling biodiversity conservation and food security. Food security as the main means to not only reducing hunger but also providing a demonstrable route out of poverty.

Keywords: Reconciling biodiversity conservation, Food security and Ecosystem.



GROWTH, YIELD AND NITROGEN USE EFFICIENCY IN WHEAT AS INFLUENCED BY USING LEAF COLOUR CHART AND CHLOROPHYLL METER BASED NITROGEN MANAGEMENT

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Field experiments were conducted at G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, during the winter (*rabi*) season of 2014–15. The study aimed to investigate the effect of leaf colour chart and chlorophyll meter (SPAD meter) based nitrogen management on growth, yield and nitrogen use efficiency in wheat crop. Application of nitrogen at lower rate of 105 kg/ha based on LCC value (4 and 5) and SPAD (30 and 40) resulted statistically similar growth, yield attributes viz., plant height, shoot density, dry matter, leaf area index, number of spikes per square meter, number of grains per spike and 1,000-grain weight with recommended practice in turn result into a par grain yield but significantly superior over LCC and SPAD based treatment of 85 kg N/ha and control treatments. Higher numerical value of nitrogen use efficiency in terms of agronomic efficiency, recovery efficiency obtained from LCC and SPAD based treatments of 105 kg/ha than recommended nitrogen management. Higher values of agronomic and recovery efficiency indicate that real time nitrogen management based on leaf colour chart and chlorophyll meter help to uptake nitrogen more efficiently from the soil and contribute maximum to grain formation rather than subjected to losses. Study revealed saving of 30 per cent or 45 kg/ha nitrogen without any significant yield decrement.

INTELLECTUAL PROPERTY RIGHTS AND ITS ISSUES AND WHY PROTECTION FOR PLANTS IS REQUIRED IN INDIA

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Intellectual Property Right is a general term covering patents, copyright, trademark, industrial designs, geographical indications, protection of layout design of integrated circuits and protection of undisclosed information (trade secrets). IPRs refer to the legal ownership by a person or business of an invention/discovery attached to particular product or processes which protects the owner against unauthorized copying or imitation. IPR developments in India 1947 Patents & Designs Act, 1911 1995, India joins WTO 1998, India joins Paris Convention/PCT 1999 Patent amendment provided EMR retrospectively from 1/1/95, 2003 2nd amendment in Patents Act. Term of Patent – 20 years after 18 months publication Patent Tribunal Set up at Chennai 2005 Patents (Amendment) Act 2005 Plant Varieties and Farmers' Rights Act & Biodiversity Act. Designs, TM/Copyright Acts updated GI Registry set up at Chennai. The protection of plant required to promote/protect investment by providing appropriate returns, To encourage need based appropriate research, To enable Indian plant breeders to get their varieties protected in other countries on reciprocity, To facilitate market access for export of seed to countries, To ensure researcher's access to foreign germplasm in future. The PVP Bill 1999, passed by Parliament in August, 2001 compliance with TRIPS some form of IPR protection is necessary for plants in the form of patent protection; or By a sui generis system; or By a combination of both.

Seasonal incidence pattern of mustard aphid, *Lipaphis erysimi* (Kalt.) in Tarai region of Uttar Pradesh and Uttarakhand

ORGANIC WEED MANAGEMENT IN FIELD CROPS

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One technology which has a potential to yield substantial increase in the production of food grains is proper weed management as weeds alone are known to account for about 15 to 85 per cent losses in the productivity. A recent estimate says that weed accounts for 45 % of total annual loss of crop production in India. The annual loss due to weeds could be equivalent to nearly Rs. 2700 crores in India. In our country we use excessive amount of herbicide that leads to poor soil health and human/animal health hazard. So we need another economical and sustainable way of weed control. So in that situation organic weed management is a better option for controlling weed. The losses due to weed is more in *Kharif* season crops compared to *rabi* season crops (Wall and Smith, 2000). Rice yield was greater when rotated with hyacinth bean or velvet bean than in continuous crop with or without N application. It was concluded that legume in rice rotation reduces weed competition and improves the yield of rice (Marengo and Santosh, 1998). Wheat cultivar PBW 621 had a competitive advantage over weeds as it recorded minimum weed dry weight and highest grain yield (Kaur et al., 2014). The plant population of 50 plants/m² was found to be significantly superior and it recorded significantly less weed dry matter and highest grain yield compared to other population levels (Walia et al., 2005). Weeding of rice three times, especially at 20, 35 and 50 days after emergence gave relatively better yield and found cost effective and recommendable under conditions (Jemberie et al., 2013). The essential oil of *Eucalyptus tereticornis* shows toxicity towards *Echinochloa crus-galli* and has potential to be used as bioherbicide (Vishwakarma and Mittal, 2014). It can be concluded that organic weed management can play an important role for controlling the weed and increasing the crop production. Integration of methods like cultural, mechanical and biological methods can improve the productivity without any adverse impact on soil and human health. Organic weed management emphasises balancing the detrimental effects of weeds (e.g. loss of crop quality or yield) with the beneficial aspects (e.g. biodiversity or pest control).



ORGANIC AGRICULTURE: WAY TO SUSTAIN LIFE

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An experiment was conducted at Medicinal Plants Research and Development Centre (MRDC) of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, District Udham Singh Nagar, India, during *Kharif* season of 2016, to study the effect of biozyme (liquid fermented product contain cow urine, cow dung, pulse flour, jiggery and microbial rich forest soil) on soil microbial population, nutrient availability and to optimize its rate of application for brahmi crop (*Bacopa monneri* L. var. CIM- Jagriti). The experiment was laid out in randomized block design (RBD) having thirty plots with ten treatments and three replications. The experimental soil was sandy clay loam in texture, neutral in reaction, having pH 6.9, medium in organic carbon (0.64%), low in available nitrogen (180.78 kg ha⁻¹) and medium in both available phosphorus (20.14 kg ha⁻¹) and potassium (200.64 kg ha⁻¹). The results revealed that microbial population was significantly increased on application of biozyme @ 5000 ltr ha⁻¹ which was at par with biozyme 4000 ltr ha⁻¹. NPK availability was highest in treatment consisting of biozyme 5000 ltr ha⁻¹ thus from the above study it was observed that biozyme @ 4000 ltr ha⁻¹ gave equal yield as compare to chemical fertilizer, farmyard manure and vermicompost.

Keywords: Biozyme, Farmyard manure, vermicompost, brahmi

SMART FERTILIZER FOR SUSTAINABLE CROP PRODUCTION

Joginder Pabnawa

Work should begin now on the next generation of fertilizer products using advanced techniques such as nanotechnology and molecular biology, especially in conjunction with plant genetics research. 'Smart' fertilizer products that will release nutrients only at the time and in the amount needed should be developed." (Dr. Norman Borlaug, 1970 Nobel Laureate). With the global uprising in population and rapid urbanization, agronomists are left with the critical duty of feeding more people from agricultural fields which are decreasing correspondingly. Investigations show that, the world population is expected to be 9.1 billion people by 2050. If food consumption in developed countries is coordinated by the other parts of the world and these people are to be fed adequately, total food consumption will have to rise by 50–70%. The plant use efficiency of the current bulk fertilizers is marred by high leaching of nutrients away from the rhizosphere, their fixation in the soil to forms that are not readily bio available to the plant, as well as other forms of losses such as volatilization. Nanotechnology offers a great opportunity to enhance the use efficiency of fertilizers. Slow release of fertilizers implies that both leaching and fixation of nutrients could be reduced, with such release permitting a better timing of nutrient availability and plant nutrient need. In the case of nutrient-deficient soils, because nanoparticles inherently release soluble ions faster than bulk particles, enhanced and sustained release of nutrients from nano materials will be important in supplying nutrients in a quick and timely manner, in contrast to slow release. Slow release of nutrient element negates the possibility of attainment of biotoxic levels of mineral nutrients and reduces loss due to leaching or fixation. At relevant concentrations, iron oxide (magnetite/hematite [Fe₃O₄/Fe₂O₃]) and Mn nano particles have shown beneficial effects on plants through the stimulation of chlorophyll production or the enhancement of the rate of photosynthesis. In addition to boosting chlorophyll formation, iron oxide nano particles also could reduce the severity of chlorosis in plants. Other nano particles synthesized from non-mineral nutrients have also demonstrated positive effects on plants.

PRECISION FARMING IN HORTICULTURE

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Precision farming (PF) is comprehensive information based farm management system to identify, analyze and manage the spatial and temporal variability within fields for optimum profitability, sustainability and protection of the resources. The application in horticultural crops was developed in the last ten years. Virtually no wastage of valuable resources of crop production. Higher efficiency of factors of production. Ability to achieve optimum produce of uniform and higher quality. Data are collected from different sources (yield and quality, soil properties, remote sensing), stored to GIS data bases, analysed using geostatistical methods to develop management zones and decision support systems are used to assist farmers to the management. Variable rate application systems were developed to apply inputs according to the real requirements of the plants in the management zones. Although variability is a well-established fact, farmers' adoption is rather slower than expected because the system is complicated and in many cases profitability is not well demonstrated. Additionally, environmental benefits cannot take direct monetary values for the farmer. PA has a wider application impact like precise movement and management of farm machinery, development of efficient mechanization and fleet management as well development of farm management information systems. basic concept of precision farming is the use of right input at right time in right amount, at right place and in right manner. Precision Farming is a direction of research rather than a destination. We have to shift our modern agriculture research in such a direction using the key elements of information, technology and management. Hence, it can be used to increase production efficiency, improve product quality, conserve energy and protect the resources.

Keywords: precision farming, geographic information system (GIS), spatial variability, temporal variability

AGRICULTURAL SUSTAINABILITY THROUGH INTEGRATION OF INDIGENOUS TRADITIONAL KNOWLEDGE OF FARMERS AND SCIENTIFIC KNOWLEDGE OF RESEARCHERS

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Nobel Peace Prize Laureate Amartya Sen has said “Development should be a process of expanding the real freedoms that people enjoy, in other words giving them the opportunities and choices that will enable them to take control of their own lives. So, it is not a case of talking about people on their behalf; rather, the role of development policy is to help them articulate and assert their own interests and rights”. Indigenous traditional knowledge (ITK) is considered as the social capital of the poor. It is their main asset to invest in the struggle for survival, to produce food, to provide for shelter and to achieve control of their own lives. ITK is the knowledge based on experience that people in a given community has developed over time and continues to develop it. It is often tested over long period of time, adapted to local culture and environment, dynamic and changing and lay emphasis on minimizing risks rather than maximizing profits. Traditional knowledge is vital for sustainability of natural resources including forests, water, and agro-ecosystems across landscape. The practitioners of traditional knowledge tend to view people, animal, plants, and other elements of the universe as interconnected by a network of social relations and obligations. They have recognized that the wellbeing of human society is closely related to the wellbeing of natural ecosystems. However, industrialized societies rely mainly on scientific knowledge. Community knowledge which includes scientific knowledge that is the basis of industrial development and traditional knowledge have separately contributed in their own way towards the process of development of mankind. Henceforth, a blend of both modern practices and indigenous knowledge will be imperative for environment friendly, need based, location-specific, technically sound, socially acceptable, economically viable and ecologically sustainable agricultural technologies. Thus, there is an immense need to plan and formulate strategies to integrate the indigenous traditional knowledge of farmers and the modern scientific knowledge of scientists from the research stations which will be effective in bringing out the aims of agricultural sustainability.

Keywords: Indigenous traditional knowledge, scientific knowledge, agricultural sustainability

IMPACT OF KVK IN THE TECHNOLOGICAL EMPOWERMENT OF WOMEN WITH RESPECT TO INCOME GENERATING ACTIVITIES

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KVK has the definite aim of improving family income through the employment generation of rural people and providing for flexibility of design at grass root level to suit the local needs and resources. Women represent almost half of the human resources of half the potential in all the societies, India being no exception, naturally, therefore the employment and autonomy of women and improvement of women's social achievement of sustainable development on all areas of life. Empowerment of women in the economic and social sphere constitutes one of the fundamental efforts in the country. So the present research based on survey was taken with the objective to find out the role of KVK in the technological empowerment of women with respect to income generating activities in the field of Home science. The present study was conducted in Deoria district of Uttar Pradesh state. Two blocks i.e. Salempur and Bhatpar Rani were selected for this study. From each block 03 villages i.e. Malhana, Jiraso, Laxmanchak from Salempur block and Pakdibabu Malhani, Dharamkhor karan from Bhatpar Rani Block were selected purposively for the study. Among each village 20 farm women were selected randomly. Hence total sample size was 120 women and further data were collected through personal interview method with the help of questionnaire developed for the purpose. The topic were the processing of cereal, pulse, vegetables, fruits and marketing of the products, tie and dye, Soft toys making, candle making, preparation of home decorative items, Agarwari making and its marketing. The study revealed that majority of the beneficiaries (88.66%) feel in the category of good knowledge whereas in the non beneficiaries it is only ten percent. Among beneficiaries maximum percentage of retention of knowledge has been observed in cereal processing, tie and dye (100%), followed by bakery, fruit and vegetable preservation (90%), pulse processing, preparation of home decorative items (80%) and in herbal colour preparation (60%). In control group knowledge of the woman was highest in cereal processing (50%) followed by fruit and vegetable processing (5%). In the other subject it was nil. The knowledge gained and retained by the woman was based on their awareness, interest, and felt need. Women education, technical training, adequate extension facilities can create a positive impact leading to a better tomorrow.

Keywords: Women, Empowerment, Education, Technical training, Extension facilities

ECO FRIENDLY ELECTROPLATING FOR SUSTAINABLE FUTURE

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Environmental Electroplating is an elaborate way of saying environmentally friendly. In the metal plating industry, responsible environmental electroplating is important for both safety and pollution prevention. An increasing world population with growing industrial demands has led to the situation where the protection of the environment has become a major issue and a crucial factor for the future development of industrial processes, which will have to meet the requirements of sustainable development. Electrochemistry offers promising approaches for the prevention of pollution problems in the process industry. The strategies include both the treatment of effluents and waste and the development of new processes or products with less harmful effects, often denoted as process-integrated environmental protection. The applications of electrochemistry for the protection of the environment involves electro analytical techniques for monitoring and trace level detection of pollutants in air, water and soil as well as of micro-organisms are needed for process automation and other environmentally sensitive technologies such as prevention through management of the discharge and development of technologies to minimize the discharge. The challenge to fulfil these requirements requires re-evaluating every aspect of the industrial process and trying to do it in a way that will sustain the profitability of the industry and its ability to support its workers. The present focus is on two approaches: green chemistry and environmental management systems. These environmentally friendly developments should eventually eliminate the majority of hazardous waste in the electroplating industry.

Keywords: environment, pollution, effluents, electrochemistry, sustainable



INTELLECTUAL PROPERTY RIGHTS (IPR), BENEFIT OF IPR AND ITS APPLICATION IN HORTICULTURAL CROPS.**Sunil K. Maurya, Sandeep K. Mauriya, Ragini maurya, Kulveer singh yadav**

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For a sustainable growth and economic development of a country, innovation and creativity is a very important dimension. Industries and the global markets of the 21st century rest on the intellectual property protection as it is one of the central public policy. From the economists view point, IPR protection represents a transaction between the profits of innovation and the costs of superiority. The term “intellectual property” acquired force after the setting up of the World Intellectual Property Organization (WIPO) in year 1967. Intellectual property was introduced so as to protect the labours of the mind, production and all a man's own. Set your business apart from competitors be sold or licensed, providing an important revenue stream offer customers something new and different from an essential part of your marketing or branding be used as security for loans. many aspects of your business can be protected its name and logo, designs, inventions, works of creative or intellectual effort or trade marks that distinguish your business can all be types of IP. IP are used in different way like trade marks get patent protection for your business, copyright for your business, protecting and handling your design. Plant breeders' rights (PBR), also known as plant variety rights (PVR), are rights granted to the breeder of a new variety of plant that give the breeder exclusive control over the propagating material (including seed, cuttings, divisions, tissue culture) and harvested material (cut flowers, fruit, foliage) of a new variety for a number of years. With these rights, the breeder can choose to become the exclusive marketer of the variety, or to license the variety to others. In order to qualify for these exclusive rights, a variety must be new, distinct, uniform and stable.

MOBILE PHONE APPLICATION FOR TRANSFER OF TECHNOLOGY IN INDIA***Ramjee Lal Meena¹, Dr. B. Jirli²,**Research Scholar¹, Professor², Department of Extension Education, Institute of Agricultural Sciences, BHU, Varanasi

Rapid growth of mobile telephony and the introduction of mobile-enabled information services provide ways to improve information dissemination to the knowledge intensive agriculture sector and also helps to overcome information asymmetry existing among the group of farmers. It also helps, at least partially, to bridge the gap between the availability and delivery of agricultural inputs and agriculture infrastructure. This paper explores further on this topic and provides evidence to show how mobile phones and mobile-enabled agricultural services have impacted the farmers. As mobile penetration continues to increase among farming communities and information services and to adapt and proliferate, the scope exists for a much greater rural productivity impact in the future. To leverage the full potential of information dissemination enabled by mobile telephony along with supporting infrastructure and capacity building amongst farmers it is essential to ensure the quality of information, its timeliness and trustworthiness.

Keywords: ICT for development, agriculture extension services, mobile phones based agri-services, farmers in India

BAKERY INDUSTRY: CURRENT STATUS AND FUTURE PROSPECT**Prince, B.R Singh, Kapil Kumar**

Department of Agriculture Engineering

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Food is a basic necessity of life. The primary concern of man, throughout the history of mankind, has been to look for alternate and better sources for food items. Among the different segments of human population, dispersed all over the world, food habits vary depending on climatic, cultural, social, and personal factors. Food is considered as the basic source of nutrition. Depending on their nutritional value, various food items provide the means for maintenance and sustenance of good health and energy necessary to carry out the activities of life. Bakery products such as bread, biscuit, etc. are the processed food items that are today considered as a major source of nutrition. Besides they are also inexpensive, convenient, and easily accessible ready-to-eat food items. Bakery industry is, therefore, a significant industry in any country. The Indian bakery industry is the largest among the processed food industries. The current estimated market is about Rs 3,295 crore and is expected to cross Rs 4,308 crore by 2012. The bread & biscuit industry accounts for 82% of the total bakery products in the country. At present, the annual production of bakery products which include bread, biscuits, pastries, cakes, buns and rusk, most of which are in the unorganised sector, is estimated to be in excess of 3 million tonnes. The production of bread and biscuits in the country both in the organised and unorganised sectors is estimated to be around 2.6 million tonnes. The bakery industry in India is taken to be a major instrument in State policy to provide nutrition to the large population and to counter the problems of malnutrition. The subject matter of the seminar is marketing in bakery industry in India and the focus is on its problems and prospects.

Keywords: - Indian bakery industry, Ready-to-eat food items, Nutritional value

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Keywords: - Indian bakery industry, Ready-to-eat food items, Nutritional value

ADVANCES IN FOOD AUTHENTICITY TEST

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Food authenticity is rapid growing field due to increasing public awareness concerning food quality. The process which can verify food is in a compliance with its level description, can be defined as food authentication¹. Recent food scares such as bovine spongiform encephalopathy and avian flu outbreaks, olive oil adulteration with hazelnut oil or the adulteration of milk with melamine have led to media and public attention regarding the origin of food and the more general concept of food authenticity². A variety of analytical techniques, for verification of food stuff origin have been developed and tested. Advanced tools like ELISA, Genomics, Proteomics, Metabolomics, NMR, IR, GC-MS, LC-MS etc. are being emerged as major authentication methodologies for discrimination of authentic food products from adulterated product³. A total of honey samples (polyfloral and acacia) from different countries have been analyzed in terms of ¹H-NMR spectroscopy coupled with multivariate statistical methods⁴. FT-IR spectroscopy is has been used as accurate and valid technique for the detection and quantification of the adulteration of goat or sheep milk with cow milk in both binary and tertiary mixtures⁵. A DNA based method coupled with High Resolution Melting (HRM) analysis has been reported to differentiate Basmati rice from non-Basmati rice varieties using microsatellite markers⁶. The future applications will cover more food commodity by using newer technologies such as NMR, isotopic methods, IR-MS and DNA-based technologies.

PRIVATIZATION OF EXTENSION IN AGRICULTURAL DEVELOPMENT

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India has been always progressive to attain its target of self-sufficiency in food grains. The increasing cost of providing services and unwillingness of government to fully support the line departments of various extension services, wide ratio between extension worker and farmer. The extension focus should be on quality, cost of crop production, value addition, market led extension and cyber application in agriculture. The process of changing role and additional responsibility, limitation of resource in public extension has created the gap. This created gap by public extension can be filled up by private extension. The objectives are to evolve technology according to the need and interest of farmers, to guide the farmer for adopting the farming according to the market need and to reduce the losses occurred during marketing. The role of private extension service providers in farm advisory services for profit maximization of clients, timely inputs supply for better production, providing market information and market intelligence and providing credit, insurance and infrastructure facilities for farmers. Private extension is very crucial for agricultural development in country for effective service delivery system and market management etc. Privatization of agricultural extension services can bring desirable changes in Indian agriculture, better services and trained manpower satisfying clientele need, has more face to face contact, increase farm management skills of farms which made them more self-reliant and opened up employment opportunities. Analysis of the whole perspective, it is clear that private service providers are deep rooting day by day through their multidimensional activities and contributing in agriculture development. Considering the significant presence of private service providers, the public private partnership may be the answer to the present and future agriculture.

Keywords: Privatization, public private partnership, cyber application, skills, market intelligence.

VOCATIONAL TRAINING NEEDS OF BUKSA YOUTH FOR LIVELIHOOD GENERATION IN AGRICULTURE AND ALLIED AREAS IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND

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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, organized in many forms and have access to facilities and institutions meant for youth services, tribal youth are mostly on neglected side. Agriculture and allied activities support the livelihoods of nearly 70 per cent of India's rural population. In recent years,



land based livelihoods of tribal farmers are increasingly becoming unsustainable. Tribal youth is entirely a different segment and a large cohort of them is currently entering the labour force to support their family. In Uttarakhand, majority of tribal population representing ethnic groups reside in rural areas. The present study was conducted in Udham Singh Nagar district of Uttarakhand covering 80 Buksa youth in village Buksoura through disproportionate stratified random sampling and data were analyzed statistically. Caste, innovativeness, achievement motivation, cosmopolitanism and mass media exposure had significant relationship with vocational training needs of Buksa youth in agriculture related areas. Maximum need in major agricultural vocations was found to be in fruit and vegetable production (2.425) followed by cattle farming (2.400), Mushroom Production (2.125), Sericulture (2.063), Poultry (1.988), Vermi-culture (1.925), Bee keeping (1.850), Floriculture (Protected Cultivation) (1.825), Fishery (1.813) and Rabbit farming (1.675). Agriculture is uniquely positioned to absorb them, although farming does not often to policy makers as a solution to the challenge of job creation. Most young people are born into farm families and for appealing tribal youth and delivering good job opportunities, agriculture must break through a number of constraints that impede growth and competitiveness.

KEYWORDS: Vocation, Training Need, Agriculture, Tribal Youth, Livelihood

HUMAN – THE ONLY THREAT TO HUMANITY

Chandrika Sharma

CoA, Ganj Basoda, J.N.K.V.V. Jabalpur

We don't have to fear any other animal in this world except the animal known as 'human being'. It's a bitter fact but the true one. Almost all men are killed, raped, crimed, treachered, humiliated and exploited by the fellow human beings. We human beings are our worst enemy. We compete against each other for resources, intellectual and to be the most superior among all. This has only resulted to huge problems of concern today like climate change, global warming, terrorism, extinction of species etc. Greed of carving future for assuring tomorrow's comfort is always embedded in children. They only have the sense of competition. This teaching is prevailing in more or less all parts of the world. Humanity, honesty, integrity is only meaningful for near and dears. These values are not ensured while dealing with the people of other society or community. One innocent person is beaten till death in today's time for political reason. Policies and ideologies are overruling humanity. Human is doing research work day and night to develop sophisticated war equipments. This enmity is killing human beings at very large scale. Pity, kindness, compassion are existing only on paper in the current century. We even abandon the ones who brings us to this world just for the sake of our little greeds. Goodness is decreasing thereby creating a man as a biggest enemy of a man. The problem is that we can't eliminate our enemy as the problem is with all of us. Mankind is divided into infinite ways into different nations,, religions, families, languages, cultures, casts, genders, economies, age etc. and they are constantly fighting against themselves and why not as the easiest and best policy to rule is to 'Divide and Rule'. Complexity has taken further steps when God is believed to be divided. Even the Christ warned humanity about the perils of dividing people, "Every kingdom divided against itself will be ruined, and every city or household divided against itself will not stand". Encroachment of thoughts has become the prime reason of enmity among men. We humans are the only nemesis to our own race. To preserve, to conserve this beautiful specie called human beings on this lovely planet, we need to move towards brotherhood, towards the feel of all as one. Human is not only the biggest foe of humanity but also the greatest ally. Just we need is to unite our thoughts and feel. After all, united we stand, divided we all.

ROLE OF MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT IN RURAL DEVELOPMENT

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Mahatma Gandhi National Rural Employment Guarantee Act, 2005, (MGNREGA) was enacted on 7th September 2005 as “ An Act to provide for the enhancement of livelihood security of the households in rural areas of the country by providing at least one hundred days of Guaranteed wage employment in every financial year to every household”. The Act covered 200 districts in its first phase, implemented on February 2, 2006, and was extended to 130 additional districts in 2007-2008. All the remaining rural areas have been notified with effect from April 1, 2008. The objectives of MGNREGA are to Providing wage employment opportunities, creating sustainable rural livelihoods through regeneration of the natural resource base i.e. augmenting productivity & supporting creation of durable assets and strengthening rural governance through decentralisation and processes of transparency and accountability. Salient features of the act is right based framework, time bound guarantee, labour intensive works, decentralized planning, work site facilities, women empowerment, transparency & accountability. The National Rural Employment Guarantee Act (NREGA) aims at enhancing the livelihood security of the people in rural areas by guaranteeing hundred days of wage employment in a financial year, to a rural household whose members volunteer to do unskilled manual work. Funding in this programme Central Government -100% of wages for unskilled manual work, 75% of material cost of the schemes including payment of wages to skilled and semi skilled workers. State Government- 25% of material including payment of wages to skilled and semi skilled workers cost. 100% of unemployment allowance by state government. Therefore, fulfilling the radical rights-based vision of MGNREGA requires delineating a clear strategic framework drawn from the stated goals of the Act and drawing up a detailed time-bound plan of action for its implementation. Such a plan requires innovative thinking as there is no precedence to many of the right- based instruments intrinsic to its design. The strategic framework has to have components that strengthen the existing delivery systems as well as to evolve new structures and re-engineer process.

HOW INTELLECTUAL PROPERTY RIGHTS IGNITES THE ZEAL OF A MAN TO RECOGNIZE HIS POTENTIAL FOR CREATIVITY AND SAVE IT

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A God gifted wonderful thing called brain to man and mother nature endowed him with the abundant physical and biological resources on earth. Imagination and creativity are gifted by God to man. With this he produces various articles or products for his needs. The owner's rights over these properties are accepted and are known as IPR (Intellectual Property Rights). These IPR laws provide a protection to the owners under different categories and names like Patents, Industrial designs, Copyrights, Trade marks and Trade secrets etc. These IPR rights essentially recognized and accepted all over the world, as they provide incentive to individuals for new creations. IPR also ensures material rewards for property. It also provides availability of genuine and original products. IPR classified as IPR items, Copyright and real rights items. A common man comes across Intellectual properties from Dawn to Dusk. Goods having a wide spectrum and associated with food shelter and clothes, the things of necessity, comfort and luxury. A common man's life is very closely linked with articles and products which are protected by law under intellectual rights. The copyright, imitation, adaptation and unauthorized reproduction of these things without the permission of the owner, may account to a serious offence. Therefore the knowledge about IPR must be known by the different standard of quality. IPR performs functions as Protection for Crop Varieties and genuineness for the future security. IPR addresses a specific need that applies broadly across the globe, in both developed and developing countries. It also provide breeders (both public and private sectors) with an opportunity to receive a reasonable return on past investments, also helps in providing an incentive for continued or increased investment in future breeding research.

Keywords: IPR, Genuineness, Quality, Security, Knowledge

A STUDY ON AWARENESS OF RURAL DEVELOPMENT PROGRAMME AMONG THE RURAL PEOPLE OF MEERUT DISTRICT.

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The present investigation entitled "A study on awareness of rural development programmes among the rural people of Meerut". Under the investigation 80 respondents were considered for the purpose. In the study it was found that maximum of respondents i.e. 55.00% belong up to 45 years age group, while 23.75% of respondents belong to 46-55 years age group, 21.25% of respondents belong to old above 55 years age group. Majority 27.50% respondents were found illiterate followed by 28.75% respondents were found literate. About 70.00% of the respondents belong to other backward class with rural family background. 62.50% respondents are marginal farmers and 7.50 % is belongs to landless. Further respondents 76.25 % respondents have no social participation. About rural development programmes followed by 2.73% had knowledge about while MGNREGA, 2.66% respondents had knowledge regarding Mid-day Meal. Maximum of respondent's i.e. 2.21% had knowledge about Indira Awas Yojana followed by 1.33% respondents have information about National health Mission followed by 2.8 % respondents are aware regarding Pradhan Mantri Jan Dhan Yojana. In context of attitude of rural development programmes 2.87 % respondents have favorable followed by 2.25 % respondent's thinks rural development programmes is income generating programmes. The constraints faced by respondents are i.e. political interference, 91.25 %, poor understanding 91.22%, lack of knowledge about the different programmes 81.25% respectively.

ASSESSMENT OF ANTIOXIDANT FACTORS IN ELEPHANT FOOT YAM (*AMORPHOPHALLUS PAEONIIFOLIUS* DENNSTONICOLSON) CULTIVARS DURING STORAGE

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Elephant foot yam, *Amorphophallus paeoniifolius* is an edible aroid cultivated in the tropical countries. Corm or tuber is the storage organ and is used as seed material or as a vegetable after cooking. Owing to the indisputable palatability, cooking quality, medical utility and therapeutic values of its tubers, this has been dubbed as "King of tubers". In this research, the various traits of eleven cultivars of elephant foot yam: BCA-1, BCA-2, BCA-4, BCA-5, BCA-6, NDA-4, NDA-5, NDA-9, IGAM-1, AC-28 and Gajendra were studied and observed during the storage stage. The cultivar BCA-1 and BCA-5 contained maximum amount of β -carotene and Carbohydrate at 0 and 90 days after storage, while the cultivar NDA-9 and BCA-1 stored the maximum amount of starch and ascorbic acid at 0 DAS. However the cv., NDA-4 and BCA-6 showed the maximum content of starch and Ascorbic acid at 90 DAS respectively. The protein amount was maximum in cv. AC-28 and IGAM-1 at 0 and 90 DAS respectively, and similarly NDA-5 and BCA-5 content maximum amount of total phenol at 0 and 90 DAS. This information will provide breeders with the ability to develop desirable types of elephant foot yams having high yields and better nutritional profiles. The purpose of study is based on physiochemical traits of elephant foot yam cultivars during storage by which to aware the peoples not only the quantitative value as well as their qualitative aspects to uplift the nutritional and socioeconomic status of vulnerable commodities of India as well as Asia.

RESHAPING AGRICULTURAL INNOVATION SYSTEMS FOR ENSURING FOOD SECURITY

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The traditional image of agriculture has more conservative than innovative. This needs to be changed. Agriculture and innovation go hand in hand. In recent times global food crises have exposed the structural vulnerability of globalized agri-food systems, highlighting climate change as just one of a complex set of environmental, demographic, social and economic drivers generating instability and food insecurity, the impacts of which disproportionately affecting marginal and small farmers'. At the heart of the food security challenge are poor farmers. Rather than search for single causes, there is a need to understand these changes at a systemic level and this could be done to bring changes in agricultural extension approaches and advisory services. Improved understanding of and engagement with the adaptive strategies and innovations of communities living in conditions of rapid change provides an appropriate starting point for those seeking to shape agricultural innovation systems responsive to food insecurity and climate change. To ensure that small farmers benefit from innovation processes, stakeholder platforms help them get organized and gain access to services they need from public and private providers to exploit new business opportunities and increase their incomes. With improving quality production and generating climate resilient cropping system in rural areas can bring livelihood security to the farmers that will definitely change the face of Indian agriculture. Sustainable agricultural development is very important for the food security. Extension can move beyond its traditional technology transfer role to work as active nodal agency, providing technological and non-technological services to farmers. Farmers need information to make necessary decision to improve their production in agriculture for which a strong network of extension systems is functioning, along with government initiative, extension scientists and functionaries working for agricultural development.

Keywords: Agricultural Innovation systems, food security, climate change, extension services.



EFFECTS OF DIFFERENT LEVELS OF CALCIUM AND PHOSPHOURS ON PERFORMANCE AND BLOOD PARAMETERS IN COMMERCIAL BROILERS

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The experiment will be conducted on seventy two healthy day old chicks of same hatch Procured and randomly divided into three treatments and one control group. They will be further divided into six sub groups with three chicks in each to serve as replicate. Chicks will be accommodated in cages with required floor space. All the birds will be reared under similar managerial conditions. Broiler starter and finisher ration as per BIS standard will be prepared. Chicks will be starter ration up to three weeks and then finisher ration up to six week of age. Ration and clean water will be offered *ad lib*. A bulb of 25 watt will be left on in each cage during night to maintain optimum temperature. T₁ (control feed without supplementation), T₂ control feed + 0.50% dry powder of calcium, T₃ (control feed + 0.50% dry powder of phosphorus), T₄ (control feed + 0.50% dry calcium + 0.50% dry phosphorus). The data on body weight of DOC, weekly body weight, feed consumption and gain in body weight will be recorded. At the end of experiment nine birds from each group will be randomly selected, slaughtered and blood samples will be collected with the help of anticoagulant for determination of blood parameters as follows. In whole blood Calcium level, blood Phosphorus level Statistical analysis. The data obtained on various parameters will be, collected tabulated and statistically analyzed by analysis of variance (ANOVA) technique as per Snedecar & Cochran (1994).

FALSE SMUT DISEASE OF RICE AN EMERGING THREAT IN INDIA

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Rice (*Oryza sativa* L., Family : Poaceae) is the world's most important crop, staple food for more than half of the world's population and its production has direct effect on food security. Among the fungal diseases rice false smut caused by *Ustilaginoidea virens* (Cooke) (Takahashi) gained a high attention as high disease incidence in the fields and reduction of yield due to disease and the status of disease become minor to major. Now a day the climatic conditions in major rice growing states changes and became favourable i.e. >90% relative humidity, frequent rainfall and increasing in temperature. As these epidemiological factors provide higher disease incidence which cause reduction in yield. The management strategy for rice false smut also a challenging aspect three major strategies for disease management – genetic resistance, chemical control, and cultural control – only the latter two have produced limited measures of success regarding the management of false smut because in resistance of any germplasm only the F1 shows resistance but F2 and F3 progeny shows susceptibility for disease. some fungicides like copper hydroxide 77 WP @ 2 g, carbendazim 12% + mancozeb 63% @ 1.5 g, trifloxistrobin 25% + tebuconazole 50% @ 0.4 g, tebuconazole 250 EC @ 1 ml and carbendazim 50 WP @ 1 g l-1 of water are recommended for foliar application at booting, pre- and post-flowering stages of rice suggested. Cultural control options may provide the most immediate and cost-effective remedy for false smut.

Keywords: Epidemiology, Disease incidence, F1, Germplasm etc

RECENT ADVANCE IN PEST MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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Pest management is an important component of agriculture production system and helps in improving income and life style of farmers by reducing the loss in yield. Since a long time the insect pest were being controlled with application of broad spectrum insecticide in a very judicious way which leads to the problems of resistance, resurgence, hazard to humans, non-target animals and environment. This above problems including decreasing soil productivity and many more for which we need to change from a conventional agricultural system to one that is sustainable. Sustainable agriculture tries to establish a good balance between the need for food production and the preservation of the ecological system within the environment. It is a system of agriculture that is ecologically, economically, and socially viable, in the short as well as long term. Now a day, many approaches are being developed for managing pest, that are based on understanding the pest biology and ecology, hence promote ecological balance, therefore, are sustainable. This include biotechnological approaches such as RNA interference and development of transgenic plant based on protease inhibitors, lectin, enzyme, etc., biorational approaches such as use of semiochemical, insect growth regulators, chitin synthesis inhibitors. Biological approach including predators, parasitoids and pathogens is a core component in sustainable agriculture. A number of plants are known to possess insecticidal property and are used for management of pest. All of these new advancements in pest management will fuel the futuristic approach where the application of chemical insecticide will no longer be needed. Thus the integration of all these approaches with each other will lead to ecofriendly management pest and make the agricultural system sustainable.



BIOPOTENCY OF *PSEUDOMONAS FLOURESCENS* FOR THE MANAGEMENT OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* ON *VIGNA RADIATA* L.**Amir Khan, Moh. Tariq, Mohd Asif and Mansoor A. Siddiqui**

Section of Plant Pathology and Plant Nematology, Department of Botany, Aligarh Muslim University, Aligarh, India (202002).

Root-knot nematode, *Meloidogyne incognita* is among the most important pest of vegetables, pulses and other commercial crops worldwide. The present investigation was carried out to evaluate the efficacy of biocontrol agent, *Pseudomonas fluorescens* for the management of root-knot nematode, *M. incognita* infecting mung bean under glasshouse condition. Results showed that highest enhancement in plant growth parameters viz., plant length (cm), fresh weight (g), dry weight (g), number of flower and pods, pollen fertility (%), chlorophyll content (mg/g), carotenoid content (mg/g), nitrate reductase activity ($\mu\text{m g}^{-1}\text{h}^{-1}$) and highest reduction in pathological parameters viz., number of galls, number of egg masses and number of eggs was found when *P. fluorescens* was applied alone. Least was recorded in those plants inoculated alone with 1500 second stage juveniles of *M. incognita*. Concomitant and sequential treatment of *P. fluorescens* with *M. incognita* also improved growth and growth yielding attributes of mung bean. Hence, it may be concluded that biocontrol agent *P. fluorescens* is better substitute against nematicide for the effective management of root-knot nematode, *M. incognita* and reduce environmental hazards for ecologically safe environment.

Keywords: Biocontrol agent, Growth parameters, *Meloidogyne incognita*, *Pseudomonas fluorescens*.**MANGROVE DIVERSITY AND ITS ASSOCIATED SPECIES IN COASTAL HABITATS OF GULF OF KHAMBHAT, GUJARAT, WEST COAST OF INDIA****Jitendra Kumar Singh and Bhawana Pathak**

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Mangroves are among the world's most threatened, dynamic and extraordinary ecosystems on earth, located at the interface of land and sea in tropical intertidal regions, which offer a considerable array of ecosystem goods and services. They are highly sensitive to environmental change and act as good bio-indicators of the environmental quality and health of any coastal ecosystem. The present ecological study was initiated to know the current status of mangrove species and associated plant species at Gulf of Khambhat region of Gujarat, India study was carried out for a period of one year from January 2014 to December 2014 at four different site (i.e. Bhavnagar, Bharuch, Surat and Navsari) with reference to its management and conservation. 16 species (6 mangrove species and 10 associated plant species) was recorded. 15 species occurred at Navsari, whereas 7, 6 and 10 species occurred at Bhavnagar, Bharuch and Surat respectively. Out of six true mangrove species, *Avicennia marina* was found to be most dominant and abundant mangroves occurring among all the four study locations. The most abundant and dominant flora species associated with mangroves were *Suaeda maritime* and *Sesuvium portulacastrum*. Most of the mangrove species are very rare at state level. Therefore, Gujarat mangrove forest habitats need to be protected and managed for mangrove conservation.

Keywords: Coastal ecosystem, mangroves, species diversity, mangrove conservation**CINNAMIC ACID PREVENTS DIABETIC PATHOPHYSIOLOGICAL COMPLICATION AND INHIBITS NON-ENZYMATIC GLYCATION BY BINDING TO SUBDOMAIN IIA OF HSA: A MECHANISTIC APPROACH****Faizan Abul Qais¹, Md Maroof Alam², Imrana Naseem², Iqbal Ahmad¹**¹ Department of Agricultural Microbiology, Aligarh Muslim University, Aligarh, UP, India² Department of Biochemistry, Faculty of Life Sciences, Aligarh Muslim University, Aligarh, UP, India

Under hyperglycaemic conditions non-enzymatic glycation of proteins gives rise to advanced glycation end products (AGEs). The AGEs thus formed generate free radicals, which foster the development of diabetes and its associated complications. Inhibition of glycation is expected to play a role in controlling diabetes. Several plant derived antioxidants including cinnamic acid (CA) are known for limiting AGE formation, however, the mechanism involved is poorly understood. Therefore, we aimed to investigate the possible mechanism of inhibition of AGEs formation by CA through various experimental approaches. Glycation of HSA was achieved by incubating the reaction mixture with glucose for 30 days at 37°C. The protein samples were tested for levels of free lysine & thiol group, carbonyl content and reactive oxygen species (ROS). Interaction between CA and HSA was also studied through various biophysical techniques. Thermodynamic studies showed strong exothermic interaction between CA and HSA. The positive value of $T\Delta S^\circ$ and negative value of ΔH° indicates that HSA-CA complex is mainly stabilized by hydrophobic interaction and hydrogen bond. Further, molecular docking reveals that CA binds to HSA subdomain IIA (Sudlow's site I) with a binding energy of $-7.0 \text{ kcal mol}^{-1}$, nearly the same as obtained in isothermal titration calorimetry (ITC) and fluorescence spectroscopy. Results of various spectroscopic techniques along with molecular docking and examination of many biomarkers highlights the role of CA in preventing disease progressi



HARVESTING OF RAIN WATER AS *IN AND EX SITU*: A SOURCE FOR SUPPLEMENTAL IRRIGATION**Vishal Kumar, Dharminder, Deshraj Yadaw and R. K. Singh**

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As soon as rain drops comes in contact of soil surface some portion of rainfall, get infiltrated into the soil and excess water gets lost from field as run-off, which ultimately become the part of reservoirs and ditches etc and a portion of infiltrated water eventually reached to surface water sources (inter water) like reservoir. The loss of water takes place in several ways namely run-off, evaporation, uptake through weeds etc. In Indian good crop harvest is dependent on monsoon, uneven distribution of rainfall leads to reduction in economical yield and in adverse condition complete crop failure is also observe. India receives average rainfall of 1194 mm per year which account 400 mha-m water and out of this 150 mha-m water is lost as flow in ocean. We can harvest this water through various agronomical measures like agronomical (mulching, tillage practices, contour farming, strip farming etc.) and agrostological practices (dealing with grasses). Run-off water can be preserved either *in situ* (like ridge & furrow method and broad bed furrow method show better rain water storage and provide sufficient soil moisture in crops duration) and *ex situ* (rain water stored in reservoir or ditches) based on situation and utilized for irrigation during uneven rainfall and long dry spells. This water could be stored for providing life saving or protective irrigation to the crops grown in dry land areas.

Keywords: Run-off, reservoirs, infiltrations, ground water, agronomic measures, rain water storage**BIOREMEDIATION OF PESTICIDES USING MICROBES IN TWO PHASE PARTITIONING BIOREACTOR****Raman Kumar Ravi and M. H. Fulekar**

Central University of Gujarat, Gandhinagar

Since the period after the Second World War, pesticides has become vital component of modern agriculture and are widely used for the control of weeds, diseases and pests of cultivated plants all over the world. But their indiscriminate use and persistent nature has posed serious problem to the biological diversity. According to World Health Organisation data, only 2-3% of the pesticides applied for mitigation of pests are effectively utilized at target point whereas rest remains in environment causing surface runoff, leaching and percolation into soil water environment leading to biota and finally human being through food chain. Pesticides toxicity depends on various factors such as the route of exposure, concentration of pesticides and time of exposure. Bioremediation is found to be an eco-friendly, cost-effective, highly efficient technology for treatment of pesticides polluted soil using microbial culture as compared to the physical and chemical methods. Biodegradation is sensitive to different parameters such as concentration of pesticides, microbial biomass, temperature and pH changes. Nowadays bioreactors are commonly used for bioremediation, which may be any vessels in which microbes or microbes free enzymes transform raw materials into biochemical products and or less undesirable by-products. Biodegradation in Two Phase Partitioning Bioreactor facilitates degradation of high level of pesticides concentration using microbial culture. The Two Phase Partitioning Bioreactor works in aerobic condition with stirrer for agitation of biomass and ensuring continuous contact of microorganism in aqueous phase with pesticides contaminant in organic phase. The present paper is a concept of utilising the bioreactor for effective bioremediation of pesticides at lab scale using bacterial strain, which can be further utilised in field through bioaugmentation.

Keywords: Bioremediation, Pesticides, Two Phase Partitioning Bioreactor, Microbial culture**EFFECT OF VARIETIES TO VARYING LEVELS OF SULPHUR FERTILIZATION ON GROWTH, YIELD ATTRIBUTE AND YIELD****Lali Jat¹, S. S. Yadav², M. L. Jat³, B. C. Dhayal⁴ and, Sanju Choudhary⁵**

Department of Agronomy, S. K. N. College of Agriculture, Jobner, Raj

A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2015 on loamy sand soil. The experiment comprising of four levels of sulphur (0, 20, 40 and 60 kg/ha) and four sesame varieties (RT-125, RT-127, RT-346 and RT-351) thereby making 16 treatment combinations was laid out in randomized block design and replicated thrice. Results showed that progressive increase in level of sulphur upto 40 kg/ha significantly increased the growth and yield attributing characters of sesame viz., dry matter accumulation, branches/plant, number of capsules/plant, number of seeds /capsule and test weight over preceding levels. It also recorded significantly higher seed (778 kg/ha), stalk (2505 kg/ha) and biological yield (3283 kg/ha) of sesame over control and 20 kg/ha. However, it was found at par with 60 kg/ha, wherein the maximum values of growth and yield attributes as well as yield were obtained. Variety RT-351 was found significantly superior among all the varieties with respect to growth and yield determining characters of sesame. It also improved the seed, stalk and biological yield to the extent of 11.7, 10.5 and 10.8 per cent over RT-127 and 26.4, 21.3 and 22.5 per cent over RT-125, respectively. It also represented significant improvement in nutrient uptake, oil content in seed and oil yield and fetched the maximum net returns of ` 52073/ha with the highest B: C ratio (2.74) among all the varieties.



INFLUENCE OF DIFFERENT HARVESTING TIMES ON POST-HARVEST QUALITY OF GARLIC DURING STORAGE

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The pre-harvest inputs influence the storage behaviour and quality of garlic directly or indirectly. The garlic crop is less perishable and also has better storage life than other vegetables but various cultural practices like choice of variety, soil type, irrigation frequency, fertilizer application, harvesting stage, etc. affects the shelf life of garlic. As early or delay in harvesting could increase post-harvest losses and deteriorates the quality during storage, therefore the investigation was done at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *rabi* 2013-14 to observe the influence of different time of harvesting on quality of garlic during storage (*Allium sativum* L.). The experiment was laid out in Randomized Block Design with four replications. Five treatments of harvesting time viz., harvesting the garlic crop 150, 157, 164, 171 and 178 days after planting were applied. The total soluble solids(%) were recorded at monthly interval during 240 days of storage. The total soluble solids at the end of storage period i.e. 240 days were found better (40.11 %) with treatment where harvesting was done 171 days after planting, which was found statistically at par with treatment where harvesting was done 164 days after planting (39.78 %). The minimum total soluble solids (35.13 %) at 240 days of storage were recorded with treatment where harvesting was done at 150 days after planting. Therefore, based on the present investigation, it may be conclude that for better quality of garlic, harvesting should done 164 days after planting.

Keywords: Garlic, bulb, harvesting time, quality, total soluble solids

GOLD COATED NANOPOROUS MEMBRANE BASED SOLID PLATFORM FOR RAPID DETECTION OF MESOTHELIN AS A POTENTIAL CANCER BIOMARKER

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Biocompatible functional solid state nanopores (SSN) have emerged as an excellent biorecognition element for electrochemical sensing of biomolecules in recent years. In this study a gold coated nanoporous (30, 50, 80, 100 nm) polycarbonate track etched (PCTE) membrane based electrochemical biosensor was developed for label free detection of a mesothelin; a tumor biomarker. To select the best nanopore, varying pore size membranes having immobilized anti-mesothelin were exposed to mesothelin antigen and resistance was compared. The antigen-antibody interaction was monitored with the aid of specially designed electrochemical cell with electronic circuit. A partial blockade in ionic trafficking across the nanoporous membrane observed upon binding of antigen-antibody on to the coated nanopore. The reduction in pore diameter was observed as a function of resistance with respect to time across nanopore matrix. Cancer biomarker mesothelin was successfully assayed up to nano-gram level in phosphate-buffered saline (PBS) and cross selectivity was adjudged by prostate specific antigen. The developed biosensor shows astounding ability to sense the biomarker with better resolution with pore size of 30 nm than 50, 80 and 100 nm. The reproducibility showed that the device is capable to detect up to nano scale (1 ng/ml) with a significant detection range of 20 µg/ml to 1 ng/ml.

RESPONSE OF AONLA CULTIVARS TO SOFTWOOD GRAFTING

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The present investigation consists of evaluation of softwood grafts for success, initial growth and survival of nine different aonla varieties viz. Banarasi, Chakaiya, NA-4 (Kanchan), NA-5 (Krishna), NA-6, NA-7, NA-10, Anand-1 and Anand-2 at nursery stage as treatments and replicated thrice in Completely Randomized Design (CRD) under shade net house conditions. The results of the present investigation showed minimum (10.37) days for sprouting of grafts and maximum graft success (91.10) per cent was recorded in grafts of variety NA-7. The maximum values of growth parameters like height of sprout (15.50 cm), number of leaves per graft (21.86) and graft diameter (5.43 mm) were also observed in grafts of variety NA-7. The significantly maximum leaf area per leaf and leaf area per graft was recorded in grafts of variety NA-4 (Kanchan). The favorable stionic ratio (close to one) was noticed in grafts of variety NA-7, Banarasi and Chakaiya. The maximum survival percentage was recorded in grafts of varieties NA-7 and Banarasi. Hence, it can be concluded that, considering the overall performance of grafts of different aonla varieties studied, the grafts of varieties NA-7 and Banarasi have performed better for most of the traits under this study.

Keywords: Aonla, Softwood Grafting, Variety, Root Stock, Scion-Stick



CLIMATE CHANGE IMPACT ON RIVERINE SYSTEMS OF INDIA**Mahendra Pal¹, H. K. Kardani¹, V. Sarman¹, Krishna¹, N. Harika¹**

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Rivers provide a special suite of goods and services valued highly by the public. The diverse river system in India harbour one of the richest fish genetic resources in the world. Rivers exhibit a complex mix of artisanal, subsistence and traditional fisheries. Climate change will add the presenting risk and also magnify it so it will alter the rainfall season, the runoff pattern, temperature. It also disturbs the biological communities and ecological linkages. The impact is manifested in the breeding failure, geographic shift of fishes, altered species richness, habitat loss/gain and increased invasion of exotic species. Lowflows in rivers would be more severe along with ageneral water stress. Increase in water temperature, extreme events like flood and drought, storms and water stress are important climate variables to riverine fisheries. They require specific adaptation actions. The establishment and management of a natural riparian zone and vegetation is a strategy to reduce climate change effect on rivers.

Keywords: climate change, fisheries, rainfall, river, snow, species, temperature.**GROWING MORE RICE WITH LESS WATER****Deo Narayan Singh^{1*}, Subodh Kumar² and Deepak Kumar Jaiswal³**¹Assistant professor, Department of Agronomy, UP College, Varanasi.²Assistant professor cum junior scientist, Department of Agronomy, BKSCOA, Dumrao Buxar, BAU, Sabour, Bihar.³Research scholar, Department of Entomology and Agricultural Zoology, I. Ag. Sc., Banaras Hindu University, Varanasi.

Rice (*Oryza sativa*) is the staple food of more than half of the population of the world, is an important target to provide food security and livelihoods for millions. 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. Considering the food basket of India, rice cannot be replaced by other arable crops. To withstand the scarcity of water, growing of rice as direct seeded rice (DSR) is one of the best options for the areas where rainfall occurrence do not support the growing of conventional rice. DSR refers to the process of establishing the crop from seeds sown in the field rather than by transplanting seedlings from the nursery. Direct seeding avoids three basic operations, namely, puddling (a process where soil is compacted to reduce water seepage), transplanting and maintaining standing water; thus saves water, labour and time.

EFFECT OF PRUNING AND PLANT SPACING ON THE YIELD ATTRIBUTES AND QUALITY IMPROVEMENT IN HIGH DENSITY PLANTING OF GUAVA (*PSIDIUM GUJAVA* L.)**Anjali Tripathi, S. K. Sehrawat, D. S. Dahiya and Anuradha Bishnoi**

Department of Horticulture, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, India.

The present investigation was conducted during the year 2016-2017, to examine the effect of pruning and plant spacing on the yield attributes and quality improvement in high density planting of guava cv Hisar Safeda. Pruning was done in the month of mid April at two levels 50 percent of last season growth and non-pruned with different plant densities. The observations clearly revealed that fruit set percentage per plant, yield per plant and quality were increased with pruning treatments in comparison with non pruned one in both rainy and winter season crop. Pruning is the most important practices of guava that helps in encouraging the new growth, more flowering and fruiting in current season crop. Maximum number of fruits per plant, yield per plant and quality characteristics like fruit TSS and firmness were obtained with wider spacing and pruning treatments of the plants. The winter season crop found superior than rainy season in terms of yield and quality characteristics. Shoot pruning at 50% last season growth in the month of April reduced the flowers per plant and yield per plant in rainy season crop but increased the flowers per plant and yield per plant in winter season crop than un pruned plants. Rainy season fruits were found more insect infected, watery, poor in quality and have less shelf life.

Keywords: Guava, Pruning, Plant densities, Yield, Quality**LIFE CYCLE AND SEASONAL ABUNDANCE OF YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* (WALKER) IN RICE (*ORYZA SATIVA* L.)****Ingle Dipak Shyamrao, M. Raghuraman and Santeshwari**

Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi

The yellow stem borer, *Scirpophaga incertulas* (Walk) is widely distributed in rice growing areas in all tropical and sub-tropical regions. It has been considered a major and monophagous pest of the rice growing areas. Its feeding start from seedling to reproductive stage and reduces tillers of rice crops. Feeding rates of first and second instars consumed 20 per cent of the larval total consumption. Caterpillar bore into stem and feed inside, as a result, central shoot withers and produce a dead heart at vegetative stage and older instar larvae produces white ear at reproductive stage. To understand about life cycle and



management practices of YSB is to help to reduce the yield losses. In present study was discusses about life cycle and seasonal abundance and occurrence of yellow stem borer.

Keywords: Life cycle, rice, *Scirpophaga incertulas* (Walk.), seasonal abundance.

ROLE OF FUNGAL COMMUNITY IN THE FORMATION OF COMPOST WITH LOW COST INPUT

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The hazardous effects of chemical fertilizers are rapidly increasing day by day and benefit-cost ratio of cultivation is also getting lesser by these. So it is a requirement to have renewable and ecofriendly nutrient sources for plants. Composting can be a best solution for it. It is an age old practice for biological conversion of organic waste to humus, compost is also found naturally but the rate of formation i.e., decomposition is slow (approx. 1 year). Considerable research has therefore been done to accelerate the composting process. Scientists of Indian Agriculture research institute, have isolated efficient fungal cultures, prepared a consortium and being used as compost inoculant, which enhanced the rate of decomposition. Selection of these fungi was on the basis of their cellulolytic/ xylanolytic/ lignolytic enzyme production potential and compatibility testing. The fungal consortium contains *Trichoderma viridi*, *Aspergillus awemori*, *Aspergillus nidulans*, and *Phanerochaete chrysosporium* as four promising lignocellulolytic fungi. The production of compost from agricultural residues (like Paddy straw, dried leaves etc.) and agro-industrial wastes is an important means of recovering organic matter and is also an effective method of waste management. Improving soil fertility by compost application is gaining more importance due to emphasis on sustainable agriculture. By this way “Best of waste” is being created and it should be extended to all farmers’ community for their awareness. The studies related to these approaches, for the sustainable management of natural resources can make future disease free, natural disasters free and all the hazardous effects of conventional farming can also be reduced.

Key words: Sustainable, Fungus, Agro-residue, Natural resources.

DOUBLE HAPLOIDS AND IT'S APPLICATION IN CROP IMPROVEMENT

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A plant or line obtained by doubling the chromosome number of a haploid plant is called double haploid. Doubled haploid methodologies have now been applied to over 250 species. Double haploid (DH) breeding helps in accelerating conventional plant breeding programmes and make early release of cultivars with superior and desirable traits. DHs are important constituent of germplasm and help in complementing back cross breeding by transferring genes of interest between wild relatives thus breaking genetic barriers. On the other hand unique complete homozygous nature of DHs, less time requirement to produce a large number of DHs, absence of heterozygosity and efficiency over conventional systems in DHs make them very valuable material for very important genetic and molecular studies. DHs play a very important role in the field of plant breeding, genetics and genetic engineering. The utility of DHs in cultivar development, back crossing, genome mapping, hybrid sorting, mutation research, evolutionary studies, gene identification, cytoplasmic research and transgenic plant development make them the best material for genetic improvement and genetic studies.

Keywords: Double haploid, Homozygous, cultivar development

STAY GREEN: AN INDICATOR TRAIT FOR HEAT TOLERANCE IN WHEAT (*TRITICUM AESTIVUM* L.)

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Wheat is the most widely grown crop worldwide. In this era of climate change wheat production is threaten by many abiotic and biotic stresses, heat and drought stress being the most devastating abiotic stress. Early maturing and stay green are two such traits which are dependent on the crop growth duration. An early maturing variety escapes the terminal heat stress but, the studies have shown that long duration variety yield more than early maturing one. Hence the varieties which can stay green even at heat and drought stress condition by altering its physiology and morphology needs to be exploited for development of stress tolerant varieties. These types of selection and exploitation are still awaited in wheat cultivars. Stay green is classified into two classes , functional stay green : in which leaves photosynthesize longer contributing to higher yield and non-functional stay green : in which plants remain green but lack photosynthetic competence. The stay-green trait is the result of alterations in hormone metabolism and signalling, particularly affecting pathways involving cytokinins and ethylene. Members of the WRKY and NAC families, and other senescence-associated transcription factors result in stay-green. Along with yield, association of stay-green trait with other traits like Canopy Temperature Depression, spot blotch resistance etc. have also been reported. Stay green trait can be measured by various methods like Leaf Area under Decline (LAUD), Normalized difference vegetative index (NDVI)/ Spectral reflectance measurement, leaf area under greenness (LAUG). etc. QTLs for stay green on the chromosomes 1AS, 3BS and 7DS have been reported. The QTLs were named as QSg.bhu-1A, QSg.bhu-3B and QSg.bhu-7D. The QTL QSg.bhu-3B and



QSG.bhu-7D were placed in the 3BS9-0.57-0.78 and 7DS5-0.36-0.61 deletion bins, respectively. All the above studies show that stay green trait can be exploited to develop heat tolerant wheat cultivars in the near future.

Keywords: Stay Green, Heat Stress, QTL, *Triticum aestivum*

CROP INSURANCE SCHEMES: THEN AND NOW

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India is an agrarian country where 58 per cent of the population is engaged in agriculture and allied activities for their livelihood. In our country, agriculture production and farm incomes are frequently affected by natural disasters like flood, drought and earthquake etc. The crop insurance could, therefore, be considered as hedge to protect farm economy from the adverse effect of crop failure. The idea of crop insurance in India was conceptualized in 1920s when J. S. Chakravarti proposed an agricultural insurance scheme based on rainfall approach. National Agricultural Insurance Scheme (NAIS), 1999, Weather Based Crop Insurance Scheme (WBCIS), 2008 and Pradhan Mantri Fasal Bima Yojana (PMFBY), 2016 were the major insurance schemes implemented in Himachal Pradesh from time to time. Maize, paddy, wheat, barley, ginger, tomato, capsicum, potato, apple and mango were found the major crops covered under crop insurance schemes in Himachal Pradesh. Besides apple and mango, WBCIS has been extended to peach, plum and kinnow. Recently, Pradhan Mantri Fasal Bima Yojana (PMFBY) has been implemented to remove the flaws in previous schemes. The following study is based on both primary and secondary data and was conducted in Panchrukhi block of H.P. in the year 2016 revealed that insurance coverage eligibility provided after one month of sowing of a specific crop, no coverage for destruction by stray & wild animals, limited crops being covered under the scheme and some of the major hazards like storm are not covered under the scheme were reported the major constraints by farmers. Inadequate field staff, lack of enthusiasm and high targets to be achieved within the given time framework were the major constraints faced by the implementing agencies. Agriculture/Cooperation Department of the states in consultation with Insurance Agencies shall work out appropriate plan for adequate awareness and publicity three months prior to the start of coverage period.

Keywords: Insurance, beneficiaries, maize, paddy, Himachal Pradesh

EFFECT OF CARRIER AND LIQUID BASED *RHIZOBIUM* AND PSB ON GROWTH AND YIELD OF BLACK GRAM (*VIGNA MUNGO* L. HEPPER)

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The experimental field was leveled and well drained. The soil was clayey in texture, low in nitrogen, very low in phosphorous, high in potash and slightly alkaline in reaction. The environmental condition prevailed during experimental period was favourable for normal growth and development of blackgram crop. The experiment was laid out in a Randomized Block Design and variety BDU-1 as a test crop along with 7 treatment combinations. The treatments are RDF+ *Rhizobium* (CB) (T₁), RDF + PSB (CB) (T₂), RDF + *Rhizobium* (CB) + PSB (CB) (T₃), RDF + *Rhizobium* (L) (T₄), RDF + PSB (LB) (T₅), RDF + *Rhizobium* (LB) + PSB (LB) (T₆) and RDF Only (25:50:00 NPK kg ha⁻¹) (T₇). Each experimental unit was replicated thrice. The gross and net plot size was 4.8 m x 4.5 m and 4.2 m x 4.1 m, respectively. Sowing was done 14th July 2014 by drilling method with spacing of 30 cm x 10 cm. The recommended cultural practices and plant protection measure were undertaken. The recommended doses of fertilizer (25:50:00 kg NPK ha⁻¹) were applied at the time of sowing through urea and SSP. The crop was harvested on 28th Sept 2014. Application of RDF + *Rhizobium* (LB) + PSB (LB) (T₆) recorded significantly higher growth, yield, quality contributing characters and N, P and K content in soil after harvest of blackgram followed by application of treatment RDF + *Rhizobium* (CB) + PSB (CB) (T₃) and RDF + *Rhizobium* (L) (T₄).

STUDIES ON EFFECT OF MAGNETIC TREATMENT ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF PADDY (*ORYZA SATIVA* L.)

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An experiment entitled "Studies on effect of Magnetic treatment on yield and yield contributing characters of Paddy (*Oryza sativa* L.) was conducted at Agricultural Research Botany farm, College of Agriculture, Dapoli to study on effect of magnetic treatment on biochemical traits and yield of paddy (*Oryza sativa* L.) during Kharif 2014-15. Magnetic exposure at different time intervals were applied before sowing of seeds. The experiment consisted of 7 treatments laid out in randomized block design with three replications. The experiment consisted of 7 treatments comprising rotation without magnet for 15 minutes and rotation with magnet for (15, 30, 45, 60 and 90 minutes). Among the all treatments, T₆ (rotation with magnet for 90 minutes) showing higher Yield and yield attributing characters viz. days required for 50% flowering, number of grains, length of panicles, fertility% of grains, 1000 grain weight and yield per plot and yield per ha.

Keywords: Magnetic, growth, paddy



CHANGING ENVIRONMENTAL SCENARIO TRIGGERS DIVERSE STRESS RESPONSES IN FISHES**S. Srivastava**

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One of the major consequences of global warming has been climatic change, which has influenced almost all aspects of biotic existence. Sudden changes in environmental conditions has put all life forms, whether terrestrial or aquatic under stress, to which they must respond for survival. Aquatic organisms like fish, experience the stress comparatively more, considering their proximity to their environments. Variations in temperatures, dissolved oxygen concentrations, dissolved carbon dioxide concentrations, pH, pollutant solubilities and the like in water cause tremendous environmental stress to fish and elicit varied physiological, biochemical, behavioural and genetic stress responses. The study focuses on the diverse environmental stressors and the associated stress responses and takes an overview of environmental management programmes for proper sustenance and development of fish species.

Keywords: climate change/ stressor/ stress response**STATISTICAL DOWNSCALING: A METEOROLOGICAL FUTURE PREDICTOR TECHNIQUE UNDER CLIMATE CHANGE CONDITION****Dinesh Kumar*, R M Singh, Bhaskar Pratap Singh, Anshu Gangwar and Raj Bhadur**

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Global Climate Models (GCMs) used for climate studies and climate projections are run at coarse spatial resolution and are unable to resolve important sub-grid scale features such as clouds and topography. To overcome this problem downscaling methods are developed to obtain local-scale weather and climate, particularly at the surface level, from regional-scale atmospheric variables that are provided by GCMs. Two main forms of downscaling technique exist. One form is dynamical downscaling, where output from the GCM is used to drive a regional, numerical model in higher spatial resolution, which therefore is able to simulate local conditions in greater detail. The other form is statistical downscaling, where a statistical relationship is established from observations between large scale variables, like atmospheric surface pressure, and a local variable, like the wind speed at a particular site. The problem of coarse grid data can be solved by downscaling GCMs to local and basin scale with the help of dynamic or statistical downscaling techniques that bridge the large-scale atmospheric conditions with local scale climatic data. Future values of the large-scale variables obtained from GCM projections of future climate are then used to drive the statistical relationships and so estimate the smaller-scale details of future climate.

Keyword: Climate change, dynamical downscaling, Global Climate Models (GCM), statistical downscaling**SOCIO-ECONOMIC TRANSFORMATION AND INDUCTION EFFECT OF TRAINEES AFTER RECEIVING MUSHROOM PRODUCTION ENTERPRISE IN SAHIBGANJ DISTRICT OF JHARKHAND****Maya Kumari *, Adarsh Kumar Srivastava **, Nidhi Sinha ***Anita Kumari **** and Baby Mandal *******

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Social transformation under Indian condition is very slow process. It required a considerable period of time and is affected by social-political situation of the village. The present study was made on the basis of a 15 days training program conducted by the Krishi Vigyan Kendra, Sahibganj (Jharkhand), in 2014-15 in mushroom production. There were 75 randomly selected respondents from the village Chanan from Borio block of Sahibganj district participated under these training program. Also 75 respondents from village Lohanda, block Sahibganj were selected as a control group, who did not receive such type of training till the time of interview. The results thus, obtained indicate that respondent's perception with regard to their social mobility was not conspicuous, as most of the changes expected of is less than 25%. However, the changes that have been expressed by the beneficiaries may be attributed to the positive effect of mushroom production training shared their ideas most frequently with family members and relatives followed by neighbors and friends. The ratio of sharing the training knowledge was found to be 1:3. In case of linkage of trainees with K.V.K, maximum number of trained entrepreneurs had high level of linkage followed by medium level of linkage. While in untrained entrepreneurs, maximum number of entrepreneurs had low level of linkage followed by medium level. However, beneficiaries had good opinion in all the selected areas which ranged between 05 to 65%.

AGRICULTURAL BIODIVERSITY CONSERVATION, DEVELOPMENT IN SUSTAINABLE AGRICULTURE**Jyoti Chauhan¹, Sneha Kumari² and Rajesh Singhal¹**¹ Research Scholar, Department of Plant Physiology, I.Ag.Sc., BHU, Varanasi 221005² Research Scholar, Department of Agronomy, I.Ag.Sc., BHU, Varanasi 221005

The late twentieth century model of land is used for biodiversity conservation. The Millennium Ecosystem Assessment state about agriculture that has dramatically increased its ecological dysfunctions. Mostly Rural communities depend on main components of biodiversity and sustainable agriculture. Fortunately, many conservation practices are use for managing to host wild biodiversity of many types, either neutral or even artificial methods. The Convention on Biological Diversity (CBD), which was adopted at the 1992 UNCED Earth Summit and to which Germany and most other countries of the world are signatories. We highlighted some evidence for the importance of soil biodiversity to sustaining (agro) ecosystem functioning and explore directions for future research. Many studies showed that soil biodiversity supports several ecosystem functions simultaneously, underpinning its crucial role in ecosystems worldwide. There is evidence for soil biodiversity stability to stress and disturbance, but until now the mechanism is not yet fully understood. We assess the potentials and limitations for successful conservation of biodiversity in productive agricultural landscapes, the feasibility of making such approaches financially viable, and the organizational, governance and policy frameworks needed to enable eco agriculture planning and implementation at a globally significant scale. We conclude that effectively conserving wild biodiversity in agricultural landscapes will require increased research, policy coordination and strategic support to agricultural communities and conservationists. The Earth's biological diversity has suffered massive losses in recent decades, putting the resources vital to life on the planet at great risk.

Keywords: eco agriculture, landscape, biodiversity conservation, agricultural production, underpinning

ECONOMIC ASPECTS OF MUSTARD CULTIVATION IN MEERUT DISTRICT OF WESTERN UTTAR PRADESH

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Mustard belong to cruciferae family and genus Brassica. Mustard (*Brassica juncea*) is also known as Rai or laha. According to various scientists, Mustard is originated from china and spread over India from there. India is one of the largest producers of mustard in the world. In India mustard is mainly grown in North West part of India, Rajsthan, and U.P. is the major mustard producing state in the country. Rajsthan is the largest mustard producer in the country with a contribution of (54%) to the country's total mustard production followed by Punjab and Haryana which simultaneously contributes (14%) In India, area under mustard was 6051 million hectares and its production was 7.67 million tones with productivity 1179 kg, /ha in 2010-11 (Directorate of Economics and statistics, New Delhi). While area, production and productivity in U.P. were 0.61 million hectare, 0.68 million tones and 1113 Kg /ha respectively. (2009-10 Directorate of Economics and statistics, New Delhi). During the same period area, production and productivity of Mustard in Meerut District was 0.004438 million hectare, 0.0574351 million tones and 1324 kg/ha respectively (2009-10) It is observed that marketing practices for disposal of mustard are traditionally done. The marketing aspect is as important as, production itself. Prevalent marketing infrastructure facilities are insufficient to provide the adequate price to the producers of the mustard crops. Sardhana block of Meerut District of Uttar Pradesh was randomly selected. Ten villages were selected randomly, from Sardhana & Sharurpur Khurd block. A separate list of mustard growers of ten selected villages were prepared with their size of holding and were classified in to four categories i.e. marginal (below-1ha), small (1-2), medium (2-4), and large (4 ha and above), in all 100 farmers were selected which consist of 50 marginal, 20 small, 16 medium and 14 large farmers. Simple tabular and functional analysis was used to analyze the data. The cropping intensity of different size group of farms, which was found highest on marginal farms (221.22 per cent) followed by small (202.46 per cent), medium (190.17 per cent), and large farms (182.48 per cent) respectively. The overall average of cropping intensity on sample farms was worked out to 192.55 per cent. On an overall average per farm and per hectare investment on sample farms were found to Rs. 662156.83 and Rs. 350613.88 respectively. On an overall average cost of cultivation per hectare of mustard crop came to Rs. 50310.84. The net income, family labour income, farm business income and farm investment income were found to Rs.11221.73, Rs.14586.79, Rs.31237.94 and 27872.88 respectively. Cobb Douglas production was fitted to found out resource use efficiency in mustard crop. Per hectare gross income was taken as independent factor and input costs of human labour, manure & fertilizers, tractor labour irrigation, plant protection, and seed, six independent input factors for mustard crop. The test of significance (t test) was used for testing the regression co-efficient and R^2 measure the fitness of overall function was also applied. Linear model in best fit for arriving trend in area, production and productivity in the study area. Area under mustard crop slightly decreased with time in the study area. Channel-I was found more efficient as compared to channel-II, and channel-III because of no middleman found was resulted less marketing cost in channel-I. Average marketing costs increased as increase in number of intermediaries under channel-II, and channel-III. By comparing retailer marketing margins was found maximum having 3.35 per cent in channel-III followed by 3.27 per cent, channel-II respectively. The producer's share in consumer's rupee was found maximum 95.82 per cent in channel-I followed by 90.59 per cent, and 83.53 per cent under channel-II, channel-III respectively. Producers share in consumer rupee decrease with increase in number of intermediaries.



FARMERS' AWARENESS TOWARDS INTEGRATED NUTRIENT MANAGEMENT (INM)**Anil Kumar Rohila*, P. S. Shehrawat, J. S. Malik and Krishan Yadav**

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The present research was undertaken to study the awareness of farmers' awareness towards integrated nutrient management (INM). Present study was conducted in Haryana state in 2017. Total 180 respondents were interviewed for the study. Present study concluded that farmers' awareness level was high in case of 'do you know INM increase the crop yield?' with weighted mean score (WMS) 2.02 and rank order 1st followed by 'do you know that 'INM sustain the soil health?' and 'do you know about organic manures and fertilizers?' with WMS 1.96 and 1.93 and 2nd and 3rd rank orders. 'Do you know about balanced use of fertilizers?', 'do you know time and method of application of manures and fertilizers?', 'INM increase the organic matter' with rank orders 4th, 5th and 6th and WMS 1.93, 1.86 and 1.82, respectively. 'Do you know percentage of N/P/K in different fertilizers?', 'are you aware from bio fertilizers i.e. Rhizobium, Azotobacter, Azospirillum?' and 'do you know about primary and secondary nutrients?' with WMS 1.59, 1.32 and 1.31 while rank orders were 7th, 8th and 9th, respectively. Awareness level was low in case of 'do you know about essential micronutrients?' with WMS 1.30 and rank order 10th. Independent variables such as age, education, land holding, farming system, farm power, mass media exposure, extension contact, innovation proneness were significant correlated with dependent variable. Cropping system, irrigation facilities and economic motivation were not significant with dependent variable whereas R-square value was 0.46.

Keywords: Awareness, Fertilizers, Management and Nutrient**TO STUDY THE INTERACTION EFFECT OF DATES OF SOWING AND VARIOUS NUTRIENTS ON SEED QUALITY OF MUSTARD VAR. "BASANTI" [BRASSICA JUNCEA L. (CZERN & COSS).]****Anubhav Kumar¹, C.B. Singh Gangwar¹, Poonam Singh¹, Anurag Kumar², and Anand Kumar Yadav³**Department of Seed Science and Technology¹Department of Genetics & Plant Breeding²C.S.A. University of Agriculture and Technology Kanpur¹N.D. University of Agriculture and Technology Faizabad²Indian Institute of Pulse Research Kalyanpur Kanpur³

An experiment was carried out at Seed Testing Laboratory, Department of Seed Science and Technology, C. S. A. University of Agriculture and Technology Kanpur during 2015-16. Quality Seed of Mustard var. "Basanti" was sown during 1st week of November and IIIrd week of November with the nutrient levels (1) RNPk (bir60:40:40 kg ha⁻¹), (2) RNPk + 40 kg S ha⁻¹, (3) RNPkS + 20 kg ZnSo₄ha⁻¹, (4) RNPkS +25 kg ZnSo₄ ha⁻¹, (5) RNPkS + 20 kg ZnSo₄ ha⁻¹ + 5 kg FeSo₄ha⁻¹, (6) RNPkS + 20 kg ZnSo₄ ha⁻¹ + 10 kg FeSo₄ha⁻¹ (7) RNPkS + 25 kg ZnSo₄ ha⁻¹ + 5 kg FeSo₄ha⁻¹ (8) RNPkS + 25 kg ZnSo₄ ha⁻¹ + 10 kg FeSo₄ha⁻¹. These two date sown seed with different nutrient levels were tested for germination, root length, shoot length, seedling length, seedling dry weight, seed vigour index I and II, 1000 seed weight and oil content %. On the basis of performance it was concluded that 1st week of November and nutrient level 60:40:40:40 (RNPkS) kg + 25kg ZnSo₄ + 5kg FeSo₄ ha⁻¹ gave the best interaction performance. So this combination can be recommended for getting better seed quality and oil content in mustard var. "Basanti".

INVITRO EVALUATION OF VARIOUS FUNGICIDES AGAINST EARLY BLIGHT PATHOGEN OF TOMATO CAUSED BY ALTERNARIA SOLANI**Anuj Bansal, V. Tilak Chowdary and Rohit Rana¹**

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Tomato is one of the major vegetable crops grown in India, which is attacked by several pathogens resulting in huge economic losses, early blight of tomato caused by *Alternaria solani* is one among them causing considerable economic losses. In the present experiment we have evaluated six fungicides at various concentrations against the pathogen in invitro by food poison technique. Among them mancozeb and copper oxy chloride have shown better results at 0.2% concentration by inhibiting the mycelial growth upto 68% and 46% respectively when compared to the control.

APPLE GROWING IN WARM CLIMATE IN INDIA: A GAME CHANGER**¹Abhilash Padhan, ¹C. Abid Hussain and ²Amit Kumar Singh***

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The subtropical region in India lie between latitude 150 and 300 north of equator covering north Indian plains, the Gangetic basins, large parts of eastern states, eastern and western ghats, Nilgiri region etc. In this zone spring is generally frost free and chilling availability ranges from 50 to 500 hours. This region is thus not considered suitable for temperate fruits but grows several low chilling varieties of peach, plum, apricot, almond, pear, apple and nuts. These areas being closer to the markets, offers better production potential than those in higher hills. The winters are relatively warm, but not as hot as the summer season. Production of apple in subtropics may seem fanciful to be initiated, but it is a practice that has existed in localized regions for generations. In areas of warm region of India, for example, chemical treatments are regularly applied to supplement the effects of limited chilling. Because temperature declines with increasing elevations, many microclimates exist in the subtropics where temperate-zone fruits are not currently grown, but could be. Due to development of low chilling apple varieties, apples can be cultivated in tropics and subtropics of India which constitutes North Indian plains, parts of eastern states, eastern and Western Ghats, Nilgiri hills. Winter chilling requirements for most of low chilling apple varieties are 500 to 1000 hrs. below 45 °F (7 °C). There are relatively few varieties adapted to mild winter climates (chill hours below 500 hrs). The cultivar like Beverly Hills, Gordon, Tropical Beauty, Anna, Dorsett Golden, and Ein Sheimer having potential to grow under low chilling requirement.

IN VIVO EFFICACY OF CHEMICALS AND BIOCONTROL AGENTS ON DAMPING OFF OF CHILLI (*CAPSICUM ANNUM* LINN.)

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Chillies (*Capsicum annum* linn.) belonging to family Solanaceae. It contains not less than 12% of non volatile ether soluble extractives. It is an important crop in Preparation of soups, chilli sauce, spicy water etc in country. It was prone to many pathogens viz. fungal, bacterial, and viral and other pathogens also but fungal pathogens were more prominent. Under fungal pathogen *Pythium aphanidermatum* which cause damping off of chilli seedlings causes more than 70% loss in the yield of chilli. Various biocontrol agents and chemicals were used for the managing this disease. Under biocontrol various biocontrol agents used viz. *Trichoderma viride*, *Pseudomonas fluorescense*, Carbendazim, Mancozeb, carbedazim + mancozeb and *Trichoderma harzianum* were used. Among these biocontrol agents *T. viride* shows maximum inhibition of fungus in vivo as a biocontrol and among fungicides Carbendazim + Mancozeb was observed best.

Keywords: Biocontrol agents, Seedlings, In vivo, Pathogen etc.

ASSESSMENT OF PROMISING SUGARCANE VARIETIES TOWARDS THE INCIDENCE OF MAJOR INSECT PEST IN THE CLIMATE OF WESTERN U.P.

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Numerous insects and pest are reported to affect the sugarcane crop, this is a leading crop of west Uttar Pradesh agriculture and extending economical substance to the formers. The onset of incidence are dependent of many factors, of which are climate and gemology of the crop is major. A number of varieties suitable for cultivation in this zone are recommended and there is sufficient degree of variations are observed among them. Keeping this fact in consideration the present study was undertaken at sugarcane research centre, Muzaffarnagar farm between the year 2012 to 2015, with eighteen varieties, i.e. (CoS. 06279, 06287, 07240, 08272, 08276, 08279, 08452, 08458, 09232, 10232, 10249, CoSe. 05460, 08455, CoS. 92423, 96268, CoJ. 64, CoS. 767 and CoS. 96275). Last 5 Varieties were standard. the replicated trial was conducted in Randomized Block Design (R.B.D.) and the observations were made for the incidence of different borers (Shoot borers and Top borers) during hot weather conditions, the weather reported congenial of incidence. The comparative analysis revealed that the incidence of Shoot borer (*Chillo infuscatellus*, Snellen) is less than 10%, which were minimum ,among test varieties. During hot weather, these varieties depict differential behavior toward Top borer (*Sciropophaga nivella*) incidence. It was observed less than 10% (i.e. less susceptible) in two varieties (CoS. 06287 and CoSe. 05460), 10 varieties were marked as moderate susceptible for top borer with an incidence of 10.10-15% (CoS. 07240, 08272, 08276, 08279, 08452, 10249, 92423, 96268, 767 and CoS 96275) and rest of 6 varieties were susceptible for top borer with an incidence of more than 15.1% (CoS. 06279, 08458, 09232, 10232, CoSe. 08455 and CoJ. 64). At last it was concluded that the scouting played an important role for screening of insect pests resistances varieties.

Keyword: depict, scout, screening Shoot borer, Top borer

ROLE OF ABIOTIC FACTORS ON THE INCIDENCE OF FRUIT FLY, *BACTROCERA ZONATA* IN GUAVA

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The fruit fly *Bactrocera zonata* population was evaluated by putting methyl eugenol traps in guava orchards. Six traps were mounted at three different places in orchards. The observations were started from 2nd fortnight of October during 2009 and 2010. During first year i.e., 2009 *B. zonata* population showed negative and significant correlation with maximum temperature (-



0.68) but minimum temperature (0.16) represented positive non-significant correlation. The correlation coefficient indicated significant positive correlation of fruit fly population with relative humidity (maximum 0.74 and minimum 0.79). In the year 2010 the sp. showed negative but significant correlation with maximum temperature (-0.47). The correlation coefficient was found significant and positive correlation with minimum temperature (0.49). The same trend of correlation coefficient was found significant and positive correlation with minimum temperature (0.49) like previous year. The significant positive correlation observed between population of *B. zonata* and relative humidity (maximum 0.79 and minimum 0.83).

BIO-NANOPARTICLES FOR RESIDUAL PESTICIDE ABATEMENT

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Pesticides are excessively used for managing the pests in agriculture and public health, that's why, a part of this is found in the drinking water. Both Surface and ground water contain this residual pesticide as they are used widespread. Most of the pesticides are resistant to biodegradation and are found to be carcinogenic in nature even at trace levels. Standard methods of pesticide removal are disadvantageous due to their inherent time consumption or expensiveness. Nanoparticles assuage both of these drawbacks and hence, they can be effectively utilized for the mineralization of pesticides. The application of chemically synthesized nanoparticles now a days considered as toxic in the nature, in contrast to this, nanoparticles may synthesis from living organisms and it considered as bio nanotechnology. Bio nanotechnology is a sustainable method as it is a safe process, energy efficient, reduces waste and lessens greenhouse gas emissions. As a major contrast, microbes are used in the production of these nanoparticles mostly metallic nanoparticles. Microbes synthesize these nanomaterial as a part of defense mechanism. These nanoparticles are ecofriendly as no harmful chemicals are utilized and can be mass produced due to high multiplication rate of microbes. The bio-nanoparticles can be used in multiple application in agriculture to sustain the production and environment, one of the major concern that utilizes the use of these metallic nanoparticles is for the degradation of residual pesticides present in ecosystem.

Keywords: Bio-nanoparticles, pesticide, sustainability, microorganism and mineralization.

BIODIVERSITY AND CONSERVATION STRATEGIES OF ENDANGERED MEDICINAL PLANT SPECIES

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Biodiversity refers to large number genetically diverse population of rare and threatened plant species from around the world. India is one of the major country having 12 mega diversities with 10 bio geographic regions. India is the rich source of plant biodiversity having different climatic condition as well as altitudinal variations, coupled with varied ecological habitats contributing to the development of rich vegetation. World Health Organization has recorded 21000 plant species of medicinal plants around the world. In India, about 2500 plant species of medicinal plant are being used in indigenous system. Medicinal plants occupy a vital sector of health care system in India which represents a major natural national resource. Medicinal plants are of various uses curing different ailments such as, wounds, cuts, fever, diarrhoea, ulcers, swelling, bone fractures, potency, antidote, skin care, night blindness, toothache, asthma, cough & cold etc. The red data book has listed 427 Indian Medicinal plant entries as endangered species, of which 28 are considered extinct, 124 endangered, 81 rare and 34 insufficiently known. Therefore, it is necessary to maintain as well as conserve plant species. There are various different strategies such as micro propagation, in vitro seed germination, dual culture with symbiotic fungi as well as callus regeneration for conservation of plant species or germplasm conservation. Hence, there is an immense need for conservation of diversity of medicinal plant for the present and future generations, by adapting the above suitable strategy with most appropriate method of conservation.

COMPETENCY OF THE EXTENSION PERSONNEL

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The combination of observable and measurable knowledge, skills, abilities and personal attributes that contribute to enhanced employee performance and ultimately result in organizational success. A Competency is a Criterion for Success. Competencies are specific work behaviors distinguishing high and low job performance. Competency is a determining factor for successful performance. The focus of the competency is Behavior which is on application of skills, job, attitude and knowledge. The ability to integrate knowledge and skill to perform a task under the varied circumstances of the real world. A competency is a qualification to perform, not the actual performance. Competencies do not establish baseline performance levels; rather they are used to raise the bar on employee performance. Competency data can be used for employee development, compensation, promotion,



training and new hire selection decisions. Competency determine the employee's career movement and also the reward to be earned. Competencies refers to skills or knowledge that leads to superior performance. Competencies are individual abilities or characteristics that are key to work.

Keywords: Competency, Extension Personnel, Knowledge, Skill and Attitude

EFFECT OF BORON TOXICITY ON MORPHO-PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Wheat is the staple food of around 40% of world population. Boron (B) toxicity is an important agricultural problem which highly limits the area, production and ultimately productivity of agricultural food products such as wheat in different part of world. The main reason of this toxicity is B rich irrigation water, fertilizers, sewage and sludge, surface mining, industrial use and fly ash. The morpho-physiological and biochemical parameters were highly affected by toxic level of boron. Leaf area and biomass were decreased remarkably. Chlorophyll a, b and total chlorophyll content was varied significantly, where chlorophyll b content was surprisingly higher. These conditions led to limited photosynthesis and affected yield. The B toxicity pushes the plants into certain abiotic stress. So it is obvious that it must affect the proline content. From this study it has also been found that the proline content was amazingly different. Our results indicate that these parameters could be used to evaluate the stress level as well as to develop models that could help prevent the damage inflicted by B toxicity in wheat plants.

Key words: wheat, boron toxicity, leaf area, biomass, chlorophyll, proline, abiotic stress.

EFFECT OF ALKALI WATER AND GYPSUM APPLICATION ON RICE-WHEAT CROPPING SYSTEM

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The experiment was conducted during 2015-2017 in *kharif* and *rabi* season on Crop Research Station, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur to carried out the "Effect of Alkali water and gypsum application on rice-wheat cropping system" on rice and wheat crop with seven treatments i.e ; Control (Sodic water) (T₁), Gypsum Beds Treatment of sodic waters (T₂) , Soil Application of gypsum (25% gypsum Requirement) (T₃), Soil application of gypsum (25% GR) + GBT of Sodic water (T₄), Soil application of gypsum (50% GR) (T₅), Soil Application of gypsum (50%GR) +GBT of Sodic water (T₆) and Soil application of gypsum (100% GR) (T₇) in Randomized Block design (RBD) with four replications. The results showed higher grain production in rice and wheat was recorded 47.41, 38.43 q ha⁻¹ and straw yield was recorded 54.78 and 43.63 q ha⁻¹ at (T₆) respectively with the application of (SA of gypsum (50% GR) + GBT) of Sodic water in comparison to control (T₁). Application of these recommendation in Sodic water dominant area to gating maximum yield and maintain soil health it is also sustain crop production very profitable for marginal farmers.

ZINC AND ITS IMPORTANCE FOR HUMAN HEALTH: AN INTEGRATIVE REVIEW

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Since its first discovery in an Iranian male in 1961, zinc deficiency in humans is now known to be an important malnutrition problem world-wide. It is more prevalent in areas of high cereal and low animal food consumption. . The diet may not necessarily be low in zinc, but its bio-availability plays a major role in its absorption. Phytic acid is the main known inhibitor of zinc. Compared to adults, infants, children, adolescents, pregnant, and lactating women have increased requirements for zinc and thus, are at increased risk of zinc depletion. Zinc deficiency during growth periods results in growth failure. Epidermal, gastrointestinal, central nervous, immune, skeletal, and reproductive systems are the organs most affected clinically by zinc deficiency. Clinical diagnosis of marginal Zn deficiency in humans remains problematic. So far, blood plasma/serum zinc concentration, dietary intake, and stunting prevalence are the best known indicators of zinc deficiency. Four main intervention strategies for combating zinc deficiency include dietary modification/diversification, supplementation, fortification, and bio-fortification. The choice of each method depends on the availability of resources, technical feasibility, target group, and social acceptance. In this paper, we provide a review on zinc biochemical and physiological functions, metabolism including, absorption, excretion, and homeostasis, zinc bio-availability (inhibitors and enhancers), human requirement, groups at high-risk, consequences and causes of zinc deficiency, evaluation of zinc status, and prevention strategies of zinc deficiency.

Keywords: Zinc absorption, zinc bio-availability, zinc deficiency, zinc intervention, zinc nutrition, zinc requirement



IMPACTS OF CLIMATE CHANGE ON WATER RESOURCES IN RELATION TO MONSOON OF HARYANA REGION

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The vulnerability of an Indian subcontinent to the impact of changing climate is of vital importance because the major impact of climate change on this continent would be on the hydrology, affecting water resources and its agricultural economy. The present studies in regions of Haryana highlighted the climate change and its impacts on the water resources with a special emphasis on floods and droughts events. Various Deterministic models are calibrated and validated for the selected regions and used to simulate the hydrological response of the region considered changing climatic scenarios. During the monsoon months, increase in precipitation is projected by about 27 percent (178 mm), most of this results in runoff 57 percent (102 mm) and base flow 4 percent (7 mm) contributing to the stream flow. About 2 percent (4 mm) of this increase in precipitation is contributed to the groundwater recharge. Increase in evapotranspiration is projected by 34 percent (19 mm). It has been observed that the impacts of climate change are not uniform over the country and varying across in various regions of Haryana.

CLIMATE RESILIENT VARIETIES: THE WAY TO COMBAT CLIMATE CHANGE

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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.

COMMUNICATION TECHNOLOGIES FOR AGRICULTURAL EXTENSION IN INDIA

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The potential role of agriculture as an engine for economic development. Agricultural technologies, such as fertilizers, seeds and cropping techniques. Public-sector programs have attempted to overcome information-related barriers to technological adoption by providing agricultural extension services. The rapid spread of information and communication technologies (ICT) in developing countries like India offers a unique opportunity to transfer knowledge via private and public information systems. The general extension approach uses specialists to provide a sort of services to farmers, from technology transfers to advisory services and human resource development. ICTs have been used in advisory service provision. Radio and TV Programme and Mobile telecenters regularly have provided agricultural information like price, quality, weather condition etc.

Keyword: Agriculture Extension, ICT, Services

CONSERVATION AGRICULTURE: PRECISION AGRICULTURE (SAVE ENERGY, SAVE MONEY)

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Precision agriculture, also known as “site-specific crop management,” is an information- and technology-based agricultural management system used to identify, analyze, and manage variability within fields for optimum profitability, sustainability, and environmental protection. Fields often vary in soil types, elevations, soil chemistry, fertility, and productivity. By applying precision agriculture practices, producers are able to specify the farm input needs (including nutrient and pesticide application, tillage, and irrigation) throughout an individual field. Precision agriculture has emerged during recent years as an improved management strategy to apply agricultural inputs at proper place, time and dose rather than applying uniformly over large



frame precision agriculture is not a technology but management of crops/ farms to respond to variability by using advanced technology. Global Position System (GPS) has made it economically possible for producers to use new precision tools, techniques, and services to enhance their efforts to save energy and reduce costs. These include yield monitoring, grid soil sampling, variable-rate application of nutrients, remote-sensing applications, soil electrical conductivity (EC) monitoring, and zone soil sampling. PA methods promise to increase the quantity and quality of agricultural output while using less input (water, energy, fertilisers, pesticides, etc.). The aim is to save costs, reduce environmental impact and produce more and better food. The methods of PA rely mainly upon a combination of new sensor technologies, satellite navigation and positioning technology, and the Internet of Things. In addition to cutting production costs and saving energy, precision agriculture reduces environmental pollution and improves water quality by reducing nutrient runoff. Other benefits include:

- Improved crop yield
- Reduced compaction by limiting traffic to specified travel lanes
- Increased opportunity to operate equipment after dark
- Labor savings through reduced implement overlap, and
- More accurate farming records

Future benefits of this study: Precision agriculture can make a significant contribution to food security and safety, Precision agriculture can promote more sustainable ways of farming, Precision agriculture will trigger wider societal changes.

Keywords: precision, save energy, GPS.

CONTRIBUTION OF AGROFORESTRY IN FUELWOOD CONSUMPTION AT DIFFERENT ALTITUDINAL ZONES OF GARHWAL HIMALAYA

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In recent decade, climate change is one of the debatable issues worldwide, having direct and indirect impacts on the human being as well as on natural ecosystem. In Himalayan region, trees at agroforestry field are alternative source of fuelwood as a provisioning service which helps in improving the livelihood of the farmers by reducing the need of commercial energy sources. The present study was undertaken to assess the contribution of agroforestry in fulfilling the demand of the fuelwood at different altitude of Garhwal Himalaya. Multistage random sampling was used to select the agroforestry dominated villages followed by agroforestry farmers during 2015-17. Fuelwood consumption by households was estimated using the weight survey method for a period of 24 hrs. The results revealed that fuelwood consumption from agroforestry (capita⁻¹day⁻¹) increases with altitude upto 1201-1600 m altitude and then declined at the peak (i.e. >1600 m) while the fuelwood consumption from forest increases with altitude. The estimates of the study will be helpful in quantifying the contribution of agroforestry in fuelwood consumption. Thus the share of agroforestry may be helpful in framing the policies regarding the adoption of agroforestry as a tool for providing the protective and productive services for adaption to changing climate as well as reducing the anthropogenic pressure on forest at high altitude of Himalayan region.

Keywords: Adaptation; Agroforestry; Climate change; Fuelwood consumption; Himalayan region

STRUCTURAL PARAMETERS FOR SCREENING OF DIFFERENT VARIETIES OF CHILLI (*CAPSICUM ANNUM* L.)

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An experiment entitled, Structural and functional parameters for screening of different Chilli varieties was carried out during 2015-16 in the field of Research Farm, J.N.K.V.V., College of Agriculture, Tikamgarh (M.P.). The experiment was laid out in RBD with ten varieties viz. Pusa Jwala, Pusa Sadabahar, JM-218, JM-283, Sonakshi-44, Divyajyoti, Classica-152, Natasha-727, Suryamukhi and Prajwala and three replications. The plant growth of different varieties at different growth intervals was statistically analyzed. The results show that the variety Prajwala recorded as the tallest (61.43 cm height at 90 DAT stage) one at every stage over the other varieties, the variety JM-283 recorded as the highest no. of branches (26.07 plant⁻¹ at 90 DAT stage) one at every stage, the variety Prajwala recorded as the highest no. of leaves (82.71 plant⁻¹ at 90 DAT stage) one at every stage, variety Sonakshi-44 recorded as the highest leaf area at 30 DAT stage but at 60 and 90 DAT stage, highest leaf area was recorded by Natasha-727 variety. The highest no. of leaves at 90 DAT stage was recorded up to 685.26 mm², being significantly higher over the remaining varieties. The parameter fruit yield plant⁻¹ Prajwala produced significantly higher fruit yield plant⁻¹ (786 g) as compared to all the varieties. The second best variety was Natasha-727 producing (713 g fruits plant⁻¹). The third best variety was Classica-152 (676 fruits plant⁻¹). Pusa Jwala produces significantly lowest fruits yield (129 g fruits plant⁻¹), closely followed by Pusa Sadabahar (143 g fruits plant⁻¹), respectively.

Keywords: Chilli, Varieties, Structural & Screening



IMPACT AND CONSTRAINTS OF TOILET SCHEME FOR RURAL WOMEN'S SECURITY IN INDIA

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The Swachh Bharat Mission of urban and rural areas aims to cover almost 1.04 crore households in order to provide them 2.6 lakhs of public toilets, 2.5 lakhs of community toilets together with the solid wastes management in every town. Community toilets have been planned to be built in the residential areas where availability of individual household toilets is difficult and public toilets at designated locations including bus stations, tourist places, railway stations, markets, etc. Cleanliness programme in the urban areas (around 4,401 towns) have been planned to be completed over five years till 2019. The costs of Programmes are set like Rs 7,366 crore on solid waste management, Rs 1,828 crore on public awareness, Rs 655 crore on community toilets, Rs 4,165 crore on individual household toilets, etc. Programmes which have been targeted to be completed are complete removal of open defecation, converting unsanitary toilets into flush toilets, eradicating manual scavenging, bring behavioral changes among public, and solid waste management. The Ministry of Human Resource Development has launched Swachh Vidyalaya Programme under Swachh Bharat Mission with an objective to provide separate toilets for boys and girls in all government schools within one year. The Programme aims at ensuring that every school in the country must have a set of essential interventions that relate to both technical and human development aspects of a good Water, Sanitation and Hygiene Programme.

Keywords: Swachh , Toilets, Programme and stations.

EFFECT OF ORGANIC AND INORGANIC NUTRIENT SOURCES ON TOTAL CHLOROPHYLL CONTENT AND YIELD IN TARAORI AND TYPE-3 BASMATI RICE VARIETIES

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Rice is the major staple food crop in India, occupying around 45 m.ha., and contributing about 100 million tones to the total food grain production. Introduction of high yielding varieties and increased use of chemical fertilizers and pesticides have lead to several harmful effects on the soil environment ultimately reducing the productivity of the soil by affecting the soil health. It is felt that organic farming may solve all these problems by protecting/sustaining soil health. Significant improvements in soil properties have been reported in several organic farming experiments because organic manures not only act as the source of nutrients, but also provide micronutrients and enhance the microbial population of soils which help in mobilizing native nutrients in soil-plant system and also improve the efficiency of applied nutrients. The present investigation was carried out to understand the effect of different organic and inorganic nutrients on physiology of Taraori and Type-3 basmati rice varieties. The experiment was laid out in split plot design during kharif season of 2015 & 2016 at Breeder Seed Production Centre, GBPUA&T, Pantnagar, India. The experiment was conducted with different nutrient sources *i.e.* farmyard manure (FYM), vermicompost (VC), green manure (GM), NPK mixture, urea and muriate of potash (MOP) and two irrigation methods *i.e.* alternate wetting and drying (AWD) & continuous flooding (CF) and establishment methods were System of Rice Intensification (SRI), Direct Seeded Rice (DSR)+Soy & Transplanted rice. The treatments were T₁: GM+FYM (AWD), T₂: Organic (AWD), T₃: FYM+VC (AWD), T₄: SRI, T₅: DSR+Soybean, T₆: Organic control (CF), T₇: Chemical control (CF), T₈: Integrated (CF). The findings suggest that significantly higher grain yield was found in T₈ which was *at par* with T₁, T₃ and T₇ among the sole crop of basmati rice in both years whereas in establishment methods DSR reported the highest yield in 2016 as compared to other establishment methods. Among the varieties Type-3 had significantly higher grain yield in both the years than Taraori basmati rice variety. Total chlorophyll was significantly higher in T₄ among the treatments whereas among the varieties Type-3 had higher total chlorophyll as compared to Taraori basmati rice variety.

Keywords: Organic farming, basmati rice, irrigation and physiology

EFFECT OF ORGANIC MANURE BASED ON DISTILLERY COMPOST, INORGANIC FERTILIZER AND FARM YARD MANURE ON THE YIELD QUALITY OF INDIAN MUSTARD (*BRASSICA JUNCEA L.*)

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The experiment was laid out in Randomized block design during the crop season of 2004-05 and 2005-06 at the research farm of J.V.P.G. College, Baraut, Baghpat (U.P.) comprising 10 treatments with 3 replication. DEBPCFYM, combinations of DEBPC ÷ FYM and inorganic fertilizer significantly increased seed yield. Biological yield and quality content of Indian mustard. Among the various treatments, application of FYM 5t/ha + DEBPC 3t/ ha recorded highest seed yield, biological yield and all the quality contents in both the years.



Keywords: Distillery compost, FYM, Urea, Indian Mustard.

INDUCED MUTAGENESIS IN RICE FOR ISOLATION OF NON LODGING MUTANTS IN ADT-45 VARIETY USING ELECTRON BEAM AND GAMMA RAYS AND ITS CHARACTER ASSOCIATION STUDIES

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This experiment was conducted during 2013 to 2016 at the Agricultural College and Research Institute, Madurai, Tamil Nadu, India. Lodging in cereal crops causes significant economic losses associated with reduced yield, grain quality, and harvesting efficiency. Lodging is a complex phenomenon as it interferes with water and nutrients uptake, reduces light interception, provides conducive environment for foliar diseases, increases harvesting cost and decreases grain yield. ADT-45 is the one of the leading varieties mostly preferred by farmers of Tamil Nadu and considered as one the best suitable variety with good quality rice which fetches very high price for the farmers due to its medium slender grain type but the only lacuna is it is susceptible to lodging. Hence in the present investigation, ADT-45 variety was treated with electron beam and gamma rays to produce lodging tolerance mutants. An association study was carried out between lodging angle with different lodging related morphological traits. The traits plant height, culm height, 1st internodal length, 2nd internodal length, 3rd internodal length, 4th internodal length, 5th internodal length had a significant direct correlation with lodging angle. While the traits 1st internode diameter, 2nd internode diameter, 3rd internode diameter, 4th internode diameter, 5th internode diameter, K and Si had significant negative correlation with lodging angle i.e., increase in the lodging angle (lodging susceptible) internodal diameter, K and Si content get reduced.

INTEGRATED NUTRIENT USE ON WATER USE & WATER USE EFFICIENCY OF HYBRID MAIZE UNDER RAINFED CONDITION IN CENTRAL PLAIN ZONE OF UTTAR PRADESH

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An experiment was conducted during *Kharif* 2016 on Soil Conservation and Water Management Farm, C.S.A. University of Agriculture & Technology, Kanpur on hybrid Maize with three level of inorganic fertilizers (kg ha⁻¹) i.e. 100% R.D.F. (100 N + 60 P + 40 K + 20 Z), 75% RDF (75+45+30+15), & 50% RDF (50+30+20+10) along with three levels of organic manure viz; 15, 20 & 25 ton FYM ha⁻¹. On the basis of results it can be concluded that the fertility level 100% RDF as water use 328 (mm) & water use efficiency 9.09 (kg ha⁻¹ mm⁻¹) and 25t FYM ha⁻¹ as water use 327 (mm) & water use efficiency 9.20 (kg ha⁻¹ mm⁻¹) was found better in respect as compared to other combinations of fertility management in respect of water use & water use efficiency ended that growing of hybrid maize crop in *Kharif* season was found most suitable and remunerative in central plain zone of Uttar Pradesh in Kanpur.

EFFECT OF SEED SIZE ON GERMINATION OF SEMECARPUSANA CARDIUM (MARKING NUT) IN GARHWAL HIMALAYA

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The present study was conducted to generate information on effect of seed size on germination of *Semecarpusana cardium* in Garhwal Himalaya. *Semecarpusana cardium* is a medium sized deciduous tree, growing up to 10-15 metres in height. The plant grows naturally in tropical and sub-tropical climate and distributed in sub-Himalayan region, Tropical region, Bihar, Bengal, Orissa and central parts of India. Its an important medicinal plant species possessing Anti-Cancer, Anti-inflammatory and several diseases like skin disease, fungal disease, excessive menstruation, fever, constipation, etc. The experiment was carried out at HNB Garhwal University, Srinagar during 2015-2016 in RBD experimental design with five replications. There were 3 treatments namely T₁ as small seeds, T₂ as medium seeds and T₃ as larger seeds. Estimates of the germination data showed that the germination ranges from 18% - 28% with highest germination on T₁₃ (28%). Thus the experiment reveals that the seed size plays vital role in germination of *Semecarpusana cardium*.

Keywords: Germination, *Semecarpusana cardium*, Seed Size, Garhwal Himalaya



FAMILY ENVIRONMENT TO INFLUENCE ON ACADEMIC ACHIEVEMENT**Reena* and Bimla Dhanda****Department of Human Development and Family Studies, COHS,
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Family is a social unit and first place where children live with their parents or guardian and begin to learn the norms and values of the society in which they find themselves. It is the source of early stimulation and experience in children. The family, being a powerful influence on the child and its importance as a primary agent of socialization could in no doubt enhance or hinder the academic achievement of the child depending on the social climate in the family. The home environment means the family background of the students; this includes all the human and material resources present at the home that affects the student's education and living, such as the parent's level of education, their occupation, socio-economic status and socializing facilities available in the house. Thus, the home is the basic institution for providing the child's primary socialization and laying the educational foundation for the child upon which the other agents of socialization are built. Academic attainment is an important parameter used in measuring students' success or failure in a particular subject in school. Success, in an educational institution is measured by academic performance. Poor performance of students has become a common concern of parents, legislators, teachers, counsellors and psychologist. A family is strongly linked to the academic motivation of a child. So, action is needed to promote awareness of the importance of education and family environment as well as ways to safeguard it.

Keyword: Family environment, children and Academic achievement.**ADAPTATION TO CLIMATE CHANGE: NECESSITY OF THE TIME IN AGRICULTURE****Chandra Kant Singh**

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Due to climate change, likelihood of further changes occurring and increasing scale of potential climate impacts give urgency to addressing agricultural adaptation. Many potential adaptation options are available for marginal change of existing agricultural systems, for climate risk management. Implementation of these options is likely to have substantial benefits under moderate climate change for some cropping systems. However, there are limits to their effectiveness under more severe climate changes. Agriculture plays a two fold in climate change, one hand, severely by climate change and other hand, significant contributor to greenhouse gas emissions. Adaptation in the agriculture sector means addressing the negative impacts of climate change and making use of the opportunities that often come with a changing climate. The overall aim of adaptation in agriculture is to reduce farmer's vulnerability and improve their adaptive capacity. In addition to all these aspects, it is concrete adaption options at farm level, as well as community based adaptation approaches. Achieving increased adaptation action will necessitate integration of climate change related issues with other risk factors, such as climate variability and market risk, and with other policy domains, such as sustainable development. To deal with various barriers the effective adaptation will require a comprehensive and dynamic policy approach covering a range of scales and issues, e.g. farmers' understanding of change in risk profiles to the establishment of efficient markets that facilitate response strategies. Multi-disciplinary problems require multi-disciplinary solutions, i.e., a focus on integrated rather than disciplinary science and a strengthening of the interface with decision makers. A crucial component of this approach is the implementation of adaptation assessment frameworks that are relevant, robust, and easily operated by all stakeholders, practitioners, policymakers, and scientists.

Keyword: Adaptation, Agricultural sector, Climate change, Climate impacts.**EFFECT OF ENTOMOPATHOGENIC FUNGI ON LIPID PEROXIDATION AND ANTIOXIDANT ENZYMES ACTIVITIES OF *SPODOPTERA LITURA* (FAB.)****Sonam*, Anoop Kumar*, Sachin S. Suroshe**, Sagar D**, Jitendra Singh* and Nashim Ahmad***

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The tobacco caterpillar, *Spodoptera litura* (Fabricius) is a polyphagous pest known for devastating outbreaks all over the world. In India, across different crops, *S. litura* causes 10 to 30 per cent yield loss. Presently, different parts of the country are witnessing the outbreaks of *S. litura* due to its high fecundity and a short life cycle under sub-tropical and tropical conditions. Of late, *Spodoptera* has become highly resistant to pesticide belonging to different classes including the bio-pesticide. Currently, two broad spectrum entomopathogenic fungi namely *Beauveria bassiana* and *Metarhizium anisopliae* are in the offing for the management of the larval population of many lepidoteran larvae including *S. litura*. So, in order to study the effect of *Beauveria* on lipid peroxidation and antioxidant enzymes activity in *S. litura*, the experiment was carried out. For bioassay respective fungal spore concentration of 1×10^7 spores per ml was used against the fourth instar larvae *S. litura*. The findings suggest that the level of immune related antioxidant enzymes viz., Super-oxide-dismutase (SOD), Peroxidase, Catalase and Glutathione-S-transferase (GST) were found to play significant role in treated larvae compared to larvae under control. The findings might give clue about the mechanisms of tolerance in spp. *Spodoptera* against the bio-pesticides.

Keywords: Entomopathogenic fungi, *Spodoptera*, Lipid peroxidation and antioxidant enzymes.

STUDIES ON THE PRODUCTIVITY AND PROFITABILITY OF SESAME BASED INTERCROPPING WITH KHARIF CROPS UNDER DIFFERENT WEED MANAGEMENT PRACTICES

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The experiment was conducted during two consecutive Kharif seasons of 2015 and 2016 at SIF, C.S. Azad University of Agriculture and Technology, Kanpur-208002 (U.P.). The experiment consisted 12 treatments having four intercropping viz; sesame + maize (4:1), sesame + maize (8:2), sesame + urd (4:1) & sesame + urd (8:2) and three weed management practices viz; Hand weeding, Pre-emergence of Pendimethaline 30% EC@3.0L/ha and Early post-emergence of Alachlor 50 % EC@0.75kg/ha replicated four times. The experiment was laid out in Factorial Randomized Block Design. The soil of the experimental field was sandy loam in texture with pH of 7.58 and EC of 0.20 mmhos/m at 25°C. The main crop as Sesame of Shekhar variety and sub crops as Maize of P-3441 variety and Urd of Shekhar-2 variety were used in the study year. Result showed that the all weed population were counted lowest Sesame + Urd (8:2) intercropping treatment. The intercropping system influence significantly the growth and yield attributes of sesame, maximum value of these parameters was with Sesame + Urd (8:2) intercropping. The significantly maximum grain and straw yield, Sesame equivalent yield, gross income, net income and B: C ratio of Sesame as main crop was recorded in Sesame + Urd (8:2) treatment over rest treatment, respectively during both the years. The system productivity and system profitability of Sesame as main crop was significantly increased with Sesame + Urd (8:2) compared to as rest intercropping treatment during both years, respectively. The treatment of Sesame + Urd (8:2) was found significantly protein content and oil content over Sesame + Maize (4:1), Sesame + Maize (8:2) and Sesame + Urd (4:1) intercropping treatments, respectively. Among weed management practices in hand weeding reduced weed population over chemical weed management practices as Pre-emergence of Pendimethaline and Early post-emergence of Alachlor, respectively. Significant improvement in growth and yield attributes was recorded with the application of hand weeding. The Hand weeding a positive effect on grain and stover yield, economic as gross income, net income and B: C ratio of sesame when the significant response was noted over Pendimethaline and Alachlor weedicides in both years of study. The response of weed management practices was significantly noted in hand weeding practices in respect to grain and stover yield of sub crops (Maize and Urd). The system productivity and profitability, protein content and oil per cent with hand weeding practices were significantly more than both chemical control of pre-emergence of Pendimethaline and early post-emergence of Alachlor, respectively in both the years.

Keywords: Sesame, Maize, Urd, Sesame equivalent yield, gross income, net income, B:C ratio, Productivity, Profitability, Weed management.

GENETIC EVALUATION OF CUCUMBER (*CUCUMIS SATIVUS* L.) STRAINS FOR DIFFERENT GROWTH, YIELD, QUALITY AND SEED PARAMETERS

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Thirteen strains of cucumber (*Cucumis sativus* L.) were evaluated at Horticultural Research Centre, Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand (India) to study the variability, heritability and genetic advance for growth, yield, quality and seed parameters. The analysis of variance revealed highly significant differences for almost all the characters. The perusal of present investigation indicated that the values of phenotypic coefficient of variation (PCV) were higher than the genotypic coefficients of variation (GCV) for all characters studied. The genotypic coefficients of variation and phenotypic coefficients of variation were moderate to low for all the characters except number of nodes bearing first male flower (33.02%, 33.66%). The high magnitude of heritability high estimated genetic advance over mean were found highest for length of fruit (100%, 58.40%), weight of fruit (99%, 39.92%), length of vine (98%, 36.12%), number of seeds per fruit (98%, 50.16%), number of nodes per vine (97%, 53.57%), number of fruits per vine (97%, 44.33%), number of nodes bearing first male flower (96%, 66.74%), TSS (96%, 44.25%), calcium content (95%, 21.75%), number of nodes bearing first female flower (94%, 58.36%), duration of harvesting (93%, 36.04%), total fruit yield per vine (92%, 35.93%) and diameter of fruit (92%, 35.80%) thus indicating that these characters had additive gene effect and therefore, they are more reliable for effective selection.

Keywords: Genetic, Phenotype, Coefficient, Variation and Heritability

GENOME-WIDE SELECTION IN CROP IMPROVEMENT

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Plant breeding largely depends on phenotypic selection in plots and only for some, often disease-resistance related traits, uses genetic markers. The more recently developed concept of genomic selection, using a black box approach with no need of prior knowledge about the effect or function of individual markers, has also been proposed as a great opportunity for plant



breeding. Several empirical and theoretical studies have focused on the possibility to implement this as a novel molecular method across various species. Although we do not question the potential of genomic selection in general, in this Opinion, we emphasize that genomic selection approaches from dairy cattle breeding cannot be easily applied to complex plant breeding. Association analysis is used to measure relations between markers and quantitative trait loci (QTL). Their estimation ignores genes with small effects that trigger underpinning quantitative traits. By contrast, genome wide selection estimates marker effects across the whole genome on the target population based on a prediction model developed in the training population (TP). Whole-genome prediction models estimate all marker effects in all loci and capture small QTL effects. Here, we review several genomic selection (GS) models with respect to both the prediction accuracy and genetic gain from selection. Phenotypic selection or marker assisted breeding protocols can be replaced by selection based on whole-genome predictions in which phenotyping updates the model to build up the prediction accuracy.

Keywords: Genome Selection Quantitative Trait Loci, Training Population ,Phenotypic Selection ,Marker Assisted Breeding And Whole-Genome Predictions

GLOBAL BIODIVERSITY CHANGE

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Global biodiversity change is one of the most pressing environmental issues in the present time. The two components of biodiversity change are biodiversity alterations and biodiversity loss—across four dimensions of biodiversity: species extinctions, species abundances, species distributions, and genetic diversity. Biodiversity is changing at unprecedented rates in human history: Species are becoming extinct or closer to extinction; mean species abundances of several taxa are decreasing; species are shifting their ranges in response to climate change; and domestic and wild genetic diversity are being lost. The major direct drivers of biodiversity change are habitat change and overexploitation. Pollution, exotic species, and disease are also important drivers. Upstream from the direct pressures on biodiversity, there are indirect drivers of biodiversity change. Major indirect drivers for biodiversity include population growth, energy use and energy production, diet, and food demand. Climate change is an emerging driver of biodiversity change. Human population growth and human resource use are the underlying indirect drivers of biodiversity change. There have been some important successes in biodiversity conservation—mainly through species management, protected areas, and increased societal awareness. Farmland abandonment is an opportunity for biodiversity restoration. Biodiversity change should be assessed in relation to its consequences for ecosystem services and species existence values.

Keywords: extinctions, species, abundance, range, land-use, climate

EFFECT OF GLOBAL WARMING: PROSPECTS

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Global warming occurs when carbon dioxide (CO₂) increase in atmosphere and other air pollutants and greenhouse gasses collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. In latest years, China has taken the front in global-warming pollution, producing about 28 percent of all CO₂ emissions. The United States comes in second in position. Although making up just 4 percent of the world's population, we produce a massive 16 percent of all global CO₂ emissions as much as the European Union in third and India is the fourth place. Every year consequences of global warming, and various agree that environmental, economic, and health consequences are likely to occur if current trends continue. Some effects of global warming on environment -Melting glaciers, early snowmelt, and severe droughts will cause more dramatic water shortages and increase the risk of wildfires, rising sea levels will lead to coastal flooding on the Eastern Seaboard and Gulf of Mexico. Forests, farms, and cities will face difficult new pests, heat waves and increased flooding. All those factors will damage or destroy agriculture and fisheries. Disturbance of habitats such as plant and animal species to destruction. Allergies, asthma, and infectious disease outbreaks will become more familiar due to increased growth of pollen-producing ragweed, higher levels of air pollution, and spread of conditions favorable to pathogens and mosquitoes. Positive effects of climate change are greener rainforests and enhanced plant growth, increased vegetation and possible increases in plankton biomass in some parts of the ocean. Harmful responses may include pollution of fresh water, increased incidence of natural fires, extensive vegetation disappear due to the droughts, change in resettlement patterns of birds and animals, changes in seasonal periodicity, disruption to food chains and species loss.

Keyword: Global warming, air pollutants, CO₂ emissions, habitats



INSECT CONSERVATION: A SYNTHETIC MANAGEMENT APPROACH**Gompa Sowdhamini*, M. A. Laichattiwar and R. S. Meena**

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Insect diversity is threatened by a range of factors from habitat loss and invasive alien organisms to environmental contamination and biological control. These threats are being supported by the joint impact of habitat loss and global climate change. Recent research on insect conservation has elucidated some basic principles for conservation management. Six basic principles have been outlined for synthetic conservation management of the insects. They are maintain reserves, maintain quality landscape heterogeneity as much as possible, reduce the contrast between remnant patches and neighbouring disturbed patches, outside reserves introduce land sparing i.e. where 'high-yielding agriculture is practiced, requiring a smaller area of land to attain the same yields and therefore leaving greater areas of natural habitat untouched, simulate natural conditions and disturbance, connecting similar patches of quality habitat. These six principles constitute a coarse-filter, landscape approach. Permeating all six is the principle of maintaining healthy population levels, which require the combined support of the metapopulation trio of large patch (habitat) size, good patch quality, and reduced patch isolation. In addition to these six coarse-filter principles is an overlay of the fine-filter, species approach, in which particular species are given focused attention and management.

Keywords: Insect conservation, Management strategies, Synthetic management, Threats**EFFECTS OF SOWING DATES ON YIELD ATTRIBUTES AND YIELD IN MAIZE (*ZEAMAYS* L.) HYBRIDS SOWN IN KHARIF SEASON****Govind Prasad*, Mehar Chand, Pawan Kumar and Ajay Singh**

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A field experiment was conducted during *Kharif* 2012 to study the effect of different dates on yield attributes and yield of different maize (*Zea mays* L.) hybrids. The experiment consists of four dates of sowing (15th June, 25th June, 5th July and 15th July) in main plot and five maize (*Zea mays* L.) hybrids of different maturity groups namely, HQPM-1 (long), HM-4 (medium), HM-5 (long), HM-6 (early) and HM-7 (extra early) in sub plot was replicated thrice in split plot design. The 10 days advance, normal and 10 days delayed sowing from normal sowing date being at par recorded significantly higher cob length, cob girth, 100 grain weight, shelling percent and grain yield/ha as compared to delayed sowing by 20 days from normal sowing date. Highest cob length was recorded in HM-4 (15.6 cm) followed by HQPM-1 (14.2 cm), HM-6 (13.4 cm), HM-7 (12.9 cm) and lowest in HM-5 (12.1 cm). Highest shelling percent was recorded in HQPM-1 (67.8 %) followed by HM-6 (65.1 %), HM-4 (63.6 %), HM-7 (62.3 %) and lowest in case of HM-5 (58.5 %). Hybrid HM-5 recorded highest cob girth (4.3 cm), 100-grain weight (27.0 g) and grain yield (7.64 t/ha).

Keywords: 100-grain weight, cob girth, cob length, grain yield, maize hybrid**GOVERNMENT POLICIES FOR SUSTAINABLE DEVELOPMENT OF AGRICULTURE****Devegowda S R*, Mukesh Kumar, Kalpana Kumari and Preeti Lata Singh**

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The word “sustainable development” signifies as development to achieve the certain needs of present situation neither extracting more of present resources nor compromising for future needs, while by transporting the situation in to sustainable development by the government, taking up deterministic policies centered on agriculture in the long term development, sustainable inclusive development to substantial judicious use of resources in agriculture for purpose of creation of hunger free nation. United Nations adopted agenda for sustainable development by 2030, consisting of 17 Goals that address the key concerns of humanity and 169 interlinked targets within these goals that reflect the complex and interrelated nature of social, economic and ecological well-being parameters. Further it aims to relate the sustainable agriculture system with the traditional system and the current system in practice, across the extents of ecological, economic and social sustainability. It also tries to give long term solutions to solve the problems plaguing the system so that sustainable practices can be encouraged and practiced for the overall policies of government for the efficient justifiable development in the economic growth in Indian agriculture.

Keywords: Agriculture, Inclusive, Policies, Sustainability.**GENETIC ANALYSES OF RESISTANCE TO SPOT BLOTCH DISEASE IN F₂ GENERATION IN WHEAT****Harsha S***

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Wheat is one of the most important staple food crop in the world. India is the second largest producer of wheat in the world. Spot blotch, caused by *Bipolaris sorokiniana*, is an important wheat disease in the warmer and humid growing regions of the world. Its importance has increased recently as the production of wheat has expanded into newer growing areas. Surveys indicate that spot blotch has become a serious disease constraint for wheat cropping in several parts of the world. The average yield loss due



to spot blotch in South Asia and India has been estimated to be 19.6% and 15.5%, respectively (Dubin and van Ginkel, 1991). Several attempts have been made to control spot blotch but no single control measure has been successful. Hence an integrated approach with host resistance as a major component is considered necessary (Joshi *et al.*, 2002). Even if it is incomplete, any degree of resistance will complement chemical and other control measures (Joshi and Chand, 2002). Inheritance studies on resistance to spot blotch are limited and the nature of inheritance is still debatable. Reports indicate both monogenic and polygenic types of resistance. However, the experience of wheat workers to achieve partial resistance in breeding populations has suggested a polygenic type of resistance. The present investigation is under taken to further enhance knowledge on the genetics of resistance and susceptible to spot blotch in wheat crop.

Keywords: Staple food, Humid, Survey, Integrated, Resistance, Susceptible, Monogenic, Polygenic

INTEGRATED DISEASE MANAGEMENT OF TOMATO WILT CAUSED BY *FUSARIUM OXYSPORUM* F. SP. *LYCOPERSICI*

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Tomato (*Solanum lycopersicum* L.) ranks first amongst all the fruits and vegetables as a source of vitamins, minerals and phenolic antioxidants. Tomato production is constantly threatened by biotic constraints, mainly fungal diseases among which *Fusarium* wilt of tomato caused by *Fusarium oxysporum* f.sp. *lycopersici* causes serious economic loss. Use of bio-control agents alone or in integration with Carbendazim may be advised to the farmer as an eco-friendly approach for profitable farming. *Trichoderma harzianum*, *Bacillus subtilis* and *Pseudomonas fluorescens* were tested *in-vitro* for their antagonistic activity against *Fusarium oxysporum* f.sp. *lycopersici*. The antagonistic potentiality of *Trichoderma harzianum* was determined by dual culture technique that resulted in 25.4% inhibition of the growth of *F.oxysporum* f.sp. *lycopersici* in presence of bio-control agent (*T.harzianum*). Antagonistic activity of bacterial bio-control agents was determined through Well Diffusion Technique and results revealed maximum Zone of Inhibition (ZOI) with *Bacillus subtilis* (29.9 mm) followed by *Pseudomonas fluorescens* (25.6 mm). The effect of *T. harzianum*, *B. subtilis*, *P. fluorescens* and systemic fungicides against *F.oxysporum* f.sp. *lycopersici* was tested in glasshouse and field conditions. Seedling treatment with a combination of *T. harzianum* and Carbendazim recorded better biometrics of tomato crop (root-shoot length, yield, vigour index), germination% and significantly reduced wilt incidence as compared to single application of bio-agents or Carbendazim or of combinations of bacterial and fungal bio-agents. Among the various seedling treatments, a combination of 0.2% Carbendazim and 2% *T. harzianum* recorded the maximum germination percentage (86.70% and 77.73%) and significantly reduced the wilt incidence (13.33% and 22.27%) on tomato in glasshouse and field conditions respectively.

STUDIES ON THE EFFECT OF VERMICOMPOST ALONG WITH NPK DOSES ON THE GROWTH AND YIELD OF INDIAN MUSTARD (*BRASSICA JUNCEA* L.) IN EASTERN UTTAR PRADESH

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A field experiment was conducted during the winter (Rabi) season of 2015-16 at National Post Graduate College, Barahalganj, Gorakhpur on silty-loam soil to study the effect of integrated nutrient management on growth and yield of Indian mustard (*Brassica juncea* L.) under four levels of vermicompost and three levels of recommended dose of fertilizers (RDF). The experiment was laid out in Randomized Block Design (Factorial) with combination of 12 treatments viz.(1) 50%RDF (2) 75%RDF (3) 100%RDF (4) 50%RDF+2t/ha vermicompost (5) 75% RDF+2t/ha vermicompost (6) 100% RDF+2t/ha vermicompost (7) 50% RDF+4t/ha vermicompost (8) 75% RDF+4t/ha vermicompost (9) 100% RDF+4t/ha vermicompost (10) 50% RDF+6t/ha vermicompost (11) 75%RDF+6t/ha vermicompost (12) 100%RDF+6t/ha vermicompost. Result revealed that the seed yield of mustard was recorded maximum 17.4 q/ha at 6 t/ha vermicompost, which was at par 4 t/ha. Calculated gross income (Rs. 41824/ha) and net profit (Rs. 18677/ha) were obtained at 4 t/ha vermicompost, which was at par 6t/ha vermicompost, respectively. Seed yield of mustard increased statistically with increased level of fertility. It was highest 16.55 q/ha at 100% RDF. The maximum expenses (Rs. 20351/ha) on mustard was with 100% RDF and minimum (Rs. 19199/ha) with 50% RDF. Gross return (Rs. 39196/ha) due to sale of seed yield was higher at 100% RDF over other remaining treatment, respectively.

ECONOMIC CONTRIBUTION OF WOMEN: AN OVERVIEW

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Women constitute 48.46 % of India's population but their representation in government and private sector jobs is very limited as it is evident from the census 2011 that Worker Population Ratio (per 1000) is shared by 819 males as against 336 females. This condition is the result of the perception of women contribution in the society i.e., on the ground of gender. Gender refers to the socially constructed roles, behaviours, activities, and attributes that a given society considers appropriate for men and women (WHO). The issue of gender inequality needs to be addressed for harnessing the economic potentialities trapped in women population. Gender inequalities include unequal rights, responsibilities, and opportunities for women and translate to poor



health status, educational attainment, and economic status compared to men. Gender inequality in India is a multifaceted issue that concerns men and women alike. There is a need to provide them equal employment opportunities to play an effective part in the development of society by being economically self-reliant. An analysis is required to look at the potentials of employment in reducing gender inequality.

Keywords: Gender inequalities, Employment, Worker Population Ratio, Opportunities

QUALITATIVE ANALYSIS OF SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH) UNDER DIFFERENT POTASSIUM LEVELS

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Sorghum (*Sorghum bicolor* (L.) Moench) is the fifth important cereal crop which is well adapted to semi-arid regions of the world occupying where salinity and drought are the chief environmental factors affecting crop productivity. It is a basic staple human food for many rural communities in many parts of the world and has a high forage value. In the present study, the effect of different potassium levels (0, 20, 30, 40, 50 and 60 kg K₂O/ha) were studied on the quality of sorghum variety HJ 541. The highest green fodder yield (494.5 q/ha) and dry matter yield (131.2 q/ha) were recorded with application of 40 kg K₂O/ha which were significantly superior to 0 and 20 kg K₂O/ha. Highest crude protein content (13.2 q/ha) and digestible dry matter (66.7 q/ha) yields were also recorded with 40 kg K₂O/ha which were significantly superior over 0 and 20 kg K₂O/ha. The HCN content ranged from 35 to 51 µg/g on fresh weight basis and was below the toxic limit. Decreasing trend was observed in HCN content with increasing levels of potassium. Crude protein content and IVDMD were not affected by different potash levels. Highest phosphorous (P) content (0.21 %) and potassium (K) content (1.36 %) were recorded with 50 kg K₂O/ha and were significantly superior over 0 and 20 kg K₂O/ha. Similarly, highest P uptake with 50 kg K₂O/ha and K uptake with 40 kg K₂O/ha were significantly superior over 0 and 20 kg K₂O/ha. Therefore, the present study indicated that potassium level at 40 kg K₂O/ha had the best quality and yield in sorghum among the given treatments.

Keywords: Crude protein, potassium, quality, sorghum, yield

ICT FOR AGRICULTURAL DEVELOPMENT IN INDIA

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Agriculture is one of the divers industry which are increasing rural income as well as long term stability of its natural resources. This can create different activities which will affect farmers, and stakeholder. ICT is any device, tool, or application that permits the exchange or collection of data through interaction or transmission. Information and communication technologies are the incorporated with different devices such as radio, television, mobile phones, computer, and internet. Information and communication technologies are increasing day by day in agriculture sector for obtaining the information about related issues, problems and their solutions. In the context of agriculture development, information and communication technologies have played central role in developing countries like India. Information and communication technologies can be used for distance learning programs. It helps the farmer for learning new approaches and technologies for the use of agriculture development in India. These technologies can provide information on weather, marketing. Empowerment of poor farmers with information and communication assets and services that will increase their productivity and incomes as well as defend their food security and livelihoods. ICT initiatives aim to provide locally relevant content to farmers which help in reducing the expert-farmer gap. All efforts are made to make content relevant, accessible and reliable knowledge sources.

Keywords: ICT, Agriculture, Farmer, Market, Income

ISOLATION, SCREENING AND CHARACTERIZATION OF LACTIC ACID BACTERIA ISOLATED FROM FERMENTED FOOD AND THEIR ANTIMICROBIAL ACTIVITY AGAINST THE FOOD PATHOGENS

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To isolate, characterize and identify lactic acid bacteria (LAB) in fermented food. This study describes a search for lactic acid bacteria capable of exo- polysaccharide production or exhibiting antimicrobial or proteolytic activities. In this study fifty (25) samples were collected from different region, for the isolation of lactic acid bacteria from fermented food and check their ability to inhibit the growth of pathogenic microorganisms. In this study, lactic acid bacteria were isolated using MRS media at 37°C for 48 hour. The isolates was identified by the morphological, and biochemical characterization and produced lactic acid purified by ammonium sulphate precipitation. Antagonistic effects of lactic acid were studied by agar well diffusion method. Lactic acid stability was studied in different temperature and pH. In this study show that lactic acid could be successful use as a food preservative and to increase the life of the food products and function as natural antimicrobial compound.



BIOFORTIFICATION IN VEGETABLE CROP

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The developing countries like India face many challenges such as fastest population growth, hunger, malnourishment of vitamin & micronutrients (hidden hunger) etc. For a decade our traditional breeding approach mainly focussed on improving crop productivity, biotic and abiotic stress management etc., against priority towards nutritional security. Vegetables are the principal source of micronutrients and have high potential to alleviate malnutrition, hidden hunger and degenerative disease like cancer etc. One such approach to combat the issue of micronutrient malnutrition is through biofortification, it is a practice of nutrient fortification into vegetable crops using agronomic, conventional and transgenic breeding methods. It provides an excellent chance for vegetable breeders to fulfil human nutritional requirements by making available nutritionally rich vegetable cultivars with added nutraceutical value to the most vulnerable people (especially in remote areas) through inexpensive and cost effective ways compared to any other mode. In agronomical approach, the micronutrients level in edible portion can be increased through application of fertilizers. Crops which have sufficient genetic variation for the micronutrients in the genotypes, parental lines with high vitamin or minerals levels can be inter-crossed over several generations to produce plants that have desired traits. But when there is the unavailability of nutrients sufficient genetic variation in crops, the application of genetic engineering offers valid alternatives for increasing the concentration of micronutrients in the edible crop tissues. In recent years, the improvement in the nutritional quality of vegetables has been added as an additional breeding approach. Thus, Biofortification is an attempt to reach malnourished population by delivering naturally fortified vegetables to people, especially in rural areas. Many crops are being covered in Harvest plus programme recently e.g. Vitamin A fortified Cassava, high iron fortified French bean etc.

Keywords: Biofortification, nutrition, malnourishment, vegetable, breeding

THE IMPACT OF CLIMATE CHANGE ON SOILS AND ON THEIR WATER MANAGEMENT

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Human activities result in changes in the global environment, sometimes with severe consequences for our future life. Changes in the gas composition of the atmosphere – partly due to CO₂ and ‘greenhouse gases’ emission – may lead to a rise in temperature with high spatial and temporal variability, to alterations in the global circulation processes, and to a serious rearrangement of atmospheric precipitation, increasing aridity in some locations. These modifications are reflected sensitively by ecosystems (natural vegetation and land use pattern) and by considerable alterations in soil formation and degradation processes, in soil properties and soil functions. The potential impacts of the forecasted climate change reservoirs are briefly summarized in the present paper with special regard to soil water management, soil moisture regime and their influences on the main soil degradation processes. Based on this analysis, conclusions are drawn regarding the possibilities of sustainable soil moisture and the required measures of rational control: increasing water use efficiency; reducing evaporation, surface runoff, seepage and filtration losses; increasing water storage capacity and available moisture range of soils.

Keywords: climate change, soil formation and degradation processes, infiltration, water storage capacity, soil moisture control.

RECENT ADVANCES IN CONSERVATION OF NATURAL ENEMIES

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Natural enemies of arthropod pests, which are well known for their efficacy as potential biological control agents, include predators and parasitoids that occur in all production systems from commercial fields to backyards. Their conservation and enhancement is of great utility and cost-effective. Natural enemies suffer severely from the two major factors viz the use of broad-spectrum pesticides and absence or destruction habitat that provide food resources, shelter sites, egg-laying places etc., during the vegetation period. Furthermore, unfavorable environmental conditions and lack of overwintering shelters during hibernation are causing high mortality among beneficial insects. Habitat management, a form of conservation biological control, is an ecologically based approach aimed at favoring natural enemies and enhancing biological control in agricultural systems. The goal of habitat management is to create a suitable ecological infrastructure within the agricultural landscape to provide resources such as artificial structure, food, alternative prey or hosts, insectary plants, shelter from adverse conditions, mediating host-prey accessibility, providing host prey finding cues, hedgerow establishment, cultural practices like trap crop, intercrop, relay crop, cover crop for enhancing the natural enemies effectiveness. Rationalizing the use of pesticides and the proper modification of environmental conditions, good synchronization with availability of suitable stages of the pest may conserve natural enemies and increase their efficacy. Plant volatiles also act as feeding and ovipositional attractant also play a critical role as signals in tri-trophic level interactions. Many flowering plants have evolved ways to attract natural enemies, pollinators and insects. The insects they catch are only used as dietary supplements. These plants can be grown in greenhouse also to control pests. The idea for conservation of natural enemy to improve biological control of crop pests is an appealing concept. In light of this crucial role, we suggest ways of manipulating morphological and chemical attributes of a crop plant for a more sustainable and balanced control of insect-pest in agro ecosystem.



GENETICS OF SOME YIELD AND QUALITY TRAITS IN BASMATI RICE (*ORYZA SATIVA* L.) TO IDENTIFY HETEROTIC COMBINATIONS, USING DIALLEL MATING DESIGN

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The present investigation was undertaken to determine the extent of variability, combined ability effects, and heterosis for different quantitative and qualitative characters in scented Basmati rice (*Oryza sativa* L.) accessions collected from diverse sources. The experimental material consisted of 6 parents and 15 crosses which were planted in Randomized Block Design with two replications during *khari* 2015 at Research Farm, Institute of Agricultural Sciences, B.H.U, Varanasi. The observations were recorded on eight yield traits viz., days to 50% flowering, days to maturity, plant height, main panicle length, effective tillers per plant, number of seeds per panicle, 100 seed weight, and grain yield per plant. Furthermore, the observations on seven quality parameters viz., kernel length, kernel breadth, kernel length after cooking, kernel breadth after cooking, Alkali Spread Value (ASV), and amylose content were also made. Analysis of Variance (ANOVA) for all the eight yield traits showed significant differences among treatments, parents, hybrids and parent vs. hybrids. Similarly, ANOVA for six quality traits revealed significant differences among all the above-mentioned sources except parent vs. hybrids group for kernel breadth after cooking and ASV. The crosses also exhibited considerable variability for all the traits studied, ranging from 2.06 to 2.82 g for 100 grain weight, 104.21 to 151.09 cm for plant height, 14.09 to 36.70 for effective tillers per plant, 23.87 to 36.96 cm panicle length, 102 to 244.26 seeds per panicle, 28.29 to 89.88 g grain yield, 7.04 to 8.79 mm for kernel length, 1.57 to 1.97 mm for kernel breadth, 11.95 to 16.85 mm for kernel length after cooking, 2 to 2.55 mm for kernel breadth after cooking, 3.36 to 6 for ASV, and 19.72 to 27.78 for amylose content. These results indicate that there is ample scope for selection of promising genotypes from the materials under study for yield and quality improvement. Based on the Specific Combining Ability effects (SCA), HUBR10-9 x B 370 was the best specific cross for seeds per panicle, grain yield, amylose content and days to 50% flowering. Maximum significant better parent heterosis values for different characters viz., days to 50% flowering was shown for plant height by HUBR10-9 x Type 3 (47.65**), for effective tillers by HUBR 10-9 x Sanowal Basmati (94.08**), for panicle length by B 370 x T. basmati (13.98**), for seeds per panicle by HUBR 10-9 x B 370 (56.59**), for 100 grain wt. by Type 3 x Sanowal Basmati (21.96**), and for grain yield per plant by HUBR 10-9 x B 370 (141.50**). In the case of quality characters, for kernel length maximum significant better parent heterosis values was shown by B 370 x Sanowal Basmati (22.34**), for kernel length after cooking by B 370 x Sanowal Basmati (15.57**), and for amylose content by HUBR 16 x Type 3 (8.92**). Thus it can be said that the uniqueness of this study lies in crosses having higher positive significant value of SCA effect showed higher heterosis value for all the characters. Careful development of such crosses can be extremely beneficial as it may help to sustain our ever-growing population and reflect India as a major producer of quality rice all over the world.

Keywords: Rice, grain characteristics, cooking quality, general and specific combining ability, heterosis.

COMPARATIVE PERFORMANCE OF F₁ HYBRIDS OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) UNDER NATURALLY VENTILATED POLYHOUSE, SHADENET HOUSE AND OPEN FIELD CONDITIONS

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The field experiment entitled, "Comparative performance of F₁ hybrids of okra (*Abelmoschus esculentus* L. Moench) under naturally ventilated polyhouse, shadenet house and open field condition" was carried out at Department of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri (M.S.) in the year 2014 in Split Plot Design with 3 replications. There were two factors studied in experiment viz. a) growing conditions and b) F₁ hybrids. The growing conditions were taken as main plot treatment and F₁ hybrids were taken as sub plot treatment. Three growing conditions studied were GC₁ (Naturally ventilated polyhouse), GC₂ (Shadenet house) and GC₃ (Open field). The four hybrids used were V₁ (OH-152), V₂ (Bhendi NS- 851), V₃ (Bhendi No- 10) and V₄ (NOH- 1258). The variety V₅ (Varsha Uphar) was used as control. While observing the effect of growing conditions, GC₁ showed the highest plant height (2.00 m), internodal length (8.97 cm), number of nodes (22.36), leaf area (221.97 cm²), days to last harvest (109.19). With regard to variation in F₁ hybrids, significantly the highest height of plant (1.66 m) at last harvest and number of nodes (21.79) were observed in V₁. Further, the highest internodal length (9.09) and the highest leaf area (214.16 cm²) was recorded in V₃. While observing the interaction effect of growing conditions and F₁ hybrids, the highest plant height (2.24 m) at the last harvest is in treatment combination GC₁ V₂. Lowest internodal length (6.69 cm) is in treatment combination GC₃ V₄. Fruit yield per plant (0.28 kg), fruit yield per m² (2.08 kg), yield per ha (16.47 t) and leaf area (245.86 cm²) were the highest in the treatment combination GC₃ V₃.

Keywords: Comparative performance, F₁ hybrids, naturally ventilated polyhouse, shadenet house, open field.



EFFECT OF NAA AND GA3 ON GROWTH ATTRIBUTES OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)**Jayram Patidar, Rajesh Lekhi and Om Prakash Prajapati**

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This study was conducted with the objective to determine the effects of Gibberellic acid (NAA) and (GA₃) on growth and yield of tomato. The experiment involve ten number of treatments combination with three replication there were three levels of GA₃ (10 ppm, 15 ppm and 20 ppm respectively) and three levels of NAA (15 ppm, 20 ppm and 25 ppm respectively). In general, it was observed that G₃ (GA₃ @ 20 ppm) was found significantly superior followed by G₂ (GA₃ @ 15 ppm) and G₁ (GA₃ @ 10 ppm) over control. As regards NAA, N₃ (NAA @ 25 ppm) was found significantly superior followed by N₂ (NAA @ 20 ppm) and N₁ (NAA @ 15 ppm) over control. The interaction effect of GA₃ and NAA showed significant effect on various characters. It was revealed that treatment G₃N₃ (20 ppm GA₃ + 25 ppm NAA) which was at par to G₃N₃ (15 ppm GA₃ + 20 ppm NAA) in maximum observations while the minimum value was recorded under control.

Keywords: Tomato, *Lycopersicon esculentum* Mill, GA₃, NAA, Spray, PPM, Growth.**FOOD SECURITY AND CROP PRODUCTION SUSTAINABILITY THROUGH BALANCE NUTRITION****Pavan Singh**

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Food security developed over the last 50 or more years addressed primarily the need for the production and access to adequate food grains to feed the world's increasing population. The principal challenges in both systems are similar: (1) there is no compelling evidence for significant increases in the genetic yield potential in both systems during the past 30 years, (2) farm yields are presently about 40-65% of the attainable yield potential, and (3) nutrient management mostly relies on approaches that do not account for the dynamic nature of crop response to the environment. Because average farm yield levels of 70-80% of the attainable yield potential are necessary to meet expected food demand in the next 30 years. Globally the ratio of N: P₂O₅: K₂O changed from 2.5:1.3:1 in the 1980s to 3.6:1.4:1 in 2002 as N consumption outstripped that of K. Balanced and timely application of nutrients needs to be demonstrated through different parameters according to the prevailing agro-climatic conditions. avoided. Food production systems must operate to be socially acceptable, environmentally benign and economically viable. As the availability of land and water resources is rapidly declining, there is urgent need to increase the productivity of remaining natural resources, including energy, while at the same time observing nutrition and environmental needs. Fertilizer can increase food grain production, release marginal lands from production and reduce environmental degradation and reduce the risk and uncertainty associated with the production of agricultural commodities.

Keywords: Food Security, Crop Production, Balance Nutrition**PRECISION FARMING IN SOLANACEOUS CROPS****Debarati Datta¹ and Sourav Ghosh²**¹ PhD Research Scholar, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India² PhD Research Scholar, Indian Agricultural Research Institute, Pusa, New Delhi, Pin-110012, India

Precision Farming' or 'Precision Agriculture' aims at increasing productivity, resource efficiency, decreasing production costs and minimizing the environmental impact of farming. Brinjal, tomato and potato are the important vegetable crops in India. India ranks 2nd, 3rd and 2nd in area, 2nd, 2nd and 3rd in production and 8th, 10th and 4th in productivity for brinjal, tomato and potato, respectively. Vegetables being short duration and high value cash crops have high scope for implementation of precision agriculture (PA) technologies. Vegetables grown with simple PA technologies like drip irrigation, site specific input management, soil map based fertilizer application, LCC, SPAD have been found to be superior than those grown under conventional techniques- both in yield and quality, with much higher Benefit-Cost ratio. Adoption of precision farming leads to about 80 per cent increase in yield in tomato, 34 per cent in brinjal and 52 percent in potato. Increase in gross margin has been found 165 per cent, 67 per cent and 152 per cent in tomato, brinjal and potato production, respectively. Lack of finance and credit facilities have been identified as the major constraints for non adoption of precision farming. Thus, it has been suggested that development of PA societies, strengthening of marketing channels and providing subsidies on water soluble fertilizers and pump sets of drip irrigation will increase adoption of precision farming in India.

DEVELOPMENT OF TRANSGENIC CHICKPEA (*CICER ARIETINUM* L.) PLANTS WITH *OSRUVB* GENE FOR SALT STRESS TOLERANCE**Preeti and Pushpa Kharb***

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Chickpea (*Cicer arietinum* L.), also known as bengal gram or channa, is an edible legume. It is a self pollinating diploid (2n=2x=16) with genome size of 740 Mb. In India, it tops the list of pulse crops with a total production of 8.83 million tons with an average yield of 925.5 during 2015-16. In addition to biotic stresses, chickpea faces various abiotic stresses such as drought, cold, terminal heat and salinity etc. Chickpea production is adversely affected due to salinity in arid and semi-arid regions



of the world as salt stress reduces water potential, creates imbalance in ion concentration and causes toxicity. RuvB is a helicase found in bacteria but now several reports show its presence in plants like *Oryza sativa* where it is required for normal levels of genetic recombination and DNA repair, by which the plant overcomes salt stress. We have developed transgenic chickpea plants with *OsRuvB* gene for salinity tolerance by using in planta transformation method for which patent has been granted (Kharb *et al.*, 2012). The putative T₀ plants were screened by PCR analysis and the PCR positive plants with transformation efficiency of 17% were observed. The plants are further being characterized for integration, expression and transgene copy number using suitable molecular techniques.

THE ROLE OF REMOTE SENSING IN PRECISION AGRICULTURE

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Advances in technologies 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. Precision agriculture is an emerging farm management strategy that is changing the way people farm. At present, there is an increasing commitment to reduce reliance on excessive chemical inputs in agriculture. Numerous technologies such as Global Positioning Systems (GPS), Geographic Information Systems (GIS), remote sensing and simulation modelling have been applied to make agricultural products safer and to lower their adverse impacts on the environment, a goal that is consistent with sustainable agriculture. With increasing population pressure throughout the world and the need for increased agricultural production, there is a definite need for improved management of the world's agricultural resources. To make this happen, it is first necessary to obtain reliable data on not only the types of resources, but also the quality, quantity and location of these resources. Satellite-or aerial-based RS technologies will become important tools in improving the present system(s) of acquiring and generating agricultural and natural resource data. As a results Precision agriculture has emerged as a valuable component of the framework to achieve this goal.

Keywords: Sustainable agriculture, Precision agriculture, Global Positioning Systems (GPS), Geographic Information Systems (GIS) and remote sensing.

EFFECT OF SULPHUR AND ZINC APPLICATION ON YIELD THEIR CONTENT AND UPTAKE BY MUSTARD

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In a field experiment were conducted in two consecutive years i.e. 2013-14 and 2014-15 at Kulbhaskar Ashram Post Graduate College, research farm, Allahabad (UP). Application of four levels of sulphur i.e. 0, 20, 40 and 60 Kg/ha and four levels of zinc i.e. 0, 4, 8 and 12 Kg/ha was applied as per treatment combination, caused significant increased in grain yield with sulphur and zinc levels during both the years. The yield varied from 14.32 to 15.74 q/ha and 15.98 to 18.53 q/ha during first year and second year, respectively and maximum yield was recorded at S4 level and Zn4 levels 15.74q/ha and 18.53q/ha, respectively. Sulphur content and uptake by mustard crop increased significantly with the increasing levels of S and Zn in Soil. The values of Sulphur and Zinc interaction was significant.

EFFICACY OF BIOPESTICIDES AGAINST TWO IMPORTANT PESTS OF POPULUS DELTOIDES BARTR

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Poplar is a very important and unique agroforestry tree species. During regular surveys in the field this poplar especially *Populus deltoides* was found to be susceptible to insect attack. On identification it was observed that *C.cupreata* and *P.phalantha* are two important defoliators which often cause severe defoliation and almost 80% defoliation in monsoons. It was also observed that severe and repeated attack adversely reduced the growth and the quality of timber. Therefore a promising strategy with potential to control the damage was worked with biopesticides and minimum or no use of hazardous chemicals/insecticides. Similarly the present study deals with testing the efficacy of botanicals (seed kernels of *Jatropha curcas*, rhizome of *Acorus calamus* and leaves of *Adhatoda vasica*) extracted in different solvents (petroleum ether, acetone, methanol and water) with 6 concentrations in distilled water and compared with commercially available Neemexcel (seeds extracted in methanol) against the most devastating stages i.e. 4th and 5th instar larvae of the defoliators. Observations were taken after 24hrs, 48hrs and 72hrs of the treatment. Results showed maximum mortality of both the pests with the seed extractives of *J.curcas* in petroleum ether at 0.6% of concentration after 72hrs. Extractives in petroleum ether was found to be most effective against the target pests followed by methanol extractives. 0.015% concentration was found as the best dose of Neemexcel after 72 hrs of treatment with maximum mean mortality against the 4th instars larvae of *C.cupreata* and *P.phalantha*.

Keywords: Biopesticides, *C.cupreata*, *P.phalantha*, concentration



STRATEGIES FOR PROMOTING AND DEVELOPING FARMER-LED-INNOVATIONS**Akanchha Singh¹ and VLV Kameswari²**¹PhD Research Scholar and ²Professor

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Sustainability and food security are two of the most prominent issues all across the globe. Most countries are facing the challenges of malnutrition, hidden hunger, climate change, nutritional security etc. In case of India the conditions are so diverse that each and every region has its own specific problems and they cannot have the same solutions. Earlier approaches to finding solutions were top-to down that did not work for specific and local situations. Pro-innovation bias and compatibility issues were also major barriers and this led to realization of the importance of farmer wisdom. Participatory approaches took birth after this and one such approach is farmer-led-innovation. Farmer-led innovation are getting recognition as it promotes social learning, recognition of farmers, effective utilization of local resources and harnessing of local potential. Cost consideration, gap between farmer and researcher, lack of documenting agencies are some of the major challenges hindering the wider acceptance of this approach. However, by adopting innovative strategies to involve farmers in innovation-generation process, rewarding and awarding farmers, like promotion through mass media, organizing national, international conferences, exhibitions and adoption of villages can change the situation. Considering this pertinent issue the paper is an attempt to provide an insight into farmer- led –innovation process, need to encourage this approach of innovation-generation and ways and means of speeding up farmers' engagement in generation of innovation.

Keywords: Farmer-led-innovation, Innovation-generation process, Urgency, strategies, Limitations, Organizations**EFFECT OF AUXINS ON PLANT REGENERATION OF WHEAT****Reena Tomer¹, Nidhi Sharma² and Varun Tomer²**¹Department of Microbiology, J.V. College, Baraut- Baghpat, UP, India

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Phytohormones can play significant role in during cyanobacteria mediated transformation. We study effect of three auxins 2,4-D, IBA and NAA used alone on wheat variety C-360, somatic embryogenesis and plant regeneration was studied. Efficiency of growth regulators has been compared at different time intervals. 2,4-D give best yield while IBA shows best proliferation. 2,4-D also give efficient results in inducing nodules in NAA also induce nodules in wheat roots but comparatively less than 2,4-D.

Keywords: Auxin, Wheat, Plant growth regulators, Yield.**CURRENT SCENARIO AND FUTURE OUTLOOK OF INERT DUSTS FOR MANAGEMENT OF STORED PRODUCT INSECTS****Rekha G^{1*} and Ramesh Babu S²**¹ Research Scholar, Department of Entomology, University of Agricultural Sciences, Raichur, Karnataka² Research Scholar, Department of Entomology and Agril. Zoology, Institute of Agricultural Sciences, BHU, Varanasi

Inert dusts have been used traditionally as stored grain protectants. Inert dusts, primarily those based upon activated silica, are finding increasing use as stored grain protectants in the grain industry. These materials can be classified into different groups depending on their composition and particle size. Non-silica dusts and those composed of coarse grain silicates, such as kaolin and sand, have been used traditionally as grain protectants by small-scale farmers in the developing countries. More recently, materials including diatomaceous earths and silica aerogels have been used increasingly in commercial storage in the developed countries, replacing conventional chemicals. These materials have been shown to control a variety of common storage insect pests. They are most effective in conditions of low humidity because they induce mortality by causing desiccation; water is lost because the dusts remove the waxy layer of the cuticle of the exoskeleton by adsorption. These materials are most effective when applied as dusts but some retain activity even when applied as water-based slurry. Modern dusts have overcome some of the health hazards resulting from inhalation, and concerns regarding abrasion of grain handling machinery are lessening. Synthetic dusts are effective in controlling primary pests of cereals and pulses, including larger grain borer. Thus, as well as being increasingly used in commercial farms, these materials may well replace conventional chemicals as protectants of stored grain in developing countries. In recent years, awareness of the consequences of environmental pollution, the increasing cost of storage insecticides and the growing problem of insect resistance has led to pest management. Unlike conventional contact insecticides, inert dusts function through their physical properties and are, therefore, generally slower acting. Insect mortality is induced primarily as a result of desiccation: water loss is a consequence of the destruction of the cuticle. Silica aerogels adsorb the waxy particles from the cuticle surface and although diatomaceous earths, having small dense particles of silicon dioxide, were said to abrade the cuticle they also function by adsorption of wax. However, silica aerogels are more effective than diatomaceous earths or other inert dusts, retaining their activity even at elevated levels of relative humidity. Because the action of these materials is not dependent on metabolic pathways, it has been postulated that insects will not be selected genetically by the action of these dusts, so that



physiological resistance will not occur. Nevertheless, it may be possible for insects to develop a behavioural response to the dust and avoid contact. Another advantage over conventional insecticides is the low mammalian toxicity of these materials. In the USA, diatomaceous earths are 'Generally Recognized as Safe' by the US Food and Drug Administration and are registered for use as food additives.

Keywords: Inert dusts, pulses, desiccation, protectants, stored product insects.

EFFECT OF INORGANIC NUTRIENTS, ORGANIC MANURE AND BIOFERTILIZER ON YIELD AND QUALITY OF WHEAT IN UTTAR PRADESH

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The current experiment on wheat crop was conducted in the farm of C.S. Azad University of Agriculture and Technology, Kanpur during the Rabi season of 2015-16. The doses of experiment were half of the soil test recommendation, recommended doses are as follows, the half of the recommended doses are 75%, 100% and 125% of soil test recommendation, the recommended doses of N₂, P₂O₅ and K₂O are 75%, 37.5% and 12t/ha FYM an Azotobacter respectively. The results showed that the grain yield ranged from 39.21 to 48.51 q/ha and straw yield from 48.09 to 63.28 q/ha. The N content in grain varied from 1.189% to 1.392%, P from 0.328% to 0.386%, K from 0.218% to 0.317% respectively. It was noted that N content in straw ranged from 0.210 to 0.245% , 0.905 to 1.214% and K ranged from 1.23% to 1.52% was noted that the N uptake ranged from 41.24 to 89.35 kg/ha, P from 11.02 to 22.79 kg/ha, K ranged from 7.23 to 18.92 kg/ha. The starch content varies from 61.68% to 67.32%, amylose from 32.44 to 36.50% and amylopectin from 31.52 to 37.32%. The treatment (125%STR + FYM + Azotobacter) gave the best result in terms of nutrient uptake values and crop quality.

ROLE OF ICT IN IMPROVING FARM PRODUCTIVITY

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Access, efficiency and affordability of agricultural information continue to be a major impediment for raising agricultural productivity among smallholders in India. Recently Information and communication technology (ICT) has provided a possible pathway to ameliorate this scenario. A variety of innovations that integrate ICTs into the dissemination of agricultural information to farmers have been developed at local, national and regional levels. Information and communication technology (ICT) have the potential to provide solution to the existing information irregularity in various lagging sectors like agriculture. India's agricultural sector suffers from low growth rates and low productivity. ITC may play an important role in belief and confidence required to influence the adoption of new approach and actions by small farmers. Increased public and private investments will be necessary to bridge the vital infrastructural gaps. Policy changes may also be needed to encourage better access to high-quality inputs and credit for small farmers.

Keyword: ICT, Farmer, Farm, Productivity.

CONSERVATION AGRICULTURE FOR IMPROVING PRODUCTIVITY –PROSPECT, CONSTRAINTS AND RESEARCH NEED IN INDIAN CONTEXT: A REVIEW

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Conservation agriculture (CA) is a sustainable agriculture production system comprising a set of farming practices adapted to the requirements of crop and local conditions of each region. Whose forming and soil management techniques protect the soil from erosion and degradation, improve its quality and biodiversity and contribute to the preservation of the natural resources, water and air, while optimizing yields. Worldwide, conservation agriculture plays a vital role in sustainable agricultural production. Even after realizing the full potential of irrigation, a major part of the farming areas in most of the countries will remain rainfed. Land holdings of poor, small and marginal farmers are mostly dependent upon rainfall. Rainfed areas have, assumed great importance for adequate and equitable food and livelihood security of the increasing population of the country like India. Land degradation is another threat to our food and environmental security. Almost 150 million hectare land is degraded due to erosion, water-logging and salinization. The pace of soil erosion accelerates with increasing slope percentage. Tillage practice in modern agriculture of developed countries had most concern to sustain production in conservation of natural resources. Recycling of crop residues, growing crops of high volume biomass, change in cropping pattern, agro-forestry, Silviculture are the some of the modules in CA. Annually 400 m ha m water is available through rainfall, out of which 75 m ha m water is lost in erosion and courtly facing problem for drinking water, Industrial use and very limited water (30%) is available for irrigation. Harvesting of water in-situ and collecting through various mechanical measures and use of it for at least one protective irrigation during entire life spell needs at most attention in CA. Crop management in changing weather and efficient utilization of bio-diversity to develop ideal plant genotypes for biotic and abiotic stress tolerance is another challenge in CA. India is a rich country for natural resources like soil, water, climate and plant diversity. Climate, soil, water and energy are key inputs



in agriculture production. CA is an approach to managing agro-ecosystem for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment through the applying of three CA principles-

- 1.Continuous minimum mechanical soil disturbance.
- 2.Maintains of permanent soil cover.
- 3.Crop system diversity, Crop rotations.

CA principals are universally applicable to all agriculture land scapes and land uses with locally adopted practices. CA enhances biodiversity and natural biological process.

SCOPE OF NANOTECHNOLOGY IN PEST MANAGEMENT

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Nanotechnology is a promising field of interdisciplinary research. It opens up a wide array of opportunities in various fields like medicine, pharmaceuticals, electronics and agriculture. The potential uses and benefits of nanotechnology are enormous. These include insect pests management through the formulations of nano-material based pesticides and insecticides, enhancement of agricultural productivity using bioconjugated nanoparticles (encapsulation) for slow release of nutrients and water, nanoparticle-mediated gene or DNA transfer in plants for the development of insect pest resistant varieties and use of nanomaterials for preparation of different kinds of biosensors, which would be useful as remote sensing devices required for precision farming. Traditional strategies like integrated pest management used in agriculture are insufficient, and application of chemical insecticides like DDT have adverse effects on animals and human beings apart from the decline in soil fertility. Therefore, nanotechnology would provide green and efficient alternative for the management of insect pests in agriculture without harming the nature.

Keywords: Nanotechnology, nanoparticles, encapsulation, pest management.

EFFECT OF NUTRIENT MANAGEMENT OPTIONS FOR STRVS IN DROUGHT PRONE SITUATIONS

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Natural organic biomass burning creates black carbon which forms a considerable proportion of the soil's organic carbon. Biochars can be produced by 'baking' organic matter under low oxygen ('pyrolysis'). The quantities of key mineral elements within these biochars can be directly related to the levels of these components in the feedstock prior to burning. Their incorporation in soils influences soil structure, texture, porosity, particle size distribution and density. The molecular structure of biochars shows a high degree of chemical and microbial stability. A key physical feature of most biochars is their highly porous structure and large surface area. This structure can provide refugia for beneficial soil micro-organisms such as mycorrhizae and bacteria, and influences the binding of important nutritive cations and anions. This binding can enhance the availability of macro-nutrients such as N and P. Other biochar soil changes include alkalisation of soil pH and increases in electrical conductivity (EC) and cation exchange capacity (CEC). Ammonium leaching has been shown to be reduced, along with N₂O soil emissions. There may also be reductions in soil mechanical impedance. The physical properties of biochar are key to understanding the way biochar functions within soil and its potential to act as a route to sequester atmospheric carbon dioxide. Incorporation of biochar can influence soil structure, texture, porosity, particle size distribution and density, thereby potentially altering air oxygen content, water storage capacity and microbial and nutritional status of the soil within the plant rooting zone. It is also apparent that the soil water regime can itself modify biochar stability depending on the initial properties of the feedstock used. Biochars produced at lower temperatures and from more labile feedstock are more easily altered. Differences in biochar particle size however over the range of 2 mm to 20 mm do not. At least in some studies appear to have significant influence on crop yields. Biochar is a carbonaceous material which contains polycyclic aromatic hydrocarbons with an array of other functional groups.

Keywords: STRVS, Biochar, Drought stress, CEC

SMART BREEDING: A NEW PLATFORM FOR CROP IMPROVEMENT

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"Stuart breeding", sometimes also called "clever breeding" or "precision breeding". Stands for methodical alternatives to genetic engineering in modern plant breeding. Classical methods - such as crossbreeding of different parent varieties and subsequent selection of progeny - are combined with novel molecular biological approaches. Smart breeding uses molecular-biological methods (e.g. Gene mapping, mutagenesis) to characterize initial plants with desirable breeding properties. Methods of vegetable tissue culturing and subsequent regeneration of intact plants essentially reduce the steps among classical crossbreeding, selection of desirable breeding results and subsequent propagation. The breeding targets, such as e.g. Resistance to diseases and pest infestation, stress tolerance (e.g. Against dryness, salt, heat) or changed components (e.g. Fatty acid pattern) are lastly achieved by



means of classical breeding, i.e. By combination of suitable parent varieties, thus leading to useful, not genetically engineered plants.

Keywords: Stuart breeding , clever breeding , crop improvement

PROBLEM AND STRATEGIES OF SUMMER VEGETABLE CULTIVATION IN INDIA

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Warm-season vegetables are most easily damaged by cold temperatures. For this, they are planted outdoors only after the last chance of frost in the spring. Many vegetables require a long growing season to produce fruit and need to be planted as soon as possible to avoid effects of extreme heat in summer. For warm season vegetables, hot conditions are favored for fruit development but restrict flowering and pollination. Vegetable crops are very sensitive to climatic vagaries and sudden rise in temperature at any phase of crop growth can affect the normal growth, flowering, pollination, fruit development. High temperatures can cause significant losses in tomato productivity due to reduced fruit set, and smaller and lower quality fruits. In pepper, high temperature exposure at the pre-anthesis stage did not affect pistil or stamen viability, but high post-pollination temperatures inhibited fruit set. Development of genotypes tolerant to high temperature, moisture stress through conventional, non-conventional breeding techniques, genomics and biotechnology etc. are essentially required to meet summer challenges. Summer vegetable cultivation includes water conservation, increase water absorption, reducing the loss of soil moisture, mulching, use of drip irrigation facilities and use of growth regulators and chemicals. Variety requirements for summer season cultivation are short-stemmed varieties with limited leaf surface minimize transpiration, deep, prolific root systems enhance moisture utilization and quick-maturing varieties are important.

Keywords: Summer Vegetables, India, Problem, Strategies.

APOMIXIS IS EFFECTIVE STRATEGIES FOR CROP IMPROVEMENT

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Apomixis is a genetically controlled reproductive process by which embryos and seeds develop in the ovule without female meiosis and egg cell fertilization. Apomixis produces seed progeny that are exact replicas of the mother plant. The major advantage of apomixis over sexual reproduction is the possibility to select individuals with desirable gene combinations and to propagate them as clones. In contrast to clonal propagation through somatic embryogenesis or in vitro shoot multiplication, apomixis avoids the need for costly processes, such as the production of artificial seeds and tissue culture. It simplifies the processes of commercial hybrid and cultivar production and enables a large-scale seed production economically in both seed- and vegetatively propagated crops. In vegetatively reproduced plants (e.g., potato), the main applications of apomixis are the avoidance of phytosanitary threats and the spanning of unfavorable seasons. Because of its potential for crop improvement and global agricultural production, apomixis is now receiving increasing attention from both scientific and industrial sectors. Harnessing apomixis is a major goal in applied plant genetic engineering. In this regard, efforts are focused on genetic and breeding strategies in various plant species, combined with molecular methods to analyze apomictic and sexual modes of reproduction and to identify key regulatory genes and mechanisms underlying these processes. Also, investigations on the components of apomixis, i.e., apomeiosis, parthenogenesis, and endosperm development without fertilization, genetic screens for apomictic mutants and transgenic approaches to modify sexual reproduction by using various regulatory genes are receiving a major effort. These can open new avenues for the transfer of the apomixis trait to important crop species and will have far-reaching potentials in crop improvement regarding agricultural production and the quality of the products.

Keywords: Asexual reproduction , Apomixis Meiotic mutants ,Apomeiotic mutants ,Genetic screening, Fertilization-independent seed mutants

THE ROLE OF ICT IN INDIAN AGRICULTURE

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21st Century we are faced new emerging problem of global food demand and exceeding the Earth's carrying capacity with the current way of agricultural production. Given the challenges, the arrival of information communication technology (ICT) is well timed. The benefits of the green revolution greatly improved agricultural productivity. However, there is need of demonstrable a new revolution that will bring lower prices for consumers through reduced waste and more-efficient supply chain management contribute to "smart" agriculture, and incentivize farmers to increase their production. Major impact are to empower poor farmers with information and communication assets and services that will increase their productivity and incomes as well as protect their food security and livelihoods and to harness ICTs effectively used to compete in complex, fast changing global market. An innovative approach is to engage the private sector under public-private partnerships model. ICTs can help to prevent and reduce crop losses through well-planned investments and disaster warnings or timesensitive alerts. Water management and disease or pest prevention are crucial to increased productivity. Advances in ICTs such as GPS, GIS, mediation software, mobile phones and tracker, and satellite imagery have improved smallholders' ability to adjust farm strategies and reduce risk. At the same time, these advances allow governments and their agency development partners to better monitor farm productivity, make more



accurate projections, and plan better for the future. Using a variety of ICTs, producers can better identify, track, and protect their crops, animals, and livelihoods.

Keyword: Information communication technology (ICT), Smart agriculture, food security

INDIGENOUS TECHNICAL KNOWLEDGE IN AGRICULTURE

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Traditional Knowledge refers to knowledge inherent in indigenous communities that has been passed to them from their ancestors. The knowledge could be of any type. It could be cultural knowledge, environmental knowledge, and medicinal knowledge and so on. The protection is afforded to Traditional Knowledge with the objective of rewarding the indigenous community for preserving such knowledge and to encourage development and utilization of such knowledge for public good. The term indigenous technical knowledge refers to unique, traditional, local knowledge existing within and developed around specific conditions of women and men indigenous to a particular geographic area. ITK is the information base for a society, which facilitates communication and decision making. Indigenous information systems are dynamic and are constantly influenced by internal creativity and experimentation as well as by contact with external systems. The term indigenous technical knowledge is often camouflaged with the belief that is associated with forthcoming happenings and innovations made by the farmers to solve specific problem. Many definitions have been proposed for indigenous technical knowledge (ITK) systems, but all of them are incomplete, because the concept is relatively new and still evolving. Literature in related fields uses various terms interchangeably to designate the concept of "traditional knowledge (TK)", "traditional ecological knowledge (TEK)", "traditional ecological knowledge and management systems (TEKMS)", "local knowledge (LK)": "indigenous knowledge (IK)", indigenous technical knowledge (ITK)", "community knowledge", "rural peoples knowledge" and "farmers' knowledge (FK)".

Keywords: ITK, IK, FK, TEKMS, LK, TEK,

RESOURCE CONSERVATION THROUGH LASER LEVELING OF AGRICULTURAL LAND: A REVIEW

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Adopting climate-smart agricultural practices is essential to equip farmers against changing weather patterns and depleting natural resources. Declining water table and degrading soil health are the major concerns for sustainability of Indian agriculture. Thus, there is need of judicious use of natural resources including conservation of irrigation water through various on-farm water management practices. Land leveling has a major impact on the germination, stand and yield of crops through nutrient water interaction as well as salt and soil moisture distribution pattern. A level soil surface is essential for equal & uniform distribution of irrigation water to the every part of the field. Resource conserving technologies perform better on well leveled fields. Laser controlled leveling technology is currently the best method to grade a field. It is a precision leveling technique used for achieving very fine leveling with desired grade on the agricultural field. It maintains the grade by automatically performing the cutting-filling for leveling operations. The field is cultivated and planked before using the laser land leveler. A grid survey is performed using grade rod to identify high and low spots in the field and mean grade is found. A grid spacing of 10m x 10m is maintained for accurate land survey; however this spacing can be varied depending upon the size of the field. A map is then drawn to identify which areas are high; require soil to be cut and the lows which require soil to be added. Study indicated that, it facilitated optimization of water use efficiency, better crop establishment, less time and water required in irrigation, less effort in crop management, less weed problems, uniformity in crop maturity, easy land preparation, less water requirement for land preparation, reduced consumption of seeds, fertilizers, chemicals and fuel, increase in farming area, assist top soil management, saves fuel/electricity used in irrigation, more uniform moisture environment for crops, good germination and growth of crop, minimizes run-off and water-logging ensuring that farmers use just as much water they need in the optimal way. Use of laser levelers over traditional land levelers reduces emission of greenhouse gases from saving energy through decreased water pumping, reduced cultivation time and better use of fertilizers. Thus, efforts should be made to aware and motivate the farmers for precise leveling of fields using laser leveler for optimization of water, nutrient as well as pesticide use efficiency and crop productivity for higher incomes of farmers.

Keywords: Laser leveler, land leveling, Resource conservation, water distribution, water use efficiency

AGRI-ENTREPRENEURSHIP DEVELOPMENT THROUGH HORTICULTURE

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India is known for producing variety of horticultural crops which covers a wide range of fruits, vegetables, tuber crops, flowers, spices, medicinal and aromatic plants. The demand for food is growing while the land and water resources are becoming more scarce and degraded with time. The consumption pattern is also changing which is resulting in increase in demand as well as export opportunities for horticultural crops. Horticulture sector has a potential to absorb and employ huge chunk of unemployed population. In the present situation, farmers are required to develop themselves as entrepreneurs for deriving greater benefits. The new generation of educated farmers and unemployed rural youth has an opportunity to become entrepreneur and adopt horticulture as a business enterprise. Protected cultivation of horticultural crops offers distinct advantages of productivity, quality and



premium market price to the growers. As a result, there has been an increase in area under protected cultivation of different horticultural crops, primarily under vegetables and flower crops. 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 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 reaches of Himalayas in the country. Besides, other entrepreneurial ventures are quality seed production in net house, plug plant production, production of off-season leafy greens etc.

FARMING SYSTEMS TYPOLOGY AND USE OF QUANTITATIVE ANALYSIS TOOLS/MODELS IN FARMING SYSTEM ANALYSIS

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A farm is conceived as a management unit consisting of a large array of interrelated components of various types. The planning of mixed farming systems with an array of crops, various animal types and a diverse range of other resources is complicated, since it involves many management decisions on resource allocation (Russelle *et al.*, 2007). Traditionally, farmers depend on traditional methods, such as, instinct and experience, and comparisons with neighbors in order to make decisions about which commodities to produce and in what quantities. This does not guarantee optimal crop patterns (Alsheikh and Ahmed, 2002) as these choices and their resulting outcomes are subject to a large range of objectives and constraints. There exists a chain of interactions among the components within the farming systems, and it becomes difficult to deal with such inter-linking complex systems manually. This problem could be overcome by construction and application of suitable whole farm models. Optimization techniques, such as linear programming and compromise programming, fuzzy linear programming, etc. are useful tools for efficient resource allocation under various constraints. Model-based support can be useful in various hierarchically structured planning windows. Farming system typology involves grouping farming systems in terms of their resources and livelihood activities, as well as agricultural management practices, which can be used for planning agricultural interventions. Farming system typologies can be used to explore and assess the possible impact of climate shocks and alternative technological interventions on food security of farm households (Santiago *et al.*, 2017). Recently, various tools have been developed and applied for integrated farming system analysis (Andrieu and Nogueira, 2010; Le Gal *et al.*, 2010; Del Prado *et al.*, 2011) and for the exploration of strategic improvements in farming systems (Groot *et al.*, 2007; Tittonell *et al.*, 2007a, 2007b; Vayssières *et al.*, 2010). Groot *et al.*, (2012) described about Farm DESIGN tool, which supports evaluation and re-design of mixed farming systems in tactical planning processes and supported the analysis of problems in the original farm configuration and indicated avenues for adjustments of the configuration to improve farm performance in terms of various objectives. Farm Design tool was utilized to explore the opportunities for improvement in existing IFS model with the objective of enhancing economic profit, increasing organic matter balance within the land and labour constraint situations. Relatively small modifications in the farm configuration through optimization may result in considerable improvement of farm performance.



EFFECT OF THE MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT (MGNREGA) ON RURAL POOR IN PAURI GARHWAL DISTRICT, UTTARAKHAND, INDIA

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Examine the effect of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), a wage for employment plans of the Indian Government, on rural poor the pathways through which MGNREGA affects their poverty. Hypothesis: MGNREGA could reduce poverty through positive effects on living standard, Poverty and income. The present study is descriptive in nature and based on both primary and secondary data. The primary data were collected from the five village of Jahrikhal Block, Pauri Garhwal district of Uttarakhand. 120 respondents were asked in total selected through purposely-random sampling. The results revealed that MGNREGA plays a key role in order to reduce the poverty of rural poor people. On the further hand it enlarge the community and economic facility by providing the employment opportunity and development of Asset creation. In this way, MGNREGA has steadily raised the standard of rural livelihood as it provides the proper wage disbursement and authentic wok facilities.

Keywords: Employment, MGNREGA, Pauri Garhwal, Rural Poor

NANO BIOTECHNOLOGY - A NEW ERA TOWARDS SUSTAINABLE DEVELOPMENT

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In today's globalized world, the development of nanotechnology is considered as a pivotal gateway towards a new era of technological evolution. The most prominent features that make nanotechnology applicable in such a large number of fields are their unique physical, chemical and biological properties. Nano technological products, processes and applications are expected to contribute significantly to environmental and climate protection by saving raw materials, energy and water as well as by reducing greenhouse gases and hazardous wastes. Nano materials exhibit special physical and chemical properties that make them interesting for novel, environmental friendly products. Examples of this technology include increased disability of materials against mechanical stress or weathering, helping to increase the useful life of a product, nanotechnology based dirt and water resistant coatings to reduce cleaning efforts, novel insulation materials to improve the energy efficiency of buildings, adding nanoparticles to a material to reduce weight and save energy during transport, Nano-solar panels, nanotechnology in reducing the greenhouse gas CO₂, Nano clay for construction, Nano-paints, depollution capacity of TiO₂. Because of its wide range applications Nano biotechnology is applied in the field of agriculture, food packaging, quality & safety sensors, pollution monitoring sensors, waste water treatment, fuel cells, in groundwater remediation to remove chlorinated hydrocarbons. Nanotechnology comes in with such tremendous opportunities for progress, defeating diseases, opening up outer space and expanding human capabilities; however currently it plays a subordinate role whether it be in research or in practical applications.

Keywords: Nanotechnology, Nanoparticles, Environment, Nanobiotechnology



BIO-NANOTECHNOLOGY AND GREEN TECHNOLOGY FOR SUSTAINABILITY

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The World is facing great challenges in meeting rising demands for basic commodities (e.g., food, water, and energy), finished goods (e.g., cell phones, cars and airplanes) and services (e.g., shelter, healthcare and employment) while reducing and minimizing the impact of human activities on Earth's global environment climate. Nanotechnology has emerged as a versatile platform that could provide efficient, cost-effective, and environmentally acceptable solutions to the global sustainability challenges facing society. This volume is devoted to the utilization of nanotechnology to improve or achieve sustainable development. Recent advances are highlighted and opportunities of utilizing nanotechnology to address global challenges in water purification, clean energy, greenhouse gas management, materials supply/utilization and manufacturing. In the future, novel, nano-technologically optimized materials, for example plastics or metals with carbon nanotubes (CNTs), will make airplanes and vehicles lighter and therefore help reduce fuel consumption. Nanoscale carbon black has been added to modern automobile tires for some time now to reinforce the material and reduce rolling resistance, which leads to fuel savings of up to 10%. Green technology is an encompassing term. It deals with using science and technology in order to protect the environment. It is also referred to as environmental technology or clean technology. Green technology helps manage and recycle waste, It also purifies water, It helps to reduce carbon emission and purify the air, Energy is being conserved through the use of such technology. Green or clean technology is also used to breathe life into ecosystem that have sustained a lot of damage due to human involvement. Through the use of this technology trees are replanted, waste is managed and recycled. This ensures that the affected ecosystem is able to start again, and this time remain conserved. This help to ensure that a lot of plant and animal species don't go extinct. The earth needs protection and green technology can help in providing exactly that to the planet we all depend upon in order to live.

ENVIRONMENTAL POLLUTION, MONITORING AND MANAGEMENT

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Environmental pollution degrades the habitat around us, for both humans and other animals and plants. Environmental pollution produces a number of negative effects including ocean acidification, global warming, acid rain and habitat loss for plants and animals species. The reason behind increase in pollution can be anything such as the excessive use of toxicity, extensive use of fossil fuels, insecticides and pesticides, deforestation, bio accumulation, bio magnification and unsuitable use of sources that are non-biodegradable such as plastics. These problems can be overcome by the use of science and technologies. The use of any non-biodegradable resource can be made degradable by the use of microbes such as the species of genus *Ideonella sakaiensis*. Many nucleic acid biosensors can also be used for monitoring of environmental pollution and toxicity. Also the use of tree bark can be used to monitor the environmental pollution. For the management of the environmental pollution, nature itself can be the reason for its cure. But the nature requires many techniques for the extraction of solutions for managing its problems. Therefore one solution can be the use of microorganisms itself for the management. For this bacterium *Ideonella sakaiensis* has been discovered. Similarly by the help of study of this bacterium, it is definitely possible to design an in vitro organism that can be capable to degrade and resolve all the issues related to environmental pollution. These organisms can be synthesized via use of different biotechnology approaches such as genetic engineering, biochemistry and environmental technologies.

Keywords: *Ideonella sakaiensis*, Genetic engineering, Biosensors



SIDDHAST TECHNIQUE: A NEW VEGETATIVE MULTIPLICATION AND WATER CONSERVATIVE TECHNIQUE FOR *Jatropha curcas*

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Energy security is one of the prime concerns of any developing/developed nation and India ranks sixth in the world in terms of energy demand. The Indian economy is expected to grow at a rate of over 6 % per annum. The petroleum imports are expected to rise to 166 MT by 2019 and 622 MT by 2047, hence there is a growing need for energy security. *Jatropha curcas* has the potential to become a significant source of renewable energy if improved varieties are developed which can achieve its potential in terms of oil yield per hectare in marginal land. For vegetative multiplication, we have successfully carried out air layering in *Jatropha curcas* through siddhast technique, where a stem is induced to form roots using Rooter Strand while branch is still intact on the parent plant. Virtually no extra water is required to be given to the parent tree to produce a rooted plant. Here, we examined the competency of eight Rooter Strands vis-à-vis two conventional techniques of air layering i.e. tourniquet and gootee. Results showed that time for root initiation did not vary with treatments. In branches tied with Rooter Strand rooting started in minimum 3 weeks; the average root initiation period with Rooter strand was 4.56-6.66 weeks of installation. However, both conventional techniques T9 and T10 required 8.05 weeks and 6.40 weeks, respectively, to start root initiation. Significantly better rooting observed as compared with tourniquet technique and highest 100 per cent rooting was recorded in Rooter Strand-2, 31 and 41 along with control. Significant difference also observed among all the treatments representing Rooter Strand showed usually 83 per cent or higher for survival percent. This technique is very easy and does not require much skill. This technique has the advantages of air layering i.e. less need for physical inputs (water, electricity, infrastructure, etc). It reduces water consumption up to 90 per cent and electricity 100 per cent as compared to tissue culture. Thus, this technique is very conservative from cuttings and much faster than normal procedure of air layering for producing true-to-type plant material and can be adopted for multiplication of superior varieties of this species for their large-scale deployment for biodiesel production to ensure sustainable development with least water requirement.

Keywords: Siddhast technique, Tourniquet technique, Air layering, Vegetative multiplication, *Jatropha curcas*.

CARBON DIOXIDE ENRICHMENT INDUCED DROUGHT TOLERANCE RESPONSES IN AMARANTHUS (*Amaranthus tricolor* L.)

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Based on reports by the IPCC (Intergovernmental Panel on Climate Change) atmospheric CO₂ concentration is rising. Elevated CO₂ concentration has been found to ameliorate water stress in the majority of species studied. Physiological and biochemical basis of varietal responses of amaranthus to water stress conditions and their modifications under elevated CO₂ environment was studied by conducting a pot culture experiment conducted with three varieties of amaranthus i.e. Arun (V₁), CO -1 (V₂) and Renusree (V₃). One Open Top Chamber with CO₂ level of 600 ppm (T1) was used for CO₂ enrichment and a second control chamber for assessing chamber effect (T2). A set of experimental plants was maintained in the open field as control (T3). During their critical stages of development, plants were subjected to water stress and then were allowed to recover. Various biochemical parameters like protein content, starch content and antioxidants like Phenol content, Superoxide dismutase (SOD) activity along with total dry matter content were analysed. Elevated CO₂ was found to increase total dry matter production (0.99 g), phenol content (25.46 mg/g), SOD activity (1.65 g⁻¹minute⁻¹) where as it decreased starch (3.22 mg/g) and protein (13.90 mg/g) content. The challenges extended by the changing climate situations along with the progressively reducing water availability, studies on drought tolerance responses as modified by elevated CO₂ environments is highly significant. The results of this study will also help in designing improved production technologies with suitable varieties for a changing climatic scenario.

Keywords: Climate change, Elevated CO₂, water stress, Drought tolerance, antioxidants.



INFLUENCE OF SILICON SOLUBILIZERS ON MORPHOLOGICAL, BIOCHEMICAL PARAMETERS AND PEST INFESTATION IN DIFFERENT GENOTYPES OF RICE (*Oryza sativa* L.)

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Rice (*Oryza sativa* L.) is the life for billions of people in the world. It is most widely consumed staple food for a large part of human population, especially in Asia. Therefore there is a need for high production of rice which can only be fulfilled when the rice crop gets resistance from biotic and abiotic stresses. To ensure food security and sustainable economic growth, there is high need for a way that improves tolerance toward diseases and insect, pest infestations, lodging and metal toxicity. Research evidences have proved that adequate uptake of silicon (Si) can increase the tolerance of agronomic crops especially rice, sugarcane, wheat, maize to both abiotic and biotic stresses. The present investigation was performed under field conditions to evaluate the physiological response of six rice genotypes (PA6129, PA6201, PA6444, PHB71, US312, BPT5204) under silicon treatments. The rice genotypes were grown in randomized block design during 2016 under three treatments viz. control, solid silicon (Imidazole) and liquid silicon (Silixol) in three replications each. The observations were recorded at tillering, panicle initiation and flowering stage. Yield attributes were also recorded after harvest. It was interestingly found that liquid silicon treatment performed better as compared to control and solid silicon treatment which was due to good plant morphology, less disease infestation and high yield attributes. Genotype PA6444 performed well in terms of yield as well as crop maturity duration followed by PHB71. It was also noticed that the pest infestation in the crop was very less in both the silicon treatments as compared with the control. Protein and micronutrient content were also found to increase with different silicon treatments. Thus, we can conclude that judicious use of silicon solubilizers in the crop can reduce pest infestation which ultimately helps to increase crop productivity.

EFFECT OF LOW LIGHT ON MORPHOLOGICAL AND YIELD PARAMETERS OF RICE (*Oryza sativa* L.)

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Rice is a global food for more than 60% of the world's population. It is very sensitive to environmental factors such as temperature, light, drought etc. during critical stages of growth, such as flowering and seed development. Low light stress is an important constraint for rice productivity in Southeast Asia. For physiological and biochemical characterization of rice genotypes for low light stress tolerance, a field experiment was conducted in Norman E. Bourlog crop research center, G. B. Pant University of Agriculture and Technology, Pantnagar during kharif season 2016 with different rice genotypes, namely, IET 24195, IET 24183, IET 24189, IET 24188, Vivekdhan 86, IET 24197, IET 24192, IET 25149, IET 25157, Shalimar Rice 3, IET 25144, IET 25154, IET 27P63, US-314, Tulasi and Swarnaprabha, respectively. These genotypes were transplanted in two blocks, one for control and another block for imposing low light stress by covering the block with 50 % shade net supported by bamboo sticks. Both the entry ends were open for sufficient ventilation. Various morphological, biochemical and physiological parameters were recorded in different rice genotypes and it was found that except plant height and chlorophyll content, all the parameters reduced significantly under low light stress. Genotypes US-314, IET 27P63, and Swarna Prabha showed tolerance for low light stress. Finally, the grain yield, harvest index, number of filled spikelet and percent spikelet fertility indicated that low light stress adversely affected these parameters. The low light stress tolerant genotypes performed better in terms of filled grain numbers and percent spikelet fertility per panicle, harvest index as compared to susceptible genotypes. Low light stress effect on soil microbial community was also studied by molecular methods like RT PCR and DGGE and it was found that low light stress significantly reduced the soil microbial community as compared to control conditions.



STUDIES ON CATTLES HEALTH MANAGEMENT IN WESTERN UTTAR PRADESH

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A study was conducted in 160 farmers of 16 villages in four district of Western Uttar Pradesh. In cattle, viral diseases score was significantly difference among farmer categories. The methods are use of animal health grading, disease, vaccination & Shelter management grad. The animal health grading of bovine was done on the basis of their physical appearance. Like that weak and depleted, fair, good, very good, excellent are the grading system. The score was maximum and significantly higher in all the farmer categories C_2 , C_3 , C_4 and C_5 over C_1 . Districts were no significantly differ from each other. Bulandsahar and Gautambudhnagar recorded higher score of bacterial diseases than Meerut and Hapur. Farmer categories were significant differ for bacterial diseases in cattle. C_5 recorded maximum and significantly higher score of bacterial diseases over other farmer categories. Districts were no significant differ from each other. Gautambudhnagar and Hapur recorded higher score of bacterial diseases than Meerut and Hapur. Fungal diseases significant difference in cattle of the farmer categories and C_4 showed significantly higher value of fungal diseases than all other categories. C_1 recorded minimum incidence score of fungal diseases in cattle also. Among districts Gautambudhnagar showed maximum and significantly higher fungal diseases value over Meerut, Hapur and Bulandsahar. Vaccination of the cattle was observed significant difference for among different categories of the farmers. C_2 and C_3 recorded significantly higher vaccination score over C_3 , C_4 and C_5 . However, difference between C_3 and C_4 , C_4 and C_5 , C_3 and C_5 was no significant. Among districts Gautambudhnagar recorded maximum vaccination value which was significantly higher over Meerut. So we are recommended the clean water, feed and timely checkup of veterinarian and giving a vaccine. The farmers for good Shelter management and sanitization for the better and healthy buffaloes production in western Uttar Pradesh.

Keywords: Cattle, Health, Viral, Bacterial, vaccination.

IMPACT OF POWDERY MILDEW ON PHYSIOLOGICAL PARAMETERS OF ORNAMENTAL MUSTARD AND MANAGEMENT USING BOTANICALS AND FUNGICIDES

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Powdery mildew (*Erysiphe cruciferarum*) is an important leaf disease of ornamental mustard (*Brassica juncea* var. *rugosa* (Roxb.) N.Tsen & S.N.Lee). With the advancement of management, it has become important to know the effect of pathogen on host physiology. The effects of fungi on host physiology, photosynthesis, transpiration and stomatal conductance were comprehensively investigated to know the adverse effect of pathogen in naturally growing population plants. Significant decrease in chlorophyll content was observed in diseased plant (1.880 mg/g) as compared to control (2.321 mg/g). As a result photosynthesis was dramatically reduced in diseased plant ($5.234 \mu\text{mol CO}_2 \text{ m}^{-1} \text{ s}^{-1}$) as compared to healthy plant ($7.321 \mu\text{mol CO}_2 \text{ m}^{-1} \text{ s}^{-1}$). Transpiration rate ($4.903 \text{ mmol H}_2\text{O m}^{-1} \text{ s}^{-1}$) and stomatal conductance ($4.852 \text{ mol H}_2\text{O m}^{-1} \text{ s}^{-1}$) was increased in diseased plants as compared to healthy plant ($4.103 \text{ mmol H}_2\text{O m}^{-1} \text{ s}^{-1}$) and ($3.961 \text{ mol H}_2\text{O m}^{-1} \text{ s}^{-1}$). Keeping in view with the adverse effect of pathogen on host physiology, a study was undertaken to estimate the effect of fungicides and phytoextracts on management of powdery mildew. Percent disease infection, percent disease intensity and percent reduction in disease intensity of powdery mildew were recorded using three fungicides viz. Wettable sulphur (Sulfex 80WP), Tridemorph (Calixin 48 EC), Blitox 50 and two phytoextracts viz. Custard apple (*Annona squamosa*), rhizome of ginger (*Zingiber officinalis*). Triademorph reduced the powdery mildew (71.70%) significantly as compared to other treatments followed by Wettable sulphur (52.06%) and Blitox 50 (44.50%). Regarding phytoextracts, maximum disease was reduced with ginger rhizome extract (25.50%) followed by Custard Apple leaf extract (8.27%). Phytoextracts are best suited eco-friendly and alternative method of management by reducing the use of toxic fungicides in developing countries.



GROWTH AND YIELD OF SESAME AS INFLUNCED BY INTEGRATED NUTRIENT MANAGEMENT

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2013 on loamy sand soil. The treatments comprised of 8 fertility levels viz., Control , FYM @ 10 t/ha, FYM @ 5 t/ha + 50% RDF, Poultry manure @ 4 t/ha, Poultry manure @ 2 t/ha + 50% RDF, Vermicompost @ 3 t/ha, Vermicompost @ 1.5 t/ha+ 50% RDF and RDF of N and P₂O₅ (40:20) and two biofertilizer levels (*Azotobacter*, seed inoculation and control), thereby making 16 treatments combinations was laid out in a Randomized Block Design and replicated three times. Results showed that different fertility treatments had significant effect on all the growth parameters (Plant height, dry matter accumulation/metre row length, number of branches per plant, chlorophyll content, CGR, LAI and RGR, yield attributes (number of capsules per plant and seeds per capsule) seed, stalk and biological yields of sesame. By and large, the significantly higher values of these parameters were recorded in the treatment, vermicompost @ 1.5 t/ha + 50% RDF and in most of the cases was at par with poultry manure @ 2 t/ha + 50% RDF, FYM @ 5 t/ha + 50 % RDF, vermicompost @ 3 t/ha and poultry manure @ 4 t/ha and significantly superior to rest of the treatments. Results further showed that with regard to growth parameters, yield attributes, yields (seed, stalk and biological), increased significantly seed inoculation with *Azotobacter* proved and superior to absolute control. The combined application of fertility levels and biofertilizer gave significantly effect on seed yield. The application of vermicompost @ 1.5 t/ha+ 50% RDF with biofertilizer was at par with vermicompost 1.5 t/ha+ 50% RDF with biofertilizer and significantly superior over the rest of treatment.

SUSTAINABLE ORGANIC FARMING THROUGH VERMITECHNOLOGY

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The ultimate aim of sustainable agriculture is to develop farming systems that are productive and profitable, conserve the natural resource base, protect the environment and enhance health and safety over the long term. Organic farming involves the use of organic inputs for the production of crops. Use of vermicompost and vermiwash increase the organic matter content necessary for the maintenance of soil properties, which is beneficial for long-term sustainability and crop productivity. Vermicompost is enriched with micronutrients and beneficial microbes that enhance the soil quality and aid in slow release of nutrients required for the healthy growth of plants. Various experiments on field crops, vegetables and fruits have been successful in terms of productivity and quality of produce. These technologies have also been adopted successfully by food growers across the globe resulting in substantial markets for organic produce. Organic agriculture is still in its infancy in India. Very little cultivated land is being used for organic vegetable production, primarily because of lack of consumer awareness and demand. Unlike chemical fertilizers vermicompost is economic and cost effective. It is very potential input for sustainable agriculture and can also be an important component of Integrated Plant Nutrient System (IPNS). Application of chemical fertilizers with vermicompost can go a long way in sustaining yields without deteriorating soil quality. Vermicomposting facilitates employ four times more people on a per ton basis than land fills. It creates new fulltime job, replicable and will demonstrate economic feasibility of commercial food discard composting and vermicomposting. Vermicomposting results in the bioconversion of the waste stream into two useful products, earthworm biomass and vermicompost. The former can be used as a protein source whereas vermicompost is considered as an excellent product since it is homogeneous, has desirable aesthetics, has reduced level of contaminates, has plant growth hormones, higher level of soil enzymes, greater microbial population and tends to hold more nutrients over a long period without adversely impacting the environment.



DALBERGIA SISOO: A GOOD CANDIDATE FOR PHYTOREMEDIATION OF HEAVY METAL FROM TANNERY AREA GROWING ALONG RIVER GANGA AT JAJMAU, KANPUR**Saqib Ul Kalam, Fauzia Naushin and Fareed Ahmad Khan**

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The boom of tanneries in north India has converted the river Ganga into a waste dumping stream. These units discharge their effluents into the river and contribute the largest levels of heavy metal. The concentrations of Cu, Cr and Ni were determined in leaves, bark and wood growth rings of 2 years old tree saplings of *Dalbergia sissoo* collected from 03 different sites along the River Ganga at Jajmau, Kanpur. Site-1 was located 1 Km upstream from the point of the discharge of the effluents of the tanneries, Site-2 close to the source point and Site – 3 about 1 Km downstream from the source point. Accumulation of Cu, Cr and Ni were estimated in the dried sample using Atomic Absorption Spectrophotometer (GBC Scientific Equipment, Dandenong, Australia). The concentrations of soil and water samples of the selected sites were also determined. The two years wood growth rings of *Dalbergia sissoo* accumulated highest amounts of heavy metal in their tissues. The wood of this tree is used for furniture and other building materials and thus for the possibility of a long term locking period this indigenous tree can be a good candidate for phytoremediation without further mechanical requirement of the recovery of phyto-extracted heavy metals.

Keywords: *Dalbergia sissoo*, Ganga River, Phytoremediation, Tannery effluents.

